

A Comprehensive Safety and Support Platform for Domestic Abuse Victims

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A thesis submitted to the Department of Computer Science and Engineering
in partial fulfillment of the requirements for the degree of
B.Sc. in Computer Science

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Declaration

It is hereby declared that

1. The thesis submitted is my/our own original work while completing degree at Brac University.
2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The thesis does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. We have acknowledged all main sources of help.

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Ethics Statement

This research has been conducted with full attention to ethical responsibilities and in accordance with institutional and legal standards. The following principles were strictly observed throughout the study:

1. **Informed Consent:** Prior to participation, all individuals involved in surveys and interviews were clearly informed about the objectives of the research, the nature of their involvement, and how the collected data would be used. Participation was entirely voluntary, and consent was obtained before any information was recorded.
2. **Confidentiality and Anonymity:** Personal and sensitive information was collected anonymously to ensure the confidentiality of participants. Data was stored securely, and no personally identifiable information was revealed at any stage of the research or in its dissemination.
3. **Legal and Institutional Compliance:** The study was carried out in full compliance with applicable national laws and institutional research ethics guidelines. All procedures involving data collection and analysis adhered to data protection regulations.
4. **Integrity and Transparency:** The research process was conducted with honesty and transparency. All results are original and based on actual findings. No part of the research involved plagiarism, falsification, or fabrication. Where applicable, external sources and prior work have been duly cited.

Through strict adherence to these ethical standards, this research upholds academic integrity and respects the rights and privacy of all participants involved.

Abstract

Domestic violence remains a critical issue, especially in surveillance-heavy environments like Bangladesh where abusers often monitor their victims' mobile activity. This research presents the iterative design and conceptual development of a discreet safety and support application for domestic abuse victims. Unlike traditional solutions, this mobile application is disguised as a benign utility app (e.g., a grocery list), ensuring discretion even under close monitoring. The app architecture follows a layered Four P's Model: Preparation, Protection, Provision, and Prevention, aligning each feature with user safety goals. While designing, a user-centered approach was adopted, involving expert interviews, focus group discussions, feature assessment surveys, and victim testing across three design phases: hand-drawn paper prototypes, low-fidelity digital versions, and a fully navigable high-fidelity prototype. Each phase incorporated active feedback from survivors and professionals to ensure clarity, minimal cognitive load, and cultural relevance. Key functionalities include dummy interface switching, real/dummy login system, encrypted evidence logging, a Quick Exit button, and Bangla localization. Additionally, the app proposes two machine learning extensions: a voice-based distress and trigger word detection model using emotion recognition, and a conceptual risk prediction framework based on user-logged incidents. While not implemented due to time and development limitations, the models were architected using open-source datasets and preprocessing pipelines, ensuring future feasibility. By embedding iterative victim feedback and Human-Computer Interaction (HCI) principles throughout, this study demonstrates a survivor-informed, context-sensitive approach to mobile safety design. The final prototype serves as both a practical intervention model and a contribution to ongoing research in HCI, trauma-aware design, and machine learning for social good.

Keywords: Domestic Abuse, Safety App Design, Human-Computer Interaction (HCI), Machine Learning for Social Good, Surveillance Evasion, Disguised Interface, Risk Prediction, Voice Emotion Recognition, Women's Safety Technology, IPV, Bangladesh, Cognitive Load Minimization, Trauma-Aware Design

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Chapter 1

Introduction

1.1 Thoughts behind the thesis

Domestic abuse is a universal issue that affects individuals from all background and gender, often trapping victims in environments dominated by control, isolation, and fear. Abusers commonly keep track of their victims' online activities, making it difficult and risky for victims to seek assistance or collect proof of the abuse. Although conventional support systems play a vital role, they often depend on visible actions, such as making phone calls or conducting internet searches, which abusers can easily detect, heightening the danger for victims.

This study focuses specifically on women as victims as a wealth of research demonstrates how women are unfairly susceptible to domestic abuse. Different studies consistently show that women are far more likely to be victims of gendered-risks, including domestic abuse. Roughly 82% of intimate partner homicide victims are women, according to the United Nations Office on Drugs and Crime (UNODC) [45] which highlights the grave risks that women face in abusive relationships. Additionally, the European Union Agency for Fundamental Rights (FRA) outlines that every one out of three women in the EU has experienced physical or sexual abuse since the age of 15, underscoring the ubiquity of gender-based abuse [27].

The domestic abuse against women in Southeast Asia is worryingly widespread. A multicountry study by The World Health Organization (WHO) [41] reported that 37% of the women in some countries of the Southeast Asia have reported ever experiencing physical or sexual abuse by their partner at some point of their life [21]. Furthermore, these norms along with their economic vulnerability serve as barriers that support domestic violence in Cambodia, Vietnam, Philippines where UN population fund (UNFPA) has been resourcing [34]. In South Asia, domestic abuse is still regarded as a major problem which was demonstrated in a research done by the International Centre for Research on Women (ICRW)[20]. For instance, in India nearly 30% women suffered physical violence from their intimate partners. Bangladesh and Pakistan also experience culturally practiced violence such as dowry related violence and honor killings which is perpetuated by their social settings[72]. Justice seeking attempts by women in the countries have also been hampered by legal and socio-cultural environment integrated with the abuse [20]. Many cultural frameworks such as the importance of family and gender power structures inhibit

women from seeking assistance or leaving violent relationships because stigma is seen as the likely consequence, victim-blaming, or social isolation.

There are several explanations for this gender disproportion. Women are frequently in more vulnerable situations in society and the economy as a result of gender norms and expectations. Abusive spouses may take advantage of these situations, controlling money, isolating themselves, and intimidating women in order to keep control over them. Furthermore, patriarchal systems in many societies reinforce the belief that male dominance and authority are acceptable, which helps to normalize violence against women [18][67][38]. Women may experience more shame or victim-blaming as a result, making it much more difficult for them to ask for assistance or leave violent relationships.

In light of these unique obstacles, discreet and innovative solutions for support are even more crucial in helping women. Comparison to typical means of assistance can show women being put in greater danger, as conventional approaches often demand overt acts with potential for easy monitoring by the abuser. As such, this paper aims to investigate other ways that are safe and confidential by which women can seek help unobtrusively.

1.2 Aims and Objectives

This research aims to design and evaluate a discreet, context-sensitive safety and support platform tailored for victims of domestic abuse in Bangladesh. Given the country’s deeply entrenched patriarchal norms, many women, especially those in marginalized or semi-urban settings—face pervasive digital surveillance by their abusers. Their access to technology is often limited, and in many cases, they do not own a personal smartphone. Instead, they rely on shared devices within family settings, which further increases the risk of exposure when seeking help or information.

In such high-risk environments, where abusers routinely monitor victims’ phone activity, restrict their contact with friends or family, and exert control over even basic communication, traditional safety tools become ineffective or dangerous to use. Therefore, this study focuses on the development of a platform that can operate under these extreme constraints—one that is concealed within everyday benign applications, offering covert access to life-saving resources.

The platform integrates four core service layers - Preparation, Protection, Provision, and Prevention -and employs advanced techniques such as dynamic masking, customizable dummy interfaces, stealth login mechanisms, and machine learning-based alert systems. Its architecture is designed not only to enable victims to seek help safely but also to collect evidence, access mental health tools, and connect with verified professionals and NGOs, all while maintaining complete discretion.

The objectives of this research are as follows:

- To understand the socio-technical barriers domestic abuse victims face when using digital tools under surveillance in Bangladesh.

- To design a safety application that mimics a harmless utility and can be used on shared devices without arousing suspicion.
- To implement discreet interaction mechanisms and customizable emergency triggers.
- To propose machine learning frameworks to enhance the app’s proactive protection features.
- To apply Human-Computer Interaction (HCI) principles to create a user-centric design, evaluate usability, stress handling, cognitive load, and accessibility based on iterative feedback from victims and professionals.
- To contribute to interdisciplinary fields—namely HCI, trauma-aware interface design, and machine learning for social impact—by introducing a real-world, user-centered model that addresses both safety and empowerment.

Ultimately, this research envisions a platform that empowers victims to seek help even in the most constrained conditions - on monitored or shared devices, without prior tech literacy, and under the constant threat of being caught, and thus transforming the act of reaching out from a risk into a right.

1.3 Research Problem

The core research problem emphasizes the considerable challenges that victims of domestic abuse encounter while trying to seek help and access support, particularly when their abusers constantly monitor or control them. Domestic abuse affects individuals from all walks of life, and while many support services are available, victims often struggle to utilize them safely due to the significant risk of detection by their abusers. Abusers exacerbate this issue by using technology to surveil their victims, making it essential for any support system to operate in a completely undetectable manner. Key points of the problem are given below:

1. Digital Monitoring and Control by Abusers: Abusers often closely monitor their victims’ digital activities, including phone usage, social media interactions, and even their physical location through Global Positioning System (GPS) tracking or spyware applications. This creates an environment where victims are tightly controlled and live in fear, as even the slightest attempt to seek help can provoke further violence or retaliation. Many existing safety measures or apps do not effectively hide their true functions, making them easily detectable by tech-savvy abusers. This situation underscores a significant gap in the availability of covert support systems that victims can safely access.

2. Limited Availability of Discreet Support Mechanisms: Many existing platforms or resources for domestic abuse victims, though well-intentioned, are not designed for covert use. They often require victims to take noticeable actions such as calling a hotline, accessing a website, or physically visiting a support center. These actions can be easily observed by abusers. As a result, there is a critical need for tools that allow victims to discreetly access support and document evidence of abuse without

raising suspicion.

3. Difficulty in Gathering Evidence: Many victims encounter serious obstacles when attempting to collect evidence of their abuse. Traditional methods like recording audio, capturing video, or storing messages can be extremely risky, as the abuser may find these files or realize the victim is tracking the abuse. Without solid evidence, securing legal protection or intervention often becomes difficult. This underscores the urgent need for a platform that allows for secure, hidden evidence collection that can be remotely accessed or deleted safely.

4. Obstacles to Requesting Immediate Help: In situations of violence or heightened danger, victims need a way to quickly notify authorities or trusted contacts without drawing attention. However, many current emergency alert systems depend on victims initiating a phone call or sending a message, actions that are easily noticeable by the abuser. There is a need for a solution that enables victims to discreetly activate emergency responses without arousing suspicion.

5. Challenges in Accessing Support Networks: Many domestic abuse victims experience isolation and are unable to reach out for professional help, such as therapists, legal advisors, or support groups, due to the fear that their abusers will uncover their attempts. Abusers often exert control over almost every aspect of the victim's life, from finances to communication, leaving little room for victims to seek outside support. This isolation increases the victim's vulnerability and perpetuates the cycle of abuse. The research problem underscores the critical need for anonymous communication channels that allow victims to seek help without disclosing their identity or location.

6. Adjustment to High-Risk Situations: Victims of domestic abuse face ongoing uncertainty, with their risk levels able to change rapidly. Abusers may exhibit increased violence at specific times or after certain triggers. A solution is necessary that can adjust to these fluctuating circumstances—one that can respond to changes in risk and deliver varying levels of support and protection depending on the situation. This includes tracking patterns of abusive behavior and aiding the victim in preparing for high-risk moments.

7. Limited Utilization of Technology for Proactive Safety: Modern technology offers various tools that could be used to support domestic abuse victims, yet many of these remain underutilized. For instance, machine learning (ML) can be applied to detect patterns in voice data, helping to recognize signs of distress or danger based on voice frequency or specific trigger words. Additionally, features like dynamic masking, periodic interface changes, and discreet communication can enhance safety; however, these innovations have not been fully integrated into support platforms for domestic abuse victims.

1.4 Research Gap

Existing digital safety solutions for domestic abuse victims often fall short in contexts where users are under constant surveillance. While many platforms provide

emergency support, they typically lack features that truly preserve a victim’s privacy in high-risk, monitored environments. In particular, these apps often fail to consider scenarios common in countries like Bangladesh, where victims—primarily women—face structural patriarchy, have limited personal device ownership, and are routinely subjected to digital surveillance by abusers. Attempts to use traditional safety apps in such settings can lead to further harm if discovered, as many do not adequately disguise their functionality or support covert operation.

Furthermore, while some tools focus on real-time alerts or helplines, few take a holistic approach that supports both immediate intervention and long-term recovery through features such as evidence collection, emotional care, and legal support—all in a discreet and user-adapted manner. This leaves a critical gap in ensuring digital safety, anonymity, and consistent support for victims navigating ongoing abuse while sharing digital spaces with their abusers.

In conclusion, this research problem tries to emphasize the area where victims face problems in seeking help because their privacy is always at stake. It sheds light on the fact that victims need a safe system to document their experiences and seek immediate help. Moreover, it highlights these significant gaps in the existing resources for the victims. By addressing these points, we hope to provide a better support for victims who bravely seek a way out of their struggling situations.

1.5 Research Questions

The investigation into existing solutions and potential improvements for assisting victims of domestic abuse will be guided by exploring through a set of research questions. The aim of these questions is to assess how well existing tools function, how privacy and security can be enhanced, and how emerging technologies, like machine learning, can be utilized to identify distress signals and improve the safety of victims.

The research questions are as follows:

RQ1. What are the existing solutions directed at assisting victims of domestic abuse, and how beneficial are these in dealing with the dimensions of abuse which are physical, emotional, and economic or cultural?

RQ2. How can the available tools be utilized effectively and optimized to provide a safe and seamless access to virtual help for domestic abuse in the instances where a victim is being monitored or controlled by the perpetrator?

RQ3 What design principles, based on the user’s perspective, should be considered to enhance the security of the victims as well as their concerns with regard to privacy, abuse in the form of control and provision to psychological support in areas where abuse may have been inflicted?

RQ4. What specific techniques and methodologies are employed in the solutions designed to assist victims of domestic abuse, and how do these techniques contribute

to the effectiveness of the solutions?

RQ5. How can machine learning algorithms be employed to detect signs of distress or danger in situations of domestic abuse? What role does dynamic data masking play in protecting victims' identities, and what are the ethical and practical challenges associated with the implementation of these technological solutions?

1.6 Thesis Structure

There are sixteen chapters within this study. The following chapters are arranged in the method described below:

- *Chapter 1:* Chapter 1 introduces the motivation behind the study, focusing on the urgent need for safer, more discreet support systems for women facing domestic abuse—especially in situations where abusers closely monitor their digital activities. It highlights the limitations of existing tools and presents the aim of designing a hidden, tech-based platform that prioritizes privacy, safety, and user needs. The chapter outlines key challenges victims face, identifies gaps in current solutions, and poses research questions exploring how technologies like machine learning and human-centered design can be used to better protect and support victims in high-risk environments.
- *Chapter 2:* This chapter discusses the work related to our study. It addresses the widespread issue of domestic abuse, including physical, sexual, and emotional harm, which impacts individuals across various demographics. While technological advancements have led to the development of digital tools to assist victims, challenges related to privacy and security remain unresolved. The chapter further examines the role of mobile applications, speech recognition, and wearable devices in supporting victims, while also noting the risks of misuse by perpetrators and concerns regarding privacy.
- *Chapter 3:* This chapter is dedicated to the work plan devised for this study as well as the timeline of the research. The plan is laid out in phases, including reviewing existing apps and AI tools, assessing their effectiveness, investigating machine learning (ML) and data masking technologies, and conducting interviews with victims. The timeline summarises which part of the research was carried out when.
- *Chapter 4:* This chapter discusses the review of several existing apps in the market dedicated to combating domestic abuse. The apps were categorised based on their features and limitations, as well as studied to see whether they are available in Bangladesh. These apps were also reviewed to check their compatibility with the Bangladeshi victim demographic.

- *Chapter 5:* This chapter shares insights from a focus group of ten experienced BRAC SELP professionals who work closely with domestic abuse victims across Bangladesh. They highlighted common challenges victims face—like social stigma, financial dependence, fear of retaliation, and limited access to smartphones. The group stressed the urgent need for discreet, easy-to-use safety tools with features like voice activation, live location tracking, and stress detection. They also emphasized the importance of privacy, community education, and linking the app to shelters and legal aid. Since victims were hesitant to join interviews due to stigma, professionals were interviewed instead to provide informed, experience-based feedback.
- *Chapter 6:* The chapter shares insights from a survey with 10 professionals who regularly work with domestic abuse survivors. They reviewed different features of the proposed safety app to see how helpful and easy they would be for real victims to use. Features like mental health support, emergency alerts, voice activation, and evidence recording were rated as the most useful. However, some tools—like hidden buttons, Bluetooth-based triggers, and emergency exits—raised concerns, especially about how easily victims could use them during stressful or dangerous moments. The professionals stressed that for the app to truly help, it needs to be simple, fast, and reliable—even for those with limited tech skills or poor internet access.
- *Chapter 7:* Chapter 7 shares insights from an anonymous survey involving survivors, supporters, and professionals to better understand how victims of domestic abuse seek help and what holds them back. Most respondents were women, with many either having lived through abuse themselves or knowing someone who had. Emotional and physical abuse were the most common experiences shared.
- *Chapter 8:* This chapter outlines the step-by-step design process of the safety app, starting from expert input and surveys to low-fidelity paper prototypes tested with abuse victims. Their feedback led to major refinements, including simpler stealth features, Bangla language support, and stronger legal and emotional help. The final Figma prototype integrated these features, while advanced AI components were planned for future development.
- *Chapter 9:* This chapter covers the creation and testing of the app’s first paper prototype. The design focused on discreet features like dummy passwords, quick exit, and legal/emotional support. Seven victims tested the prototype, appreciating its safety focus but highlighting issues with password complexity, language barriers, and usability. Their feedback emphasized the need for simpler stealth features, Bangla language support, and anonymous emotional help. Despite limitations of the paper format, this stage provided key insights to improve the next digital prototype.

- *Chapter 10:* This chapter presents feedback from seven domestic abuse survivors to understand how safe, usable, and discreet the app felt to them. Each woman shared her experience with abuse, her phone habits, and what features she would trust. Most lived under digital surveillance, feared being caught, and wanted an app that could stay hidden. Their responses highlighted the need for features like quick exit, disguised interface, and silent support. Thematic coding revealed 44 common behaviors and concerns, which helped guide the app’s design to be safer and more survivor-friendly.
- *Chapter 11:* This chapter outlines key updates to the app based on victim feedback. The new design followed the Four P’s model—Preparation, Protection, Provision, and Prevention—to match real user needs. Major changes included a simpler dummy password, a central Quick Exit button, risk alerts, legal help in Bangla, emotional support tools, and a cleaner dashboard. All updates focused on making the app safer, easier, and more trauma-informed.
- *Chapter 12:* A criminal lawyer from Chattogram reviewed the app and confirmed its usefulness for abuse victims. She emphasized emotional support, legal guidance, and abuse pattern recognition. While online GD filing is not yet legally strong, she recommended keeping it for future use. She also suggested adding a checklist of legal documents and educating users about their rights and court procedures. Her input helped align the app with real legal and emotional needs.
- *Chapter 13:* The final app prototype was built to feel safe, simple, and familiar for domestic abuse survivors. It looks like a regular grocery app from the outside, but once a real password is entered, it opens a full safety dashboard in Bangla. It includes emergency tools, emotional support, legal guidance, and a secure space to store evidence. A quick-exit button and personalized settings help users stay in control during tense moments. Every feature was designed to protect and support women in danger—quietly and with care.
- *Chapter 14:* This chapter presents a discreet, machine-learning-powered system within the safety app that detects emotional distress and potential danger through voice analysis and app-logged data. Built on a Bangla adolescent speech dataset, the system recognizes fear, sadness, and anger—indicators of high risk—and can silently trigger an SOS using predefined or custom voice commands like “bachao” or “help.” To protect user privacy, all audio is deleted if no threat is found. Additionally, a risk prediction model analyzes multi-modal inputs—such as emotional cues, incident logs, and optional data like heart rate—to classify user risk as low, medium, high, or unknown. This guides protective actions like activating stealth mode or sending alerts. The system is still conceptual but designed with accessible, ethical tools and prioritizes user trust by handling missing data transparently.

- *Chapter 15:* This chapter presents the final evaluation of the safety app prototype, showing how users from different tech backgrounds—ranging from confident to struggling—interacted with its key features. Through hands-on testing, emotional safety questions, and NASA-TLX assessments, the study found that while tech-savvy users found the app easy from the start, others needed a bit of guidance before feeling comfortable. Features like stealth mode, SOS, and voice messages were praised for making users feel in control and emotionally safe, especially in crisis situations. Simplicity, anonymity, and discreet design emerged as crucial factors in building trust. Overall, the app was well-received, with most users saying they would rely on it in real emergencies.
- *Chapter 16:* This chapter outlines the study’s key limitations, such as relying on a Figma-only prototype, untested machine learning features, and the lack of real-world deployment or backend systems. It also emphasizes the need for broader trials to improve accessibility and personalization. Looking ahead, future work will focus on building a fully functional app with integrated machine learning, dynamic disguise modes, community moderation, and testing in real-life distress scenarios. Concluding the study, the chapter reflects on how the project addresses the often-hidden crisis of domestic violence in Bangladesh. By centering discretion, accessibility, and user safety, the research lays a foundation for developing secure, scalable tools to support survivors seeking help quietly and safely.

Chapter 2

Related Work

2.1 Introduction

Domestic abuse is a multifaceted social problem which affects millions of individuals across various gender, age, social class, and ethnicity and culture of the population. Abuse victims struggle with their own set of challenges in seeking audience help, especially in situations where they are being targeted all along by the perpetrators. In the last few years, there has been some improvement in the development of digital platforms which would be helpful for the victims, but there is quite a number of areas with inadequacies in privacy, ease of use and advancement in technology. This literature review observes previous and present research in the areas of domestic violence and abuse intervention services, Human-Computer Interaction (HCI) design, application of machine learning in the area of safety solutions, and structure, processes and other conditions which hinder support for abuse victims.

2.2 The Prevalence of Domestic Abuse

Most of the vile crimes done against women are through physical, sexual, psychological, and social abuse. These violent acts are so common that it is estimated that 1 out of 3 women worldwide or about 35% of them have, at some time in their lives, experienced physical or sexual abuse as a result of IPV or non-partner violence [51][41]. This statistic is so threatening that it has been echoed in multiple global studies, including Ellsberg et al. [29]- who confirmed that domestic violence is a leading cause of non-fatal injury and psychological harm to women around the world. According to their research, in addition, societal stigmas and fear of retaliation were common for under-reporting of domestic abuse particularly in third world countries.

Domestic violence is blindly rampant in South Asia across countries like Bangladesh, India and Pakistan. Schuler et al.[19], continued the exploration of domestic violence in rural Bangladesh, and found that although levels of physical abuse have been reduced, psychological and economic abuse continue to occur. This is especially because of severe under-reporting, they said, in rural areas where societal norms and the fear of further violence keep women silent. The Bangladesh Bureau of Statistics (BBS) reports a decline in domestic violence in Bangladesh. According to survey data, the rate of domestic violence has decreased from 87% in 2011 to

77% in 2013 and 72.6% in 2016 [36]. However, even with this reduction, a significant portion of the female population continues to experience intimate partner violence, particularly in rural and marginalized communities.

Beyond South Asia, it has been shown by Devries et al. [22] the violent intimate relations and partners have long term negative consequences on the women's mental well being. It was found out in this longitudinal study that women who have suffered from IPV had a nearly two fold increase rate of meeting the criteria for depression and a more increased likelihood of attempting suicide. Heise and Kotsadam [31] brought further support and added that structural and cultural determinants significantly influence the risk of IPV especially in areas with longer standing traditions of violence within the home. They further proposed that changing such cultural norms may be critical for violence reduction.

There are new types of abuse as well in the present era consider Freed [40] who further looked at digital technologies in IPV with New York City Mayor's Office to Combat Domestic Violence. Their study shows the problems which the survivors have in relation to technology facilitated violence that includes the abuse of social networks, spyware and cellular controls to control the movements of the victims. Victim advocacy groups recommend the development of technology-based interventions that are both responsive to the concerns of safety and privacy while being accessible to help technological and legal measures for dealing with IPV in the modern world.

Finally, Johnson and Leone [7] also extend the definition of domestic violence to mean not only physical violence but coercive control which clearly demonstrates that IPV is pervasive and systematic undermining the liberties of the victims. It is this expanded definition of domestic violence that brings to focus the need for addressing a number of levels and dimensions of domestic violence as well as its determinants.

2.3 Technological Interventions and Domestic Violence

Multiple approaches of a technological nature aimed at preventing domestic violence have been developed, some of which have grown more successful over time than others. For instance, [66] emphasize on those initiatives that allow the IPV victims in The United States of America and Australia, to use mobile phones for free. These technologies allow victims to record instances of abuse and ask for assistance, however, the abuser can also use these technologies in order to control the victim even more. This particular research puts emphasis on the issue that such technologies must come with privacy and security features that prevent further victimization and stress damaging indicators into Machine Learning/Machine Learning algorithm based systems.

It has been noted that women in Bangladesh are finding smartphones particularly useful as an empowering tool enabling them to help themselves as they become

more urbanised and able to use such devices in order to find help with domestic violence issues [74]. Unfortunately, however, patriarchal regimes and social taboos often undermine the potential of such means. Their findings point out the fact that DV is more sociological problem rather than DV can be solved with the help of DV technological advancements alone.

The majority of methods intended for the domestic abuse victims focuses on direct outreach approaches such as hotlines, shelters, and mobile applications targeted at helping the victims reach support services. As per a report [9], these providers serve important functions for giving support when necessary, but their outreach may compromise the safety of the victims. In their study, Dutton [8] pointed out that there are abusers using technology and the Internet to control the victim, which makes it hard for the victims to seek these services discreetly. Call centers, emergency apps or services are also available, but these are not good for the victims because they are bound to be noticed by the abuser. Platforms like The Aspire News [23] and The Bright Sky [32] application try to deliver discreet assistance, but these applications turn out to be low in their range of services and adaptability.

2.4 Mobile Applications for Domestic Violence Prevention

The effectiveness of mobile apps in combating domestic violence has been evaluated by different studies. One study [26] suggests use of QR codes, hidden gateways and other technologies to help survivors gain access to support without leaving markers in cyberspace that an abuser might be able to track. Similarly, another study [25] suggests that a privacy-focused app would need to balance the usability and security by enabling an implementation where browsing histories are sanitized only on survivors' smartphones as opposed of online servers while not raising suspicion.

According to McKay and Miller's work [57], formerly incorporated smart technologies need to be replaced with new ones that cannot be misused by the abusers. According to them, most wired home devices available currently tend to further assist abusers in the surveillance and the controlling of their victims, and the focus of their designs should be reversed for example how survivors can be enabled to relinquish the control of these devices. It is argued in their research that technologists, policymakers and domestic violence experts should work together to produce devices that will help the victims rather than the perpetrators.

Different researches propose the requirement for a mobile app to tackle women's harassment in public transport. Sarosh et al. [39] discuss the need for a safety app for women from low socio-economic backgrounds in Pakistan and introduced an app called MehfoozAurat which supports women by offering route safety alerts, emergency notifications, audio recordings of any harmful incident as well a few self-defense advice. It is designed with predominantly Urdu speakers in mind. Usability testing showed that users can use this app with few technological skills. The authors also mention that the app addresses the social taboos and linguistic challenges of its region. To better serve a larger audience and strengthen safety precautions for

women who are harassed in public, the authors advocate for more improvements, such as the addition of voice-based controls. A research conducted by Hossain and Umara[55] analyzed DV data from Bangladesh from 2014 to April 2020 using EDA to assess the trend in DV cases before and after the pandemic. They devised a mobile app to support the victims which has a System Usability Scale (SUS) score of 66.71% [55]. The app showed faster data transmission—essential for emergency contact with the victim—at a speed of 8.64 milliseconds. The authors further highlight the necessity to integrate technology into the broader DV response and propose some future work aiming to improve usability and enhance the features to suit other crises similar to the pandemic.

A study [68] conducted a systematic review of 136 smartphone applications aimed at preventing domestic violence. Their study found that while many apps offer emergency alerts and location-sharing features, few incorporate artificial intelligence to automate emergency detection or response. They recommend future app development prioritize AI integration, cross-platform compatibility, and enhanced privacy protections to improve accessibility and user trust. A similar study to that of [68] was carried out by Ford et al. [59] which is more comprehensive and includes much more data. They studied 503 safety and violence prevention apps available on IOS and Android and found that only 61% provided full access for free. Common features included alert systems (71%), alarms (22%), and evidence capture (34%). Users expressed concern regarding personal data use and dubious pricing. Many of these apps are untested which calls for regulations to ensure that victims are not relying on questionable technology.

Aiming in a different direction than the average technological platforms, Manikumar et al.[56] propose a smart device for women’s safety that includes features such as GPS, GSM module, neurostimulator, IoT module, solar charging battery, button-sized camera, and several other sensors. The device can be activated by a trigger and it then proceeds to send an emergency signal and the victim’s location to nearby police while also capturing the aggressor’s image and emitting a loud buzzer. It also works like a Taser to disarm the aggressor and monitor the victim’s heart rate. However, there are certain limitations such as battery dependency, durability, and usability.

Another study by Orji et al.[63] designed a user-centric app for female DV survivors in the age range of 15 to 49 years. It has 8 features which were first demonstrated through a fidelity Prototype (LFP), and based on the results, they selected the features that were perceived as the most persuasive and designed a High Fidelity Prototype (LFP). This study revealed which features the victims responded to the best. Amidst, Panic button (press a button to contact authorities): 75% of the victims were interested, Daily companion (hotline or chatbot to talk to): 50% were interested, Self-Discovery(a questionnaire to support DV victims): 75% were interested, Diary(diary to log their thoughts): 62% interested, Knowledge-Box(resources to support victims): 50% interested, Third ear(listens and analyses the sounds in their environment): 50% interested.

Mahalakshmi et al.[72] introduce a practical IoT solution aimed at improving women’s

safety. Their system features a wearable device with a heartbeat sensor and GPS that automatically detects emergencies and notifies family members or authorities. This builds on prior technologies, such as facial recognition and real-time data sharing, to enhance protection.

Although mobile applications are essential for improving personal safety, they bring up serious privacy and security issues. These issues include the possibility of virus attacks, data theft, identity fraud, financial scams, privacy breaches, and phishing. In order to guarantee a safe and secure experience, it is crucial to address these concerns because users rely on these applications for their security and provide personal information [70].

A notable example of locally developed safety app is Protibadi, which is created to overcome the problem of public sexual harassment in Dhaka, Bangladesh. Created based on the thorough ethnographic field studies of university students, Protibadi has a panic button (Save Me), reporting of incidents, and blogging tool to anonymously write about the experience of harassment. The application is installed to raise an alarm that is quite loud in addition to triggering SMS text to people of emergency contact through the use of GPS. The users are also able to file reports with time and location tags, which are located on an interactive map. But user reviews were not good, people loved the panic feature when they read about it, but in practice, some of them were worried about embarrassing themselves, and did not use that feature often. Other negative criticisms were the absence of police integration, as well as lack of wider scope that initially focused on street harassment only. Users proposed an extension to its coverage to cover online stalking and other gender-based violence. In its shortcomings as an early project, Protibadi was nevertheless a participatory design experience in which the concern of victims was prioritized and one that demonstrated the vital importance of user-informed safety technology design in South Asia [24].

2.5 Speech Recognition and Wearable Technology in IPV Detection

A DV victim is always vulnerable, and in several instances during the perpetrator's conviction, a victim might be often rendered with no evidence. According to Hloviuk, Zavgur, Igor, and Oleksandr[71], most court only accepts if the origin of the audio recording is clear and the method of recording is ethically acceptable. Therefore, while some audio or video clips might not be accepted, certain recordings enforce the victim's claim. Thus speech recognition technology will only prove to benefit our cause.

Technological advancements in speech recognition and wearable devices have shown promise in detecting and preventing domestic violence. Many researchers utilized AI to develop tools to help domestic abuse survivors. For example, the study conducted by Talwalkar and Crooks [73] introduced SAFE (Survivor Assistance through Forecasting and Engagement) which is an AI tool used to help IPV survivors by predicting abusive behavioral patterns in abusers while also providing support during recovery. When it comes to violence and sending immediate assistance to the vic-

tims, speech recognition proves to be the most efficient method for detecting any assault quickly. Another study [35] introduces a technique to detect distress in speech by developing a binary classification to classify fear and anxiety in the victim’s voice and anger in the abuser’s voice. Several other studies were conducted interlinking both Speech Recognition and verbal assault.

One study conducted by Gao and Ye [50] proposes bullying detection in schools by an algorithm based on k-NN. It uses features extracted from acceleration and gyro data to detect assault and uses speech-emotion recognition for verbal abuse. They categorize different emotions to train the model and differentiate between bullying and nonbullying. The KNN algorithm produced an accuracy of 70.4% for physical assault and 78% for verbal assault. A more detailed study with better accuracies was carried out by Muraleedharan and Garcia-Constantino [62] developed a domestic violence detection system using smart microphones and deep learning models, achieving an 83 percent accuracy in detecting violent incidents based on sound data. This innovation represents a novel application of IoT technologies in IPV prevention, offering a cost-effective and privacy-conscious solution. Similarly, Mareeswari and Patil [47] propose a voice recognition-based wearable device that can send emergency alerts when triggered by voice commands or a panic button. While the system offers hands-free communication during emergencies, challenges such as false alarms and reliance on internet connectivity highlight the need for further refinement in real-world applications.

Further into this study of speech detection, Anwar, Amna and Kanjo, Eiman [65] devised an app that utilizes mobile recordings through the device’s speakers to detect violent speech. According to the authors, this user-centered app “actively demonstrates applied theoretical practices across both the Tiny Machine Learning and HumanComputer Interaction literature.” This app has several designs which are considered “Self Reporting” and “Manual Recording”, giving the user control of the recording methods and devices, and also recording the audio whenever they see fit. There are also the options of “Privacy”, “Persistent Notification” and “Contact Warnings” which ensure that the user is getting updates on the constant data access the app has, and also has saved trusted contacts to whom the audio can be forwarded should the need arise.

Since our study is based on Bangladeshi women, we have to consider the main language as Bangla. While there are countless studies on speech recognition in English, our’s will be focusing on recognizing speech in Bangla. Paul et al. [15] developed a comprehensive Bangla speech recognition system utilizing speech signal processing and pattern recognition. It recognizes speech patterns through Linear Predictive Coding (LPC) (extracts important speech features) and an Artificial Neural Network (ANN) (recognizes speech patterns).

2.6 Case Studies on Domestic Violence and Cultural Context

Several case studies provide context for understanding the broader societal factors contributing to domestic violence. While the existence of various helplines for DV victims might appear to be beacons of hope, several victims refuse to reach out for reasons relating to societal taboos. Schuler and Islam [13] and Taher and Jamaluddin [33] examine the prevalence of IPV in Bangladesh, finding that patriarchal norms and economic dependence often prevent women from seeking legal remedies. Naved [11] also highlighted the barriers to disclosure and the behaviour of seeking help among Bangladeshi women, showing that many victims remain silent due to societal stigmas and fear of further harm. These studies underscore the need for societal changes in addition to technological interventions to combat domestic violence effectively.

Further studies by Khandoker et al.[12] attribute the reluctance of women to speak against DV to societal stigma, patriarchal attitudes, legal inefficiency, and the dowry system. They studied data from Bangladesh Demographic and Health Survey conducted in 2004 and highlighted that 67.7% of wives experienced domestic violence, and 26.6% suffered sexual violence. Aside from societal bounds, women often hesitate to contribute to the prosecution of their abusers for fear of getting stalked and assaulted. Infact, Logan and Walker [14] focus on the phenomenon of partner stalking revealing studies that show that 81% of women who are stalked by a partner face physical assault and 31% face sexual assault. They interlinked the instances of severe stalking with severe psychological abuse, controlling behavior, and threats. The victim's cooperation is required to build a case against the abuser which leads to further threats to the victim's safety. Overall the victim is discouraged further and further to expose the abuser.

2.7 Digital Surveillance on Victims

As a result of the advancement of technology, there are new means through which abusers are able to monitor and control their victims which aggravates the already multifaceted issues related to domestic violence. Chatterjee et al.[44] look into a serious matter where one of the partners in a relationship uses apps as tools of abuse to monitor their partners as they consider the apps as tools of abuse rather than all-purpose apps. The study noted that there were hundreds of these apps and stated that security measures in use today can often fail to detect these apps posing a serious risk for the victims of abuse. Building on this, Freed et al.[46] studied stalkerware abuse in greater detail focusing on the particular kind of software which allows abusers to control the interactions of their victims on the internet, as well as gain access to their physical location and key movements. Unlike other kinds of spyware, stalkerware is hard to detect and is therefore very risky. Many victims of domestic violence do not even know that they are being spied on so there is always an aura of being watched and there is no sense of privacy. Such factors raised the issue of the higher need for better detection technologies and policies which would

restrict the way such technologies are abused.

Moreover, Salter et al.[48] investigated a study of abusers who tend to utilize common technologies today such as social media tools, GPS devices, and even smart home devices to stalk and dominate the lives of their victims. Victims remain in oblivion of how their privacy is breached and information posted online can be retrieved and edited with ease. This low level of understanding increases the dangers of such technological abuse as digital stalking which makes the victim quite prone to abuse and threats from their perpetrators. Their study highlighted the necessity of public awareness raising efforts together with stronger privacy enhancing technologies aimed at mitigation of these adverse practices. In the same vein, [53] examined the phenomenon of surveillance by intimate partners aided by easily purchasable spyware tools. Their research pointed out that the commodification of such spyware has made it easier for abusers to surveil their partners without requiring technical expertise. They raised concerns about the unethical use of such physical tools and therefore, proposed that the distribution and sale of these tools should be limited but not completely ignored. Another researcher who pursued the idea of "tech abuse" was Woodlock [42] whose emphasis was on how technology allows an abuser to control almost all aspects of life of the victim physically and psychologically. From her interviews with survivors of domestic violence, she learnt that a number of the victims were usually helpless, as technology allowed abusers to monitor their activities remotely and continuously. A collectivisation of Woodlock's argument suggests that the trauma associated with abuse is compounded by the presence of cameras and the knowledge that private moments are likely still being observed.

The high level of prevalence of digital surveillance over victims highlights the necessity of quiet and secure platforms that can assist in covertly and securely, with no more risk to victims. Given the escalating abuse that abusers commit with technology to constrain and monitor partners, it is critical to develop victim centric technological products which are focused on a person's safety, privacy, and autonomy. The growing use of digital tools compounds the need for platforms which provide covert support for victims to receive assistance while maintaining safety and security in both physical and digital location.

2.8 Privacy Challenges in Shared and Surveilled Mobile Environments

The design of any safety application for domestic abuse victims must critically consider the pervasive privacy challenges in shared or surveilled mobile environments. Victims of domestic violence, particularly in regions like South Asia, often do not have exclusive control over their mobile devices. Instead, they must navigate their digital experiences under close scrutiny from abusers or family members [49].

In Bangladesh, for instance, Saquib et al. [49] found that women frequently rely on shared phones due to economic dependence and household norms. This shared access compromises their ability to store sensitive information, communicate with support networks, or even log abusive incidents safely. Victims reported relying on makeshift

strategies such as app masking, deleting logs, or hiding contacts, all of which are fragile and prone to discovery. The authors highlight an urgent need for technological systems that enable victims to maintain privacy through non-discoverable, dual-use interfaces—an approach directly aligned with the disguised app model proposed in this thesis.

Mennicken et al. [28] further emphasize the complexities of interaction design in shared domestic spaces, noting that even benign digital interactions are influenced by power dynamics and visibility concerns. Their study found that users prefer systems that provide private control over conversational data and that they tend to avoid digital features perceived as invasive or overly visible. The app design developed in this thesis applies these findings by integrating consent-based SOS features, a customizable dummy interface, and real-time emergency logic—all tailored to reduce perceptual risk for users under surveillance.

Beyond South Asia, similar concerns have been addressed in broader HCI literature. Woodlock [43] terms this pattern technology-facilitated abuse, where abusers use GPS tracking, spyware, and even shared smart home devices to exert psychological control. She argues that effective counter-designs must incorporate survivability-by-design, where user interaction patterns remain indistinguishable from mundane behavior. This thesis incorporates that logic through its grocery-list themed disguise and anonymized support community.

Additionally, DeVito et al. [52] explore contextual privacy needs, particularly how users' behavior adapts based on who they expect to observe them. Victims may not require blanket encryption or deletion features but rather subtle control mechanisms that can be adapted dynamically. The app's ability to update dummy passwords, change disguise modes, and customize help triggers directly supports such needs.

Together, these studies underline a shift in HCI research toward victim-aware, culturally localized, and discreet systems of protection. Rather than assuming victims are always free to choose when and how to use digital tools, the literature suggests designing under conditions of constraint, coercion, and non-consensual surveillance, a guiding philosophy throughout the development of this research.

Chapter 3

Methodology

There are multiple websites, mobile apps, and AI tools that are introduced in the market to benefit a wide margin of DV (Domestic Violence) victims. Each platform has its specific design principles catering to a set of victims who were interviewed. Most of the platforms prioritize usability and privacy, however, a large portion of these designs do not consider the language and literacy barriers[68]. The target audience for this study is the women who are domestically abused in Bangladesh. Therefore, the language and literacy barriers in the existing platforms are only one of several limitations. Thus, we devised a work plan to address these existing features along with their limitations, and propose methods to improve these methodologies in a way that bridges the gap between the solutions and our victims.

3.1 Work Plan

The work plan will be carried out as shown in Figure 3.1.

A phases of the work plan have been carried out, and their results have been analysed in the chapters following ahead.

Part 1: This part of the study constitutes of the extensive research done on existing apps, conducting interviews with professionals and carrying out surveys to decide on the features best suited for the victims.

Phase 1: Literature Review and Search for Existing Solutions for Domestic Abuse Victims

- Conducted a study on domestic violence research, reviewing governmental reports, mobile apps, and AI tools to assess methods utilized in aiding victims.
- Classified each solution according to its field of study (e.g., physical, emotional, financial, and societal abuse).
- Determined the effectiveness of each solution based on usability, user approval, privacy, and the results of these interventions.

Phase 2: Investigate Ways to Improve Existing Solutions

- Examine trending ML and dynamic data masking technologies in DV victim support platforms.

Phase 3: Data Collection and Assessment

- Collected quantitative data from DV victims/survivors to assess the effectiveness and usability of existing support platforms.
- Examined areas for improvement in existing DV platforms based on usability, safety, and privacy preferences collected from surveys.

Phase 4: Study the Methodologies Used in Existing Platforms

- Studied methods such as real-time monitoring, emergency contact options, and discreet texting.
- Analyzed the success rate of these methodologies in real-world apps and assessed their impact on victim security.
- Compared methodologies used across various platforms to determine the best approach.

Phase 5: Investigate How Machine Learning Algorithms Can Assist in Detecting the Emotion of Fear

- Analyzed the ethical concerns regarding voice recognition and audio recording, focusing on the privacy risks for both the victim and the aggressor.

Part 2: This part of the study researches methods to hone the existing architectures, conduct the victim interviews, and finally develop the app prototype.

Phase 1: Investigate Ways to Improve Existing Solutions

- Identify how these technologies can be improved to ensure greater security for victims under constant surveillance.
- Discuss strategies for dynamic data masking models.

Phase 2: Conduct Qualitative Interviews with Victims to Determine the Best Approaches

- Conduct qualitative interviews with DV victims to understand their psychological and security needs when using these platforms, focusing on privacy preferences.
- Introduce user-centered design principles to enhance surreptitiousness, flexible usability, and mental support for victims.

Phase 3: Analyze How Dynamic Data Masking Helps Provide Security

- Analyze how dynamic data masking can help DV victims, particularly those under constant surveillance, and how this technology can aid in using the platform undetected.

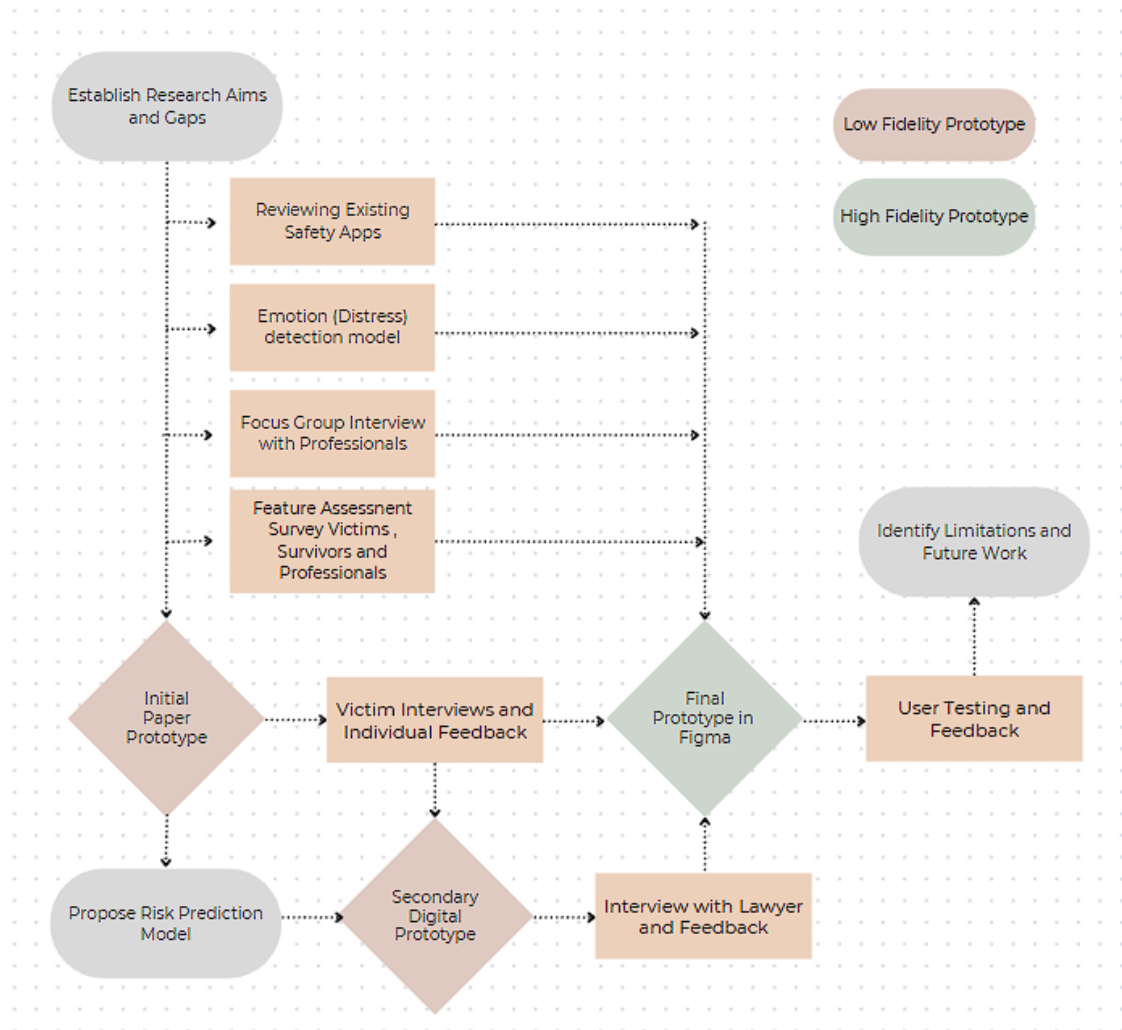


Figure 3.1: Workflow Chart

Phase 4: Model Testing and Feedback

- Gather user feedback on the improved model, focusing on safety, surreptitiousness, and ease of use.
- Collect qualitative and quantitative data to improve the model and technologies.

Phase 5: Analyze Challenges of Dynamic Solutions and research existing ML models

- Analyze technological and ethical challenges when implementing the dynamic data masking methodologies. Research and find existing ML algorithms to help with voice recognition and risk prediction modules

Phase 6: Final Analysis

- Analyze the improvements the model brings to the security of DV victims.
- Provide recommendations for future work to further support DV victims.

3.2 Review of Existing Apps

To systematically evaluate the suitability and usability of mobile safety applications for the Bangladeshi context, this chapter employed a multi-method approach combining market analysis, heuristic evaluation, persona-based user testing, and comparative feature assessment. Initially, a market review was conducted to identify widely available safety applications, focusing on both local and international platforms. The selection criteria emphasized app functionality without internet dependency, support for local languages such as Bangla, affordability, and the presence of privacy-focused features. Following the initial screening, Nielsen’s 10 Usability Heuristics were applied to assess each app’s interface and interaction quality, particularly focusing on emergency functionality, language accessibility, simplicity, and feedback mechanisms. To supplement the heuristic evaluation and better simulate real-world usage under distress, persona-based testing was conducted using detailed user profiles that reflected diverse socio-economic and technological conditions in Bangladesh. This method allowed the testing of apps within scenarios that mimic urgent, high-risk situations, where digital literacy, internet availability, and device types varied across personas. Each persona’s interactions, pain points, and success rates were meticulously documented to highlight both functional barriers and contextual mismatches. Finally, a comparative matrix was developed to categorize the apps based on feature sets, platform availability, regional limitations, and operational dependencies such as GPS and mobile data. This layered methodology ensured a comprehensive, context-sensitive assessment of the safety apps, offering insights that are directly applicable to the Bangladeshi user demographic.

3.3 Focus Group Interview with SELP Professionals

To obtain practical insights and expert opinions regarding the challenges domestic violence victims face and to develop appropriate app features, a focus group discussion was carefully conducted with ten seasoned professionals from BRAC’s Social Empowerment and Legal Protection (SELP) program. These professionals were purposefully selected based on their extensive field experience, with service lengths ranging from 3 to 27 years, and were drawn from various districts across Bangladesh, including regions such as Manikgonj, Shariatpur, Pabna, and other smaller communities. Their backgrounds provided a broad understanding of both urban and rural domestic abuse cases. The session was held online via Google Meet on January 20th, coordinated by the SELP Zonal Manager from the Khulna Zone, and continued for approximately ninety minutes. A semi-structured interview guide (refer to Appendix A) was used to direct the conversation while allowing participants to openly share their lived experiences, professional observations, and critical suggestions. To ensure natural communication, the discussion was conducted in the native language (Bangla) and later translated into English for systematic review. Throughout the session, the professionals offered detailed accounts of victim behaviors, privacy concerns, barriers to technology access, and potential features that could genuinely support women in danger. Responses were carefully analyzed using thematic coding to identify recurring concerns and to extract practical recommendations for app development. Due to the sensitive nature of the topic and ethical limitations in directly involving survivors, this focus group method provided a reliable and contextually rich alternative to gather field-based perspectives essential for designing an effective, discreet digital intervention.

3.4 Feature Assessment Surveys

3.4.1 Professionals’ Preferred Features Survey

To comprehensively evaluate the practicality, safety, and accessibility of the proposed domestic abuse prevention app features, a structured survey was conducted among ten seasoned professionals who actively support survivors of domestic violence across Bangladesh. The participants, selected from diverse regions such as Faridpur, Kishoreganj, Sherpur, Rajshahi, Jhalokati, and Sirajganj, brought varying levels of field experience, which enriched the diversity of insights collected. The survey was meticulously designed to assess specific app functionalities, each aimed at supporting victims in emergency and high-risk scenarios. It covered key components such as stealth interface design, dynamic masking, emergency escape mechanisms, covert communication options, real-time tracking, evidence collection, mental health resources, and integration with NGO support networks. Respondents rated each feature’s usefulness and accessibility on a five-point Likert scale, ensuring quantifiable feedback, while open-ended questions provided space for nuanced, qualitative perspectives regarding usability challenges, potential privacy risks, and improvement opportunities. The mixed-method approach allowed both statistical trends and detailed professional recommendations to surface. Data was carefully compiled

and thematically analyzed to identify strengths, weaknesses, and areas requiring refinement. The insights gathered from this survey serve as a critical foundation for improving the app’s design, particularly in terms of user safety, discretion, and adaptability in real-life, high-pressure situations.

3.4.2 Users’ Preferred Features Survey

A targeted, anonymous survey was employed to explore the experiences, barriers, and digital access challenges faced by domestic abuse survivors and those supporting them. The survey design incorporated a combination of multiple-choice, checkbox, and open-ended questions, carefully structured to ensure participants could provide valuable information without being required to reveal sensitive or triggering personal details. This mixed-methods approach enabled both quantitative data collection and in-depth qualitative insights, allowing the study to capture the complexity of abuse experiences. The participant pool was intentionally diverse, including survivors, advocates, professionals such as social workers and legal counselors, and individuals connected to victims through personal relationships. This diversity ensured the data reflected multiple viewpoints, from direct experiences to external observations. The survey was designed to assess not only the types and patterns of abuse but also the technological habits of participants, focusing specifically on how digital access influences the ability to seek help discreetly. Particular attention was given to identifying barriers such as fear, lack of privacy, and unawareness of available support systems. Data was systematically gathered and analyzed to uncover trends in communication preferences, patterns of abuse reporting, and technological dependencies that could inform future interventions. This methodology was critical for understanding how support tools, including mobile applications, can be tailored to meet the real-life needs of domestic abuse survivors in both safe and accessible ways

3.5 Design of Paper Prototype

In this part of the research, the design process followed a user-centered and participatory approach, using paper prototyping to develop and assess an early version of a safety-focused mobile application for domestic abuse survivors in Bangladesh. The prototype was created by hand to visually map out the app’s structure, screen transitions, and key features in a simplified, low-fidelity format that participants could easily understand without needing technical expertise. This approach was selected because it allowed quick adjustments based on user feedback while making the app’s flow accessible to individuals with varying levels of digital familiarity. The design was shaped by earlier findings from interviews with survivors, input from legal experts, survey results, and discussions with community-level support workers. To gather practical insights, the paper prototype was introduced to seven women currently facing domestic violence. During individual feedback sessions, participants were guided through the screens while their immediate thoughts, hesitations, and concerns were noted using observation and think-aloud methods. This allowed the research team to uncover significant challenges such as memory strain from complex

password management, the need for full language localization, and the strong desire for simple, confidential ways to seek emotional support. This methodology ensured that the feedback collected came directly from those most affected, helping to refine the design in ways that are responsive to their real-world safety needs and daily experiences.

3.6 Victim’s Interview on The Design

This stage of the research employed a qualitative, user-centered methodology to evaluate the usability, appropriateness, and discreetness of the proposed mobile application for domestic violence victims. The core method involved conducting semi-structured interviews with seven participants, each of whom had experienced some form of domestic abuse and came from diverse educational and technological backgrounds. This diversity was intentional, ensuring that the insights gathered would reflect a wide range of user experiences, digital literacy levels, and safety constraints. To maintain strict ethical standards, each participant was fully informed about the purpose and scope of the study, and verbal consent was obtained prior to participation. No personally identifiable information was collected, and participant anonymity was rigorously protected throughout the process. The interviews took place in safe, private environments selected by the participants themselves to promote comfort and openness. Each session lasted approximately 20 to 25 minutes and involved walking the participants through a paper prototype of the initial app design. Open-ended questions were asked in Bangla, following a semi-structured interview guide, and participants were encouraged to share their real-life concerns, preferences, and feedback in their own words. The responses were later translated into English and manually coded to identify recurring themes, usability barriers, and critical design requirements. The analysis particularly focused on features that would be most relevant in high-risk situations, including those requiring stealth, ease of use, and emotional support. This methodology ensured that the design decisions were directly informed by the lived experiences and safety needs of the victims, rather than being based solely on theoretical assumptions. The insights from this phase significantly shaped the app’s evolution and served as a foundation for the subsequent design refinements.

3.7 Development of the Secondary Design

In the secondary design phase, the development process focused on refining the application based on direct feedback from domestic abuse survivors who had previously engaged with the paper prototype. This iteration was guided by a user-centered design methodology, where real user experiences shaped both the structure and interaction flow of the digital prototype. The team transitioned to using a basic digital design platform, which allowed for more interactive visualizations and smoother navigation simulations compared to the earlier paper-based model. The feature development and interface organization were anchored in the Four P’s framework—Preparation, Protection, Provision, and Prevention—which helped en-

sure that each app component addressed specific stages in a victim’s safety journey. Throughout this phase, priority was placed on integrating user-informed changes, such as simplifying the login process by removing email requirements, redesigning the dummy password system for easier recall, enhancing the visibility and placement of the Quick Exit button, and providing culturally appropriate Bangla language support. The methodology emphasized iterative improvements, where victim feedback was not only gathered but actively used to reshape the app’s features, such as emotional support channels, practical legal guidance, and the addition of a risk prediction tool. This participatory process allowed the prototype to evolve beyond initial assumptions, creating a more accessible and emotionally supportive experience that closely aligns with the complex realities faced by victims in Bangladesh.

3.8 Advocate’s Interview on the Design

To obtain professional legal insights regarding the app’s usability, legal accuracy, and practical implementation, an in-depth, semi-structured expert interview was conducted with a practicing criminal lawyer based in Chattogram, Bangladesh. The lawyer was purposefully selected using expert sampling due to her specialized experience in criminal cases involving women, children, and drug-related offenses, making her an authoritative source for appraising the app’s relevance to domestic violence (DV) victims. The interview was conducted virtually via Google Meet and lasted for approximately one hour and twenty-three minutes, allowing sufficient time for detailed exploration of complex legal topics. A semi-structured interview format was employed to provide flexibility, enabling the lawyer to share her professional judgment while allowing the interviewer to ask follow-up questions for clarification and deeper understanding. Prior to the interview, a discussion guide was prepared, which covered the app’s proposed features, legal assistance components, and the practical steps domestic abuse victims must take within the Bangladeshi legal framework. The session was audio-recorded with the lawyer’s consent and supplemented by real-time note-taking to ensure the capture of both technical and nuanced feedback. The qualitative data gathered from this session were later thematically analyzed and cross-referenced with relevant Bangladeshi legal statutes, including the Criminal Procedure Code (1898)[3], the Domestic Violence (Prevention and Protection) Act (2010)[17], and the Women and Children Repression Prevention Act (2000)[6], to ensure accuracy and legal validity. This expert interview method was crucial in strengthening the app’s design by aligning its features with the legal, social, and emotional realities faced by domestic violence victims in Bangladesh.

3.9 Development of the Final Prototype

For designing the final prototype, the methodologies employed in developing the personalized settings, support tools, legal assistance modules, and the app community were grounded in user-centered design and trauma-informed technology principles. To ensure adaptability and user autonomy, the personalized settings module was developed to allow victims to dynamically update critical safety elements such as

disguise interfaces, dummy passwords, emergency contacts, and SOS trigger configurations. This customization capability was prioritized to accommodate the evolving risk environments victims often face. Emotional support tools were incorporated based on qualitative feedback from survivors, who emphasized the need for accessible self-care resources and discreet community interaction. These features were carefully designed to minimize cognitive load, using simplified navigation structures, calming color palettes, and minimal text density to ensure effective usability during high-stress situations. The legal assistance component was iteratively developed in consultation with legal professionals to address widespread knowledge gaps around filing General Diaries (GDs) and understanding legal rights. Additionally, the app community was structured as a non-real-time, anonymously moderated space to foster peer support while safeguarding user identities. All community posts underwent manual moderation before publication to ensure safety and appropriateness. Throughout the development process, the NASA TLX was utilized during user testing phases to quantitatively assess cognitive workload, confirming that design adjustments such as intuitive task flows, immediate feedback confirmations, and functional parity between the real and dummy UIs effectively reduced user strain. Importantly, the dummy interface was engineered with full functional replication to withstand potential scrutiny by abusers, including a settings module that seamlessly allows for dummy password changes without compromising the core safety system. The methodologies across these modules consistently emphasized proactive protection, emotional empowerment, and plausible deniability, ensuring that the app not only provided immediate safety mechanisms but also supported long-term resilience and user autonomy in high-risk scenarios.

3.10 Machine Learning Integration

3.10.1 Distress and Trigger Word Detection

In this phase of the project, the methodology focused on integrating machine learning-based emotional distress detection and trigger word recognition into the safety application. The process began with selecting an existing BASER Dataset[60], a culturally appropriate Bangla-language speech emotion dataset that captures five core emotional states relevant to the target user group. The model [61] was tailored to the application’s context by developing a custom distress detection logic, where simultaneous high probabilities of fear, sadness, and anger were used as indicators of acute emotional distress. This rule-based extension enhanced the system’s sensitivity to high-risk scenarios requiring immediate intervention. The machine learning component was designed for flexible deployment, either through on-device processing using TensorFlow Lite or server-side processing via FastAPI to ensure accessibility across varying device capabilities. Audio recordings were collected in discreet, five-second intervals, preserving user privacy through automatic deletion if no distress was detected. To complement emotional monitoring, a trigger word detection system was proposed using lightweight offline engines such as Porcupine and Vosk, enabling the app to respond to personalized emergency keywords like “bachao” or “help.” Privacy and safety were prioritized throughout the methodology by ensuring user-controlled settings for enabling or disabling background monitoring, using

silent recording modes to avoid abuser detection, and strictly avoiding unauthorized microphone access. Battery efficiency was also carefully considered by minimizing sampling frequency and optimizing file compression. This multi-layered approach ensured that the distress detection feature could operate reliably, privately, and efficiently within the safety-critical environment of the app.

3.10.2 Risk Prediction Model

This component of the research employed a multi-modal predictive framework to assess domestic abuse risk levels based on user-generated incident data within the app. The model utilized a combination of structured inputs, including timestamps, incident types, frequency of occurrence, and optional physiological indicators such as heart rate, alongside unstructured text descriptions provided by users. Textual inputs were preprocessed using natural language processing techniques such as tokenization and lemmatization, and transformed into numerical vectors via methods like TF-IDF or contextual embeddings. Time-based features were normalized to capture situational patterns, such as whether incidents occurred during late-night hours or weekends. For risk classification, a Random Forest model was selected due to its flexibility in handling both categorical and numerical variables, with alternative options like logistic regression and gradient boosting considered for comparative evaluation. Risk levels (High, Medium, Low) were predicted using a combination of learned patterns and predefined heuristic thresholds based on incident frequency, severity, and behavioral indicators such as abusive language or escalation trends. To address missing or incomplete user data—a frequent challenge in real-world deployments—the system was designed to flag situations with insufficient information as “Risk Unknown,” prompting the user to log further incidents for accurate personalization. Model outputs were integrated directly into the app’s visual interface through a color-coded dynamic calendar, providing users with contextual safety recommendations and guided action prompts. Throughout the methodology, a conservative design philosophy was adopted: the system was programmed to prioritize user safety by favoring higher risk classifications in ambiguous scenarios, ensuring that emergency features remained accessible regardless of predicted risk levels. This approach carefully balanced algorithmic decision-making with ethical safety considerations, emphasizing that the app serves as a supportive tool rather than a replacement for personal judgment.

3.11 User Testing of The Final Prototype

In this study, a comprehensive user-centered evaluation was conducted to understand the app’s usability, emotional security, and cognitive demands. A combination of qualitative and quantitative methods was applied to ensure a well-rounded analysis. The core technique involved user interaction using the Think-Aloud Protocol, where participants continuously described their thoughts, challenges, and decision-making as they navigated key app functions like stealth login, silent SOS activation, sending voice messages, and quick app exit. This approach made it possible to capture

real-time reactions and uncover areas where users struggled or hesitated. To complement these observations, participants completed a structured assessment based on the NASA Task Load Index (NASA-TLX) [4], which evaluated their perceived mental effort, physical exertion, time sensitivity, satisfaction with performance, required effort, and frustration levels. Furthermore, the emotional safety and trustworthiness of the app were explored through targeted, scaled questions that measured how secure and confident users felt during their experience. By integrating direct user feedback with cognitive workload measurements, this evaluation provided both practical and emotional insights into how users of varying technological skill levels interact with the app.

Chapter 4

Existing Safety Apps Review

4.1 Overview

Mobile applications designed to prevent domestic abuse serve as essential tools for ensuring the safety and well-being of victims. However, their effectiveness is influenced by factors such as internet connectivity, accessibility, affordability, and language options. This evaluation examines **53** safety apps to determine their suitability for individuals in Bangladesh. The reviewed apps are listed in Table 4.1.

Table 4.1: List of 53 Safety and Support Mobile Applications

Apps
Avoy[76], JOY[86], bSafe[81], iSharing[85], Guardians, Life360[87], StaySafe, Letstrack, WanderSafe, UrSafe[75], AlertCops, EyeWatch, Raksha, React Mobile, Shake2Safety[92], MySafetipin, Noonlight[91], Bright Sky[94], Injury Capture, SOS Watch, AlertNow, Easy Rescue, SaveGirl Rescue, TapeACall[95], Silent Beacon[77], SOS Alert, ICE Personal Safety, WeHelp, Circle of 6, Aspire News[90], Sheroes[93], Shelter App, DV Assist, Teen Counseling, NCDV, Safety Navigator, Women’s Safety App, CareLife, HelpButton, RescueMe, Home Safe, iProtect, MayDay, ProtectMi, Google Family Link, ch.ch Safety and Justice, MySOSFamily, NineOneOne Emergency Dialer, Silent SOS, SOS App, MayDay App, Home Safe App, My Safety App

4.2 Availability in Bangladesh

The apps were categorized into two groups- available in Bangladesh and not available in Bangladesh. The apps were available in Bangladesh as they were available on either the App Store [84], Play Store [88], or on different websites as APK files. However, 95% of those are not compatible with Bangladeshi users, with limited usability.

Findings

- Majority of the apps are available in Bangladesh, as shown in Figure 4.1 but with limited functionality available for Bangladeshi Users.
- Some apps are developed specifically for Bangladesh, such as **JOY**[86], and **Avoy** [76], but suffer from a lack of awareness and are not listed on major app stores [84], [88].

Safety Apps' Availability in Bangladesh

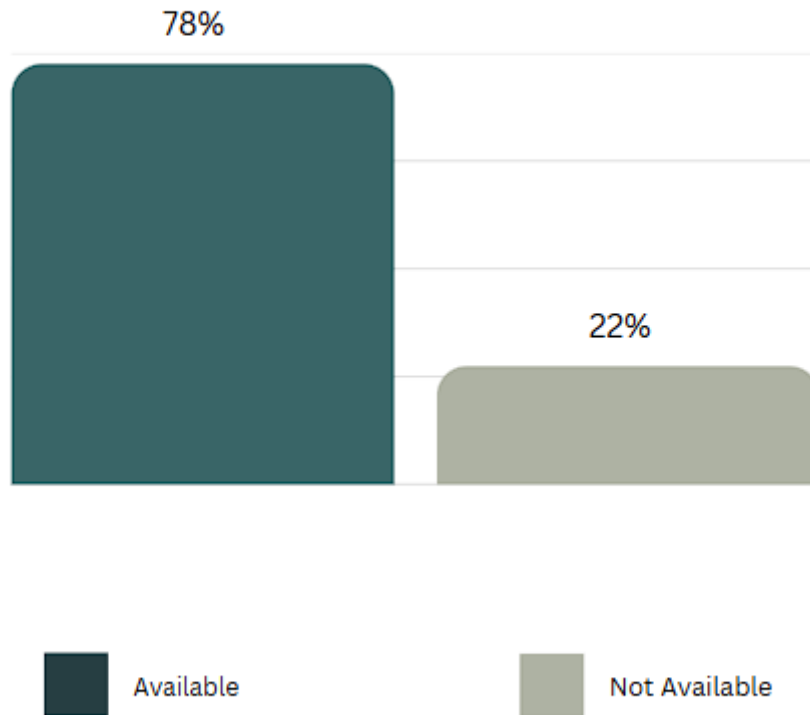


Figure 4.1: Availability in Bangladesh

Implications

- Victims in Bangladesh have fewer options for digital safety solutions, which may force them to rely on alternative, non-digital means of seeking help.
- The regional restrictions on many international apps indicate that these tools are not tailored for a global audience, potentially excluding users from developing nations.
- A greater focus on local development or adaptation of global apps is necessary to ensure widespread accessibility.

4.3 Platform Distribution

The Figure 4.2 depicts that 27.1% of apps are available on Android [88], 6.8% are available only on iOS [84], 33.9% of apps are available on both Android and iOS, while 32.2% of apps are not found on the App Store[84] or Play Store[88].

Platform Distribution of Safety Apps

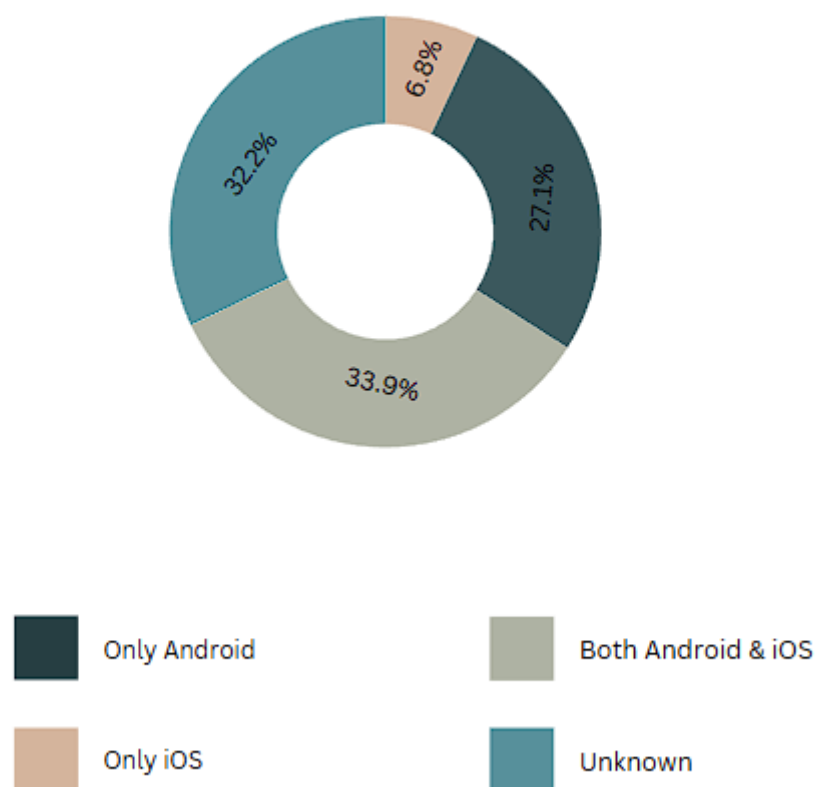


Figure 4.2: Platform Distribution

4.4 Considerations for Compatibility

Several factors affect how well an app can serve victims in Bangladesh:

- **Offline Functionality:** Internet access may be unreliable or unavailable.
- **Minimal Data Consumption:** High data costs can limit app usage.
- **Emergency Assistance Features:** Quick access to help is critical.
- **SOS or SMS Alerts:** Notifications should work without an internet connection.
- **Language Support:** Availability in Bangla or other local languages improves usability.
- **Privacy Protections:** Victims often need discreet communication options.

Based on these criteria, the apps have been categorized as Moderately Compatible or Not Compatible for Bangladeshi users. The percentage of apps which are compatible with the victim demographic in Bangladesh is significantly smaller compared to the percentage of apps which are not compatible. This statistic is visualised through Figure 4.3.

Compatibility for Bangladeshi Demographic

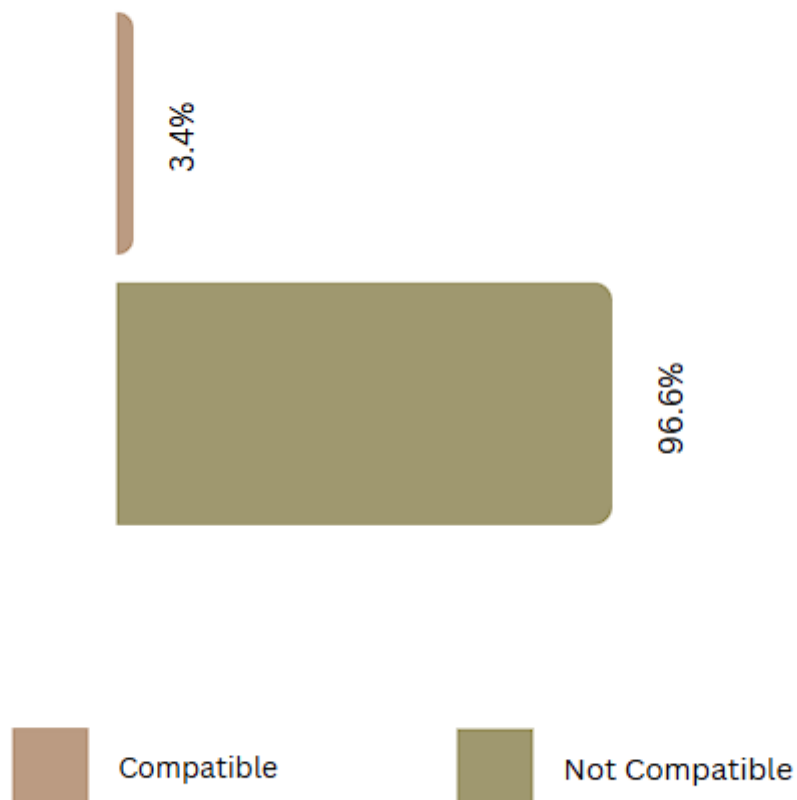


Figure 4.3: App Compatibility for Bangladeshi Demographic

Moderately Compatible Applications:

These apps possess valuable features but have certain limitations affecting their usability in Bangladesh.

Avoy [76](Developed in Bangladesh)

- Specifically created for Bangladeshi users.
- Helps users locate safe areas and connect with emergency services.

- Awareness about the app remains low, and it is not listed on major app stores [84], [88].

bSafe [81]

- Provides voice-activated SOS and live audio/video streaming.
- Allows discreet alerts to emergency contacts.
- Some functionalities may be limited to specific regions and were not designed with Bangladesh in mind.

Noonlight [91] (formerly SafeTrek)

- Offers a panic button feature to notify emergency contacts.
- Enables real-time location sharing for safety.
- Requires a constant internet connection and was not specifically designed for Bangladeshi users.

iSharing [85]

- Facilitates real-time location sharing between trusted individuals.
- Relies heavily on GPS and internet connectivity.

Life360 [87]

- Sends emergency notifications to selected contacts.
- Some vital features are locked behind a paid subscription.

JOY App [86]

- Government app created and catered for Bangladeshi users.
- Not currently available on major app marketplaces [84], [88].
- Feature details are not documented.

Apps Not Compatible for Bangladeshi Users:

These apps have significant constraints that hinder their practicality for users in Bangladesh.

Aspire News App [90]

- Limited availability, accessible only within the U.S.
- Requires a stable internet connection to function properly.

MyPlan [89]

- Primarily intended for users in developed nations.
- Demands extensive data input before assistance is provided.

One Love [83]

- More focused on spreading awareness rather than offering emergency assistance.
- Lacks features needed for immediate action in crisis situations.

and many more.

In conclusion, moderately Compatible Apps may be useful but require modifications for better accessibility and efficiency in Bangladesh. Not Compatible Apps are impractical due to limitations such as internet dependency, restricted regional access, and affordability concerns. Developing or adapting apps tailored to Bangladesh's unique needs would enhance the safety and support available to domestic abuse victims.

4.5 Usability Heuristic Evaluation: Safety Apps in Bangladesh

To assess the usability of safety apps in the Bangladeshi context, we applied Nielsen's 10 Usability Heuristics, a widely accepted framework in Human-Computer Interaction (HCI) used to evaluate interface design. This allowed for a systematic examination of both local applications such as Avoy[76] and JOY[86], and international platforms like bSafe[81], Noonlight[91] etc.

While apps like Avoy and JOY are developed specifically for Bangladesh and include familiar language and contact options, they are often difficult to discover and suffer from limited awareness or technical limitations. In contrast, global apps such as bSafe and Noonlight offer advanced capabilities like real-time location tracking and panic alerts but assume high-speed internet or GPS access, which is not always feasible in many areas of Bangladesh.

Quick, one-tap emergency alert mechanisms proved to be one of the most effective features across apps. However, issues such as overly complex setup, subscription requirements, and vague confirmation messages hindered performance. Additional privacy concerns emerged from features like visible alerts or automatic call recordings, which could inadvertently expose victims to further danger.

For safety apps to be truly functional in Bangladesh, they must:

- Operate under poor or no internet connectivity,
- Provide interfaces and content in Bangla,
- Offer critical features for free,
- Ensure simplicity, discretion, and speed under stress.

Heuristic-Based Findings

Table 4.2: Nielsen Heuristic Evaluation of Safety Apps in the Bangladeshi Context

Heuristic	What's Working Well	Where It Falls Short / What Could Help
1. System Status Visibility	SOS alerts clearly show when they're sent	No clear feedback when offline or poor signal; show connection status clearly during emergencies
2. Real-World Match	Local apps use familiar names and contacts	Global apps don't fit local context well; use local language, contacts, and emergency info
3. User Control & Freedom	Some apps let users easily cancel alerts	Some require lots of info or can't easily cancel; make it quick and easy to cancel or exit alerts
4. Consistency & Standards	Local apps follow local design practices	Global apps feel inconsistent and confusing; use a consistent, simple design that fits local users
5. Error Prevention	Some apps confirm before sending alerts	Others don't warn if connection fails; add confirmation steps and backup alert methods (like SMS)
6. Recognition vs Recall	One-tap SOS triggers are simple and easy	Complex setups make it hard to use in a crisis; keep it simple—less typing, fewer steps
7. Flexibility & Efficiency	Basic safety features are free to use	Paid features block key safety options; make sure essential features are free and fast to access
8. Minimalist Design	Some apps focus on the most important features	Clutter and poor visibility in others; clean up the interface and highlight core functions
9. Help with Errors	Some error messages exist	Few apps explain what to do if something goes wrong; provide clear tips and next steps when errors happen
10. Help & Documentation	Resource apps offer useful info	Most apps don't explain how to use SOS features; include simple guides and tips inside the app

Overall Analysis

The evaluation revealed a mixed performance across safety apps. While locally developed apps tend to align better with user expectations in terms of language and

emergency contact relevance, they remain underutilized due to poor discoverability and inconsistent functionality. On the other hand, international apps, though feature-rich and visually polished, often fail in practical scenarios where users lack consistent access to the internet or GPS.

A major positive across several platforms was the presence of a one-tap SOS button, which minimized cognitive burden and facilitated rapid emergency response. However, many apps negated this benefit by requiring complex onboarding, offering vague status feedback, or placing core features behind paywalls.

A key concern was the lack of system feedback and error recovery options. In situations where a user is unsure whether their alert was sent or failed, their confidence in the application diminishes. This lack of transparency and guidance can be detrimental during life-threatening situations.

Ultimately, usability must be grounded in the socio-technical realities of Bangladesh. This includes limited device capabilities, shared phone use, intermittent connectivity, and cultural constraints. Addressing these usability barriers is essential in designing safety apps that are not only technologically advanced but also contextually effective and trustworthy.

4.6 Persona-Based Testing: Complementing Heuristic Insights

While the Nielsen Heuristics evaluation helped identify general usability issues across apps, we further validated these insights through persona-based testing- an HCI method that simulates real users in real-world contexts. This provided a deeper look into how diverse users in Bangladesh might experience these safety apps under distress. We created three realistic user personas based on location, phone type, literacy, and risk exposure. Each persona was tasked with using a specific app during a simulated high-risk situation.

We developed three realistic user personas based on known socio-demographic profiles in Bangladesh. For each persona, we simulated high-risk tasks using selected safety apps and documented the outcomes.

Persona 1: Rina Akter – The Urban Student

- **Age:** 22
- **Location:** Dhaka City
- **Phone:** Android smartphone (low-end)
- **Internet:** Mobile data, often unstable
- **Language Preference:** Bangla
- **Experience:** Comfortable with apps but under stress avoids complex interfaces

Task: Send a silent SOS alert during an argument at home using bSafe[81]

Result:

- Could not locate Bangla language option
- Alert setup required permissions and steps that were unclear
- No confirmation if alert was sent due to poor signal

User Feedback: “I don’t know if it worked. I needed something quicker and clearer.”

Persona 2: Mariam Begum – The Rural Housewife

- **Age:** 38
- **Location:** Rajshahi (rural area)
- **Phone:** Basic Android smartphone
- **Internet:** Very limited; mostly offline
- **Language Preference:** Bangla only
- **Experience:** Low digital literacy; relies on family members for complex tasks

Task: Use the Avoy[76] app to locate a safe shelter and send an SMS-based SOS alert

Result:

- App was not listed on Play Store; required manual APK installation
- Interface was fully in Bangla, which helped navigation
- GPS failed to detect exact location due to poor signal
- SMS failed due to insufficient mobile credit and no fallback option

User Feedback: “It looked helpful, but I couldn’t install it myself or send the alert when I needed to.”

Persona 3: Asha Rahman – The Hidden User

- **Age:** 19
- **Location:** Chattogram
- **Phone:** Shared Android phone (monitored by partner)
- **Internet:** Stable home Wi-Fi
- **Language Preference:** Bangla and English
- **Experience:** Tech-savvy, aware of privacy risks, needs stealth options

Task: Install and test the UrSafe[75] app, using SOS, fake call, and tracking features without getting detected

Result:

- SOS button, fake calls, and live location tracking worked reliably
- Voice activation and hands-free options offered discreet triggering
- App icon and interface were clearly labeled “UrSafe”
- App appeared in recent apps and generated visible notifications
- No built-in disguise mode (e.g., calculator or fitness mask)

User Feedback: “The features are amazing, but I’d be caught using this. I wish the app looked like something else, a diary or a fitness tracker so I could use it safely without anyone noticing.”

Conclusion

Persona-based testing illustrated that apps which score well in usability may still fail under contextual pressure- especially for Bangladeshi victims. Cultural fit, simplicity, and stealth matter more than advanced features. This supports the case for a Bangladesh-specific app with offline support, localization, and discreet design.

4.7 Comparative Analysis of Selected Apps

After reviewing the apps, a comparative analysis of the selected apps was presented under certain criteria in Table 4.3. The apps were also grouped in to these criteria based on the similarities of features and limitations between them.

Table 4.3: Categorization of Safety Apps by Feature Type, Limitations, and Platform

Criteria	Apps	Features	Limitations	Platform
Location Sharing & Tracking	bSafe, iSharing, Guardians, Life360, StaySafe, Letstrack, WanderSafe, UrSafe	Real-time tracking, live video streaming, continuous sharing, fall detection, driving behavior monitoring	Dependent on GPS and internet; privacy concerns; limited regional availability	Android, iOS
	AlertCops, EyeWatch, Raksha, React Mobile, Shake2Safety	Trigger-based alerts (e.g., phone shake, emergency button), integrated notifications	Limited global coverage, some region-specific	Android, iOS
Emergency Alerts	MySafetipin, Noonlight, Bright Sky, Injury Capture, UrSafe	Quick SOS with GPS location, fake call for distraction, multimedia evidence capture, voice-activated trigger	Dependent on phone signal and battery; visible UI; privacy issues if monitored	Android, iOS
	SOS Watch, Alert-Now, Easy Rescue, SaveGirl Rescue	Simple emergency alert mechanisms	Lacks advanced features or integration with emergency contacts	Android, iOS
Community Support & Resources	Sheroes, Shelter App, Bright Sky, DV Assist, NCDV, Teen Counseling	Community platforms, self-defense guidance, abuse resource directories	Primarily informational; lacks real-time SOS or tracking	Web, Android, iOS
	Circle of 6, Aspire News	Discreet resources with emergency call button disguised	Limited features beyond notifications	Android, iOS
Personal Safety Apps	Safety Navigator, Women’s Safety App, CareLife	Journals, tips, safe route mapping	Region-specific limitations or broader generalized functions	Android, iOS
Unique Specialized Tools	TapeACall, Silent Beacon, SOS Alert, ICE Personal Safety, WeHelp	Call recording, sharing emergency details, integration with emergency services	Legal or data protection concerns related to recording	Android, iOS

4.8 Discussion

The evaluation of existing safety apps reveals a critical disconnect between their technical capabilities and their real-world usability in Bangladesh. While many apps offer advanced features such as live location sharing, fake calls, or multimedia evidence capture, these tools are often designed with assumptions that do not hold true for many Bangladeshi users, such as uninterrupted internet access, English proficiency, and a private, unmonitored phone environment.

Apps like bSafe [81] and Shake2Safety [92] offer powerful reactive features, including panic triggers and live tracking. However, their effectiveness is undermined by their reliance on GPS and mobile data, both of which are unstable or unaffordable for many victims in rural and low-income settings. Moreover, when alerts fail silently or interfaces do not confirm success, users are left vulnerable and uncertain, a failure that can be as dangerous as the threat itself.

Local apps such as Avoy [76] and JOY [86], though culturally tailored, face barriers in distribution, awareness, and sustained development. These tools are often developed in response to funding cycles or pilot projects, but lack long-term support or integration with wider government and NGO safety infrastructures. This leaves users dependent on apps that may vanish from app stores [84], [88] or become nonfunctional over time.

Community-oriented platforms like Sheroes [93] and Bright Sky [94] fulfill an important educational role, promoting awareness and empowerment. However, they reflect a preventive or passive model of protection. Their lack of embedded real-time alert features reflects a broader issue: the divide between content-based safety and action-based safety. In contexts of immediate danger, the latter is non-negotiable.

Some novel insights also emerged from persona-based evaluation. For example, the experience of Asha, the hidden user, illustrates that stealth is not merely a convenience, it is a survival mechanism. Despite the robust features of UrSafe [75], its visible branding and app presence put users at risk when their devices are monitored by abusive partners. This points to the urgent need for rethinking app design through the lens of concealability, including disguise as utility apps, stealth uninstall options, and invisibility in recent activity logs.

Another underexplored dimension is emotional usability. During stress or trauma, a user's cognitive bandwidth is severely reduced. Apps that require multiple setup steps, language switches, or verification loops are unlikely to be used correctly or quickly. As Rina's case shows, even tech-literate users may freeze or fail to complete tasks if feedback is missing or unclear. Future safety apps must therefore be designed with trauma-informed UX principles—emphasizing one-tap actions, confirmation cues, and minimal text.

Finally, the analysis suggests that safety is not purely technical, it is deeply social. The success of any app depends not only on its features but also on users' perceptions of safety, trust in the interface, and confidence in the consequences of pressing that SOS button. Designing safety apps in Bangladesh thus requires integrating local community support networks, gender dynamics, and fear of police or digital surveillance.

In summary, this chapter demonstrates that while safety apps are evolving rapidly in function, they often remain inaccessible or ineffective for users in Bangladesh. To bridge this gap, future interventions must prioritize contextual relevance, emotional design, and stealth-oriented innovation. Safety is not merely about alerting, it is about doing so in a way that fits seamlessly, invisibly, and reliably into the lives of those most at risk.

Chapter 5

Focus Group Interview with SELP Professionals

5.1 Overview

A focus group of ten experienced professionals from various districts of Bangladesh provided valuable insights into the realities of domestic abuse cases. The group, all connected to BRAC SELP[80], shared their experiences and emphasized the urgent need for discreet, voice-activated safety tools that protect victim privacy. They highlighted barriers such as social stigma, financial dependence, limited smartphone access, and family-imposed restrictions. Key recommendations included features like live location tracking, real-time recording, and stress detection to improve emergency responses. The discussion stressed that while current platforms offer basic support, victims need more advanced, user-friendly, and easily accessible digital tools to seek help safely and confidently.

5.2 Information of the Focus Group:

The group consisted of 10 professionals from different districts of Bangladesh, including places like Manikgonj, Shariatpur, Pabna and many small districts around the country. All of these professionals have been affiliated with BRAC SELP [80] starting from 3 years to up to 27 years. All of them have been closely associated with DV victims. Their experience witnessed the abuse of girls as young as 15 years old to the abuse of elderly women of up to 45 years of age.

5.3 Methodology of the Interview

This interview was arranged online by the zonal manager of SELP [80], Khulna Zone, for an hour and a half on the 20th of January 2024, 9:00 am over google meet. Within this timeframe they shared their stories, their experiences and valuable insights while answering questions from a structured questionnaire (see Appendix A)

5.4 Professional’s Feedback

Professionals working with domestic abuse victims reported that most cases involve physical, emotional, and financial abuse, with many victims delaying help due to social stigma, financial dependence, and privacy fears. Victims often prefer low-visibility, voice-activated safety tools, especially in rural areas with limited resources. Professionals emphasized the need for discreet, easy-to-use apps with features like live recording, location tracking, and minimal data collection. They stressed that long-term support, community education, and integration with shelters and legal services are essential for truly helping victims. They responded to the questions presented to them from the questionnaire in appendix A, and below are their responses for each section of queries (see Table 5.1 for key takeaways).

Types of Cases and Demographics

About 90% of the participants work with a wide range of domestic abuse cases, including physical violence (the most common), financial abuse, and mental/emotional abuse. They collectively handle cases from both urban and rural areas.

Strategies and Resources for Helping Victims

Most victims prefer to keep their identities confidential due to privacy concerns. Additionally, 60% of the professionals expressed interest in speech recognition technology that could automatically trigger an emergency alert in high-tension situations.

Challenges Faced by Victims

The professionals identified social stigma as the primary barrier preventing women from seeking help. Many endure abuse for 5, 10, or even 15 years before reaching out. Some victims do not own smartphones, while others live in rural areas with poor internet connectivity. Family restrictions on technology use were also cited as a challenge, particularly in areas like Kishorgonj.

Privacy and Safety Concerns

70% of the professionals stated that victims fear societal backlash and further violence from the abuser’s family. In many cases, when victims reached out to authorities, their families received death and rape threats.

Financial Dependency as a Barrier

According to 85% of the participants, financial dependence on their husbands prevents many victims from seeking help. Some victims, despite being the family’s breadwinner, cannot afford smartphones.

Smartphone Usage Among Victims

One participants stated that the ratio of smartphone-owning victims to non-owners

is 3:2. However, another suggested that even those without personal smartphones have access to one in some form.

Use of Digital Tools

While victims have access to Facebook, very few seek help through it. The professionals agreed that recording evidence would be legally admissible as self-defense in Bangladesh.

Concerns About Technology Use

90% of the professionals agreed that victims might trust a platform requiring minimal personal information. Existing platforms mostly provide helplines, which victims resort to as a last resort rather than seeking early assistance.

Accessibility in Low-Resource Settings

Professionals agreed that NGOs could educate victims on using a new platform. They believed that with some guidance, victims could quickly adapt to digital tools.

Preventing Overwhelming Support Systems

9 out of 10 professionals suggested a chat-based feature to help victims assess whether they need to consult a professional.

Critical Safety Precautions

40% of the professionals had worked with victims who remained at risk even after legal resolutions. They emphasized the need for gathering enough evidence for law enforcement to take strict action.

Existing Platforms for Domestic Abuse Victims

100% of the professionals were aware of BRAC Sonjog[79], a directory of essential helplines. While useful, they agreed that victims require more advanced tools like live recording, location tracking, and speech emotion recognition.

Victims' Comfort with Technology

One participant noted that many victims actively engage with platforms like Facebook and TikTok. She believed they would likely adapt to a dedicated safety app.

Essential Features for a Domestic Abuse Prevention App

95% of the professionals preferred:

- Live recording
- Live location tracking

- Speech recognition technology to detect distress

Two of the participants emphasized that live location tracking could significantly improve emergency response.

Encouraging Victims to Use the App

90% of participants recommended features like voice commands and stress detection to activate emergency alerts discreetly.

Privacy and Protection Measures

90% of professionals supported dynamic masking technology to help victims discreetly use the app without detection.

Long-Term Support for Victims

Many victims face financial insecurity and emotional distress after seeking help. Professionals emphasized that victims need reassurance about their future to feel safe and supported.

Integration with Existing Services

All the individuals agreed that the app should be linked to shelters, hotlines, and legal aid services to create a comprehensive support system.

Theme	Key Takeaways
Victim Challenges	Victims face stigma, tech restrictions, and financial dependence; many delay seeking help for years.
Preferred App Features	High demand for live recording, GPS tracking, and distress-based voice recognition.
Technology Accessibility	Not all victims own smartphones, but most have some form of access.
Safety & Privacy Concerns	Users prefer apps requiring minimal personal info with dynamic disguise capabilities.
Integration with Services	Experts emphasized linking the app with shelters, hotlines, and legal aid.
Long-Term Support	Victims require continued emotional and financial support post-intervention.
Training & Education	NGOs can teach victims how to use safety apps effectively, even in low-resource settings.

Table 5.1: Key Takeaways from Focus Group Interview with SELP Professionals

5.5 Limitations of the Interview

Initially for this interview, an attempt was made to interview both victims of domestic abuse and professionals who have firsthand experience working with survivors.

As part of this effort, the manager of SHEBREC [96] at BRAC University was approached to discuss the urgency of a platform for victims and to gain insights from her experiences with survivors. She noted that victims might be unwilling to participate in interviews, as domestic violence remains a taboo subject in society. Even with assurances of anonymity, a significant number of victims might feel uncomfortable engaging in such discussions. However, she recommended reaching out to the Director of Social Compliance and Safeguarding at BRAC [78].

The meeting with the director, though brief, proved highly valuable, as she facilitated a subsequent meeting with the Senior Programme Manager of the Social Empowerment and Legal Protection (SELP) programme at BRAC [80]. During discussions with him, it was suggested that professionals be interviewed instead of victims. He explained that the target demographic for the research, primarily situated in semi-urban areas, might not be familiar with the conceptual aspects of the proposed platform. While they may understand the interface of a physical application, comprehending the underlying features and their functions could present challenges. Given that the research was still in its developmental phase, he arranged an interview with a group of ten professionals from various districts, each with up to 27 years of experience working closely with domestic violence survivors and victims.

5.6 Discussion

The interviews conducted in this study reveal the complex challenges that domestic abuse victims in Bangladesh face, including societal stigma, economic dependency, and technological limitations. While platforms like BRAC Sonjog [79] offer valuable assistance, there is a critical need for more sophisticated digital tools designed specifically to meet victims' unique requirements. Experts stressed that privacy, accessibility, and usability are pivotal in determining whether victims choose to seek technological assistance.

This research underscores the importance of integrating features such as live location tracking, real-time recording, and speech recognition into domestic abuse prevention applications to enhance emergency responses. Moreover, ensuring discretion and maintaining user anonymity are essential for encouraging wider adoption. Since many victims lack familiarity with digital security measures, awareness initiatives and NGO-driven training programs can help bridge this knowledge gap.

In essence, a thoughtfully designed, secure, and user-friendly platform can play a crucial role in providing support to victims, allowing them to seek help safely and confidently. The insights gained from this study will contribute to the development of an effective technological solution that empowers victims while reinforcing existing support networks.

Chapter 6

Survey For Feature Assessment By Professionals

6.1 Overview

This survey, titled was designed to collect insights from 10 professionals who work closely with survivors of domestic abuse. The primary objective was to assess the usefulness, accessibility, and effectiveness of various app features designed to provide support in high-risk situations.

6.2 Demographics and Professional Experience

The survey participants consisted of professionals from various regions, including Faridpur, Kishoreganj, Sherpur, Rajshahi, Jhalokati, and Sirajganj. Their levels of experience varied, ensuring a broad perspective on domestic abuse intervention. Specifically, 57% had over eight years of experience, 29% had 1–3 years of experience, and 14% did not disclose their experience level. This diversity provided a well-rounded evaluation of the app’s effectiveness and usability.

6.3 Survey Structure

The participants were asked to fill up a form (see appendix B) which was divided into sections, each focusing on a specific safety or support feature within the app. Respondents were asked to evaluate the following aspects:

- **Discreet Interface & Dynamic Masking** – Ensuring the app remains hidden from abusers.
- **Emergency Escape Features** – Evaluating how quickly a user can exit the app in danger.
- **Dynamic Calendar** – Reviewing a tool for tracking risk patterns.
- **Stealth Audio/Video Recording** – Assessing the practicality of discreetly capturing evidence.

- **Stealth Messaging** – Determining the effectiveness of covert communication.
- **Educational Resources** – Examining the ease of access to learning materials.
- **Continuous Monitoring & Alerts** – Checking the effectiveness of real-time safety tracking.
- **Hidden Help Buttons** – Testing the feasibility of concealed emergency triggers.
- **Instant Access to Support** – Measuring the efficiency of direct connections to emergency services or support networks.
- **Support Network Integration** – Evaluating how well the app connects users with NGOs and community groups.
- **Live Location Sharing & Tracking** – Assessing safety benefits for emergency response.
- **Panic Triggers (e.g., phone shake)** – Ensuring the reliability of physical safety triggers.
- **Emergency Alert System** – Analyzing notification effectiveness in critical moments.
- **Evidence Collection Tools** – Examining the security of multimedia storage.
- **Community Support Features** – Looking at the impact of peer-driven assistance.
- **Specialized Safety Tools** – Reviewing additional security and accessibility options.
- **Mental Health Support** – Checking for features that promote emotional well-being.

6.4 Evaluation Process

Each feature was rated on a 1 to 5 scale, where:

- **1** : Minimal usefulness or accessibility.
- **5** : Highly effective and accessible.

Additionally, open-ended questions were included to gather qualitative insights on:

- The most critical features for real-world use.
- Challenges related to accessibility and privacy.
- Suggestions for improvement to enhance usability and effectiveness.

6.5 Purpose and Expected Impact

By analyzing the responses, the study aimed to:

- Identify priority features that require refinement or enhancement.
- Address usability challenges and improve accessibility.
- Optimize app functionality to better support individuals facing domestic abuse.

The insights collected serve as a guiding framework for enhancing the app, ensuring that it aligns with the real needs of both survivors and professionals providing support.

6.6 Survey Findings and Analysis:

A. Effectiveness and Accessibility of Features

To gauge victim comfort levels in using the app, respondents rated its usability. 40% of participants rated it as very comfortable (5/5), 30% gave it 4/5, while 20% rated it (3/5). Only 10% expressed discomfort (ratings 1–2), suggesting overall positive reception but also room for improvement.

Regarding protection from detection, 60% rated the app’s security features 4 or 5, showing strong confidence in its privacy measures. However, 10% found them ineffective (1–2 ratings), indicating a need for enhanced security.

Opinions on accessibility in emergencies varied. 50% rated the features as easily accessible (4–5), 30% considered them moderate (3), and 20% found them difficult to use (1–2). This highlights the importance of refining the interface for quicker, more intuitive access during crises.

B. Feature-Specific Assessments

- Risk Assessment Tools: 67% rated them as highly useful (4–5), though 33% saw room for improvement in intuitiveness.
- Evidence Collection & Encryption: 57% found this feature effective (4–5), but 14% highlighted privacy concerns.
- Discreet Communication & Voice Activation: 60% rated discreet messaging highly, while 20% noted usability challenges. Voice activation received a strong 71% approval (4–5).
- Hidden SOS Button & Encrypted Messaging: 64% found these effective (4–5), though 15% cited accessibility issues.
- Safe Zone & Pre-Recorded Messages: 67% responded positively (4–5), with 33% suggesting more customization options.

C. Support and Long-Term Impact

- Anonymous Communication & NGO Support: 57% found it effective, but 14% felt it needed improvement.
- Emergency Accessibility: 50% rated it highly (4–5), whereas 20% found it inadequate.
- Usability Under Stress: 43% rated usability as high (4–5), 29% as moderate (3), and 28% as difficult (1–2), indicating a need for better emergency usability.

D. Privacy, Discretion, and Mental Health Support

- Privacy and Confidentiality: 57% found the app secure, but 14% raised concerns about navigation and security gaps.
- Safety Alerts and Bluetooth Dependency: 50% rated these as effective, while 28% worried about Bluetooth limitations.
- Mental Health and Educational Resources: 60% found them beneficial, but 20% suggested expanding mental health support options.

6.6.1 Overall Feature Analysis and Key Takeaways

The highest-rated feature was ‘Regular Mental Health Support’, with an average rating of 4.0, highlighting the necessity of continued psychological support for victims. Average ratings are displayed in Table 6.1.

Other highly rated features included:

- Emergency Alerts
- Stealth Audio and Video Recording
- Evidence Collection Features

Each of these features averaged 3.8–4.2, confirming their significance in ensuring victim safety and supporting legal proceedings.

However, certain aspects received mixed feedback:

- Discreet Interface and Dynamic Masking, and Emergency Escape Features averaged 3.2–3.5, showing usability concerns in high-stress situations.
- Bluetooth-Based Safety Features and Tech Literacy Accessibility were among the lowest-rated (2.8–3.0), suggesting worries about usability for victims with limited technological knowledge or in areas with weak connectivity.

A key concern was accessibility in emergencies. When asked, “How easily can these features be accessed in high-stress situations?”, the average response was 3.7, indicating that while features were effective in theory, real-world usability required enhancement.

Hidden triggers, encrypted messaging, and real-time tracking received moderate effectiveness ratings (3.5–3.7), with professionals recommending refinements to boost victim confidence in using them discreetly.

Table 6.1: Average Professional Ratings for Feature Categories

Feature Category	Avg. Rating (out of 5)
Mental Health Support	4.0
Emergency Alerts	4.2
Stealth Recording	4.0
Evidence Collection	3.8
Discreet Interface	3.4
Escape Features	3.5
Bluetooth Features	2.8
Tech Literacy Support	3.0
Hidden Triggers	3.5
Encrypted Messaging	3.6
Live Tracking	3.7

6.7 Discussion

The survey findings offer valuable insights into the practical strengths and challenges of the proposed app’s features from the perspective of professionals working closely with domestic abuse survivors. Overall, the responses indicate that the app has strong potential, particularly in areas like mental health support, emergency alerts, and evidence collection, which were consistently rated as highly useful. These features appear to address critical safety needs and are likely to support victims effectively during emergencies and legal processes. However, the survey also identified important areas that require further refinement. Features such as discreet interfaces, emergency escape tools, and Bluetooth-based safety options received mixed reviews, with concerns about their accessibility and ease of use, especially under high-stress conditions. The results emphasize that while many participants trusted the app’s privacy measures, some expressed worries about possible security gaps and the challenge of navigating the app quickly during moments of danger. Additionally, feedback highlighted that victims with lower tech familiarity or limited access to stable connectivity might struggle to use certain features confidently. Voice-activated commands, encrypted communication, and real-time location tracking were recognized as essential, but professionals stressed that these tools must be simple, fast, and reliable for victims who are often in high-pressure situations. The survey clearly shows that while the app’s core concept aligns with the urgent needs of domestic abuse survivors, future improvements should focus on making the interface even more intuitive, reducing dependence on Bluetooth, and providing more comprehen-

sive guidance to ensure that all victims—regardless of their technical skills—can safely and effectively use the app.

Chapter 7

Survey for User Preferences

7.1 Overview

This anonymous survey, titled was designed to collect insights from victims, survivors and advocates/professionals. The primary objective was to collect information about the experiences and difficulties encountered by domestic abuse survivors, examine how digital access affects their ability to seek assistance, and identify obstacles that prevent them from escaping abusive situations.

7.2 Survey Structure and Format

The survey followed a structured questionnaire (see appendix C) format, consisting of multiple-choice questions, checkbox selections, and open-ended response fields for additional input. The questions were deliberately crafted to be non-intrusive, ensuring participants could provide insights without feeling pressured to disclose sensitive details.

7.3 Participant Categories

The survey was open to various groups, including:

- Survivors of domestic abuse who shared personal experiences.
- Advocates and professionals such as counselors, legal experts, and social workers who assist victims.
- Individuals who know a victim through personal relationships, offering second-hand insights into the issue.

By including responses from multiple perspectives, the survey created a well-rounded picture of how domestic abuse affects different individuals and the various forms of support needed.

7.4 Purpose of the Survey

This study aimed to:

- Identify common experiences and challenges faced by domestic abuse survivors.
- Assess how digital access impacts victims’ ability to seek help.
- Uncover barriers preventing victims from leaving abusive situations, including financial dependency and technological monitoring.
- Determine the most urgent forms of support such as legal aid, counseling, secure housing, and financial independence.
- Provide data-driven insights to improve policies, intervention strategies, and victim support resources.

A. Demographic Overview and Trends: The gender distribution among respondents who disclosed their identity showed that 80% identified as female, while 20% categorized themselves under "Other." A significant portion opted not to reveal their gender, potentially due to privacy concerns or a reluctance to share personal details. The overall gender composition aligns with trends observed in domestic abuse research, where women are often disproportionately affected. However, the inclusion of individuals who identified as "Other" highlights that abuse impacts diverse gender identities, emphasizing the necessity of inclusive and accessible support services.

The findings of each sections in the survey are summarized in Table 7.1.

Table 7.1: Summary of Key Findings from User Preference Survey

Category	Key Findings
Demographic Trends	80% female, 20% other; 75% employed; 75% have a bachelor’s degree or higher.
Abuse Types Experienced	37.5% emotional/psychological, 37.5% physical, 18.8% sexual, 12.5% financial and digital.
Reporting to Authorities	70% did not report abuse; 30% did.
Reasons for Not Reporting	Fear of abuser (41.7%), lack of privacy (33.3%), didn’t know where to get help (50%).
Preferred Communication Channels	Messaging apps (41.7%), phone calls (33.3%), face-to-face (33.3%), emergency apps (25%).
Smartphone Usage Frequency	83.3% use smartphones multiple times daily.
Barriers to Seeking Help	Top barriers: Lack of information (50%), fear (41.7%), lack of privacy (33.3%).

In terms of respondents’ direct or indirect connection to domestic abuse, 33.3% stated they knew a survivor or victim, making it the most frequently selected category. Meanwhile, 26.7% identified themselves as survivors, and another 26.7% were

advocates, demonstrating active engagement from both direct victims and those providing support. Only 6.7% of respondents were professionals working in this field, pointing to a potential gap in professional representation and involvement in discussions surrounding domestic abuse.

Regarding living conditions, 60% of respondents who provided relevant information reported living with family, while 40% lived alone. Education levels showed that 75% of those who answered had obtained at least a bachelor's degree, while 25% held a high school diploma or lower. Employment figures indicated that 75% were employed, with 50% working full-time and 25% working part-time, while 25% were unemployed.

These demographic findings suggest that domestic abuse is a pervasive issue affecting individuals across various socioeconomic backgrounds. The high percentage of respondents who were both educated and employed suggests that abuse is not restricted to any particular economic class. However, the lower participation of professionals in the survey may indicate a need for increased involvement from legal experts, healthcare professionals, and social workers to better address the needs of survivors.

B. Patterns of Abuse and Reporting Challenges: Among respondents who disclosed the type of abuse they experienced, 37.5% reported emotional or psychological abuse, making it the most common form. An equal percentage (37.5%) indicated they had experienced physical abuse, while 18.8% reported sexual abuse. Additionally, 12.5% experienced financial abuse, and another 12.5% faced digital or social abuse. The data, as visualized in Figure 7.1, suggests that many survivors endure multiple types of abuse simultaneously, reinforcing the need for multi-faceted intervention strategies.

A concerning 70% of respondents did not report their abuse to authorities, with only 30% seeking assistance from legal institutions. Among those who did report, many found authorities unhelpful, raising concerns about the effectiveness of law enforcement and judicial support systems in handling domestic abuse cases. The most frequently cited reasons for not reporting included fear of the abuser (41.7%), lack of privacy (33.3%), and not knowing where to seek help (50%).

These findings highlight critical barriers that prevent victims from reporting their abuse. Many survivors feel unsafe disclosing their experiences due to fears of retaliation, distrust in legal authorities, and concerns about privacy. Additionally, the fact that 50% of respondents did not know where to seek help suggests a pressing need for better awareness initiatives and improved access to information regarding available resources.

Considering that many individuals experience multiple forms of abuse simultaneously, it is essential for support systems to take a holistic approach, integrating mental health support, financial assistance, legal advocacy, and digital safety measures.

Types of Abuse Experienced By Victims

The total percentage is higher than 100% indicating individuals have experienced more than one type of abuse at once

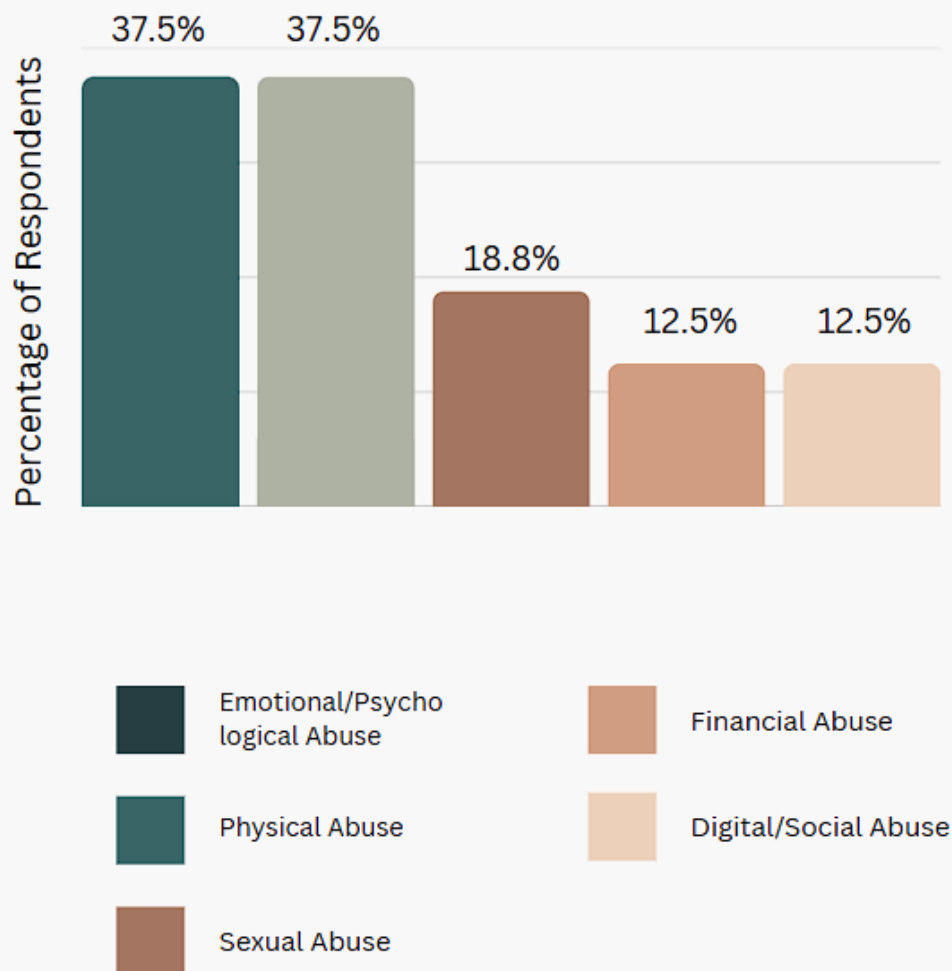


Figure 7.1: Types of abuse endured by the victims

C. Technology Use and Preferred Communication for Seeking Help: When respondents were asked about their preferred method of communication for seeking assistance, 41.7% favored messaging apps, making it the most preferred option. 33.3% preferred phone calls, while another 33.3% opted for face-to-face interactions. Additionally, 25% indicated they would use an emergency app, suggesting that digital tools could be crucial in providing discreet access to support services.

Smartphone usage data revealed that 83.3% of respondents use their devices multiple times a day, highlighting a heavy reliance on mobile technology. This suggests that integrating emergency support features into frequently used apps could significantly enhance accessibility to assistance.

The preference for messaging apps (41.7%) underscores the importance of discreet and accessible communication channels when seeking help. While traditional phone calls and in-person conversations remain relevant, they may not always be practical in situations where an abuser is closely monitoring communication.

Given the high reliance on smartphones (83.3%), there is a significant opportunity to develop mobile-based emergency response features, quick-exit functionalities, and encrypted chat-based support that allow survivors to reach out for help securely.

D. Barriers to Seeking Help: The most frequently cited obstacle preventing victims from seeking assistance was not knowing where to find help (50%), indicating a major gap in public awareness regarding available support services. Additionally, 41.7% of respondents reported fear of their abuser, while 33.3% cited a lack of privacy as a major challenge.

These barriers suggest that many survivors either lack information on how to access support or fear that reaching out may put them in further danger. The fact that 33.3% mentioned privacy concerns highlights the reality that traditional support methods—such as visiting shelters or contacting helplines—may not be viable options for many individuals.

7.5 Discussion

The survey provided valuable insights into the lived experiences, technological barriers, and support preferences of domestic abuse survivors and those connected to them. A key takeaway is that domestic abuse affects individuals across diverse backgrounds, regardless of gender, education, or employment status. Emotional, physical, and financial abuse emerged as the most common forms, with many survivors experiencing multiple types of abuse at once, pointing to the need for multi-layered support systems that address psychological, legal, and financial challenges together. Alarming, most participants did not report their abuse to authorities, often due to fear of retaliation, concerns about privacy, or simply not knowing where to find help. This highlights significant weaknesses in public awareness and trust in formal support channels. The data also revealed that mobile technology plays a central role in survivors' lives, with a strong preference for messaging apps as a discreet

means of communication when seeking assistance. This reinforces the importance of creating mobile-based, easy-to-access support tools that are secure and can be used quickly in dangerous situations. However, barriers such as privacy concerns, fear of the abuser, and limited information about available resources continue to prevent many from reaching out. The findings emphasize the need for digital safety solutions that are not only secure but also widely promoted, simple to use, and adaptable to different risk levels. Future interventions must focus on closing the information gap, enhancing the visibility of support services, and developing discreet communication channels that survivors can trust and access safely.

Chapter 8

Designing the Solution: From Concept to Prototype

8.1 Overview

This chapter outlines the step-by-step design development process that led to the creation of the proposed safety and support application for domestic abuse victims. Each stage of the process was guided by evidence gathered through expert interviews, victim feedback, feature evaluations, and contextual constraints specific to Bangladesh. The goal was to build an application that is not only comprehensive and discreet but also technically feasible and socially appropriate.

8.2 Low-Fidelity Approach and Initial Research

The development process began with a commitment to low-fidelity prototyping- a strategy that prioritizes speed, flexibility, and user involvement. Instead of jumping directly into digital tools, the initial focus was on understanding the actual needs of victims and safety professionals.

Step 1: Expert Consultations

The first step involved in-depth discussions with root-level professionals including NGO workers, counselors, and shelter managers. These conversations highlighted the practical constraints and lived realities of victims in high-risk environments.

Step 2: Feature Assessment Survey

A feature assessment survey was conducted with two groups:

- Professionals working in domestic violence support roles,
- Survivors and victims of domestic violence (via anonymous online responses).

The survey presented a list of features derived from existing safety apps and those envisioned by the team. Participants were asked to rate their usefulness, concerns, and implementation challenges. This input guided early prioritization.

8.3 Paper Prototype and Victim Feedback

Based on the insights gathered, a hand-drawn paper prototype was developed to visualize the core layout and user flows. This prototype was tested with seven active victims of domestic violence (see Chapter 10). The review process required careful facilitation to ensure that the participants felt safe and understood the prototype's intent.

Feedback from this stage led to the following insights:

- Dummy password logic was appreciated but deemed cognitively difficult to manage.
- Users preferred fixed or simpler stealth mechanisms.
- Bangla language support was essential.
- Visibility of the Quick Exit button needed improvement.
- Emotional support and legal information were ranked as higher priorities than initially expected.

8.4 Secondary Prototype Development

In response to the feedback received from the paper prototype review, a revised low-fidelity prototype was developed using a simple digital drawing tool. This second iteration incorporated clearer layouts, simplified user flows, and refinements based on the victims' usability concerns. The updated prototype emphasized ease of access, discretion, and practical utility.

This version was reviewed by:

- Three additional active victims (from the original participant group),
- One practicing criminal lawyer.

The lawyer's feedback focused specifically on the legal aid component of the app. She emphasized the importance of including accurate guidance on filing a General Diary (GD), navigating legal reporting processes, and accessing relevant support documents. Her input was instrumental in shaping the app's law assistance section to be both contextually appropriate and legally sound.

8.5 Final High-Fidelity Prototype in Figma

The final prototype was developed in Figma, capturing approximately 90% of the app's intended features, including:

- Stealth entry logic (real/dummy password),
- Stealth interfaces,
- Emergency contact configuration,

- Dynamic calendar and journaling,
- Secure storage features (audio, video, logs),
- Legal aid center and document support,
- Anonymous emotional support options,
- Full UI translated to Bangla.

Limitations of Figma Prototype

Some planned features could not be implemented in the Figma prototype due to platform limitations:

- **Voice-based ML Monitoring:** An ML model that passively detects distress from audio cues and triggers silent SOS alerts.
- **Risk Prediction Engine:** A machine learning model that analyzes daily logs to predict abuse escalation.

These features will be described in detail in subsequent chapters (see Chapters 14.1 and 14.2).

8.6 Development Flowchart

Figure 8.1 summarizes the design journey from research to prototyping.

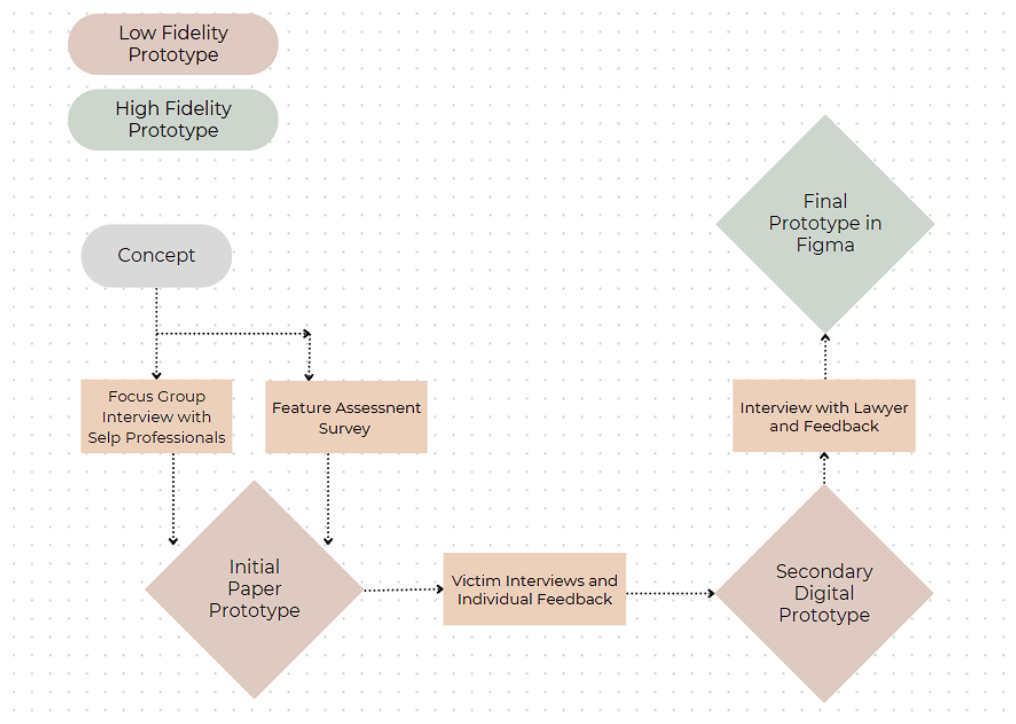


Figure 8.1: Design Development Process Flowchart

8.7 Discussion

The development process described in this chapter reflects more than a linear sequence of design steps; it represents a layered co-construction of safety, agency, and contextual sensitivity. At each stage - from initial professional interviews to the Figma prototype, the design choices were influenced not only by user needs but by ethical imperatives around discretion, cognitive load, and trauma-informed technology.

One of the most significant insights to emerge was the tension between functionality and invisibility. Unlike typical user-centric apps that aim to be engaging or habit-forming, this app had to remain forgettable on purpose. The disguise logic and dummy UI were not simply aesthetic elements but safety mechanisms - a novel application of misdirection as a usability principle. This reframing of user experience toward strategic concealment marks a critical departure from conventional HCI principles.

Another key design lesson was the adaptability of the solution to the cognitive limitations of users under duress. The feedback from victims repeatedly emphasized the inability to memorize session-based dummy passwords or to navigate multi-layered workflows under pressure. The final design's shift toward persistent dummy credentials and simplified navigation not only improved usability but aligned the app with real-life behavioral constraints experienced in abusive environments.

The iterative process also underscored the importance of hyper-local context. For example, the demand for full Bangla translation, as well as detailed guidance on filing General Diaries (GD), emerged from a culturally situated understanding of legal and linguistic accessibility. The criminal lawyer's input added legal robustness that is often missing in tech-driven solutions, turning the law assistance module from a static FAQ into a credible, action-oriented toolset.

Finally, the limitations of the Figma prototype served as a reminder of the boundary between interface design and functional deployment. While the Figma model helped visualize user flows and feature logic, its inability to simulate machine learning, stealth triggers, or backend data processing highlighted the need for deeper technical collaboration in future phases.

In summary, this chapter demonstrates that designing for safety under violence is not just about usability or aesthetics- it is about engineering trust, maintaining plausible deniability, and enabling silent empowerment. These insights will inform not only the subsequent technical chapters (Chapters 14.1 and 14.2) but also offer broader contributions to the emerging field of humanitarian HCI.

Chapter 9

Initial Design of the App: Paper Prototyping

9.1 Overview

This chapter presents the initial paper prototype of a safety and support application designed for domestic abuse victims in Bangladesh. The prototype was developed after a comprehensive review of existing safety apps, interviews with survivors, surveys with field professionals, and focus group discussions with grassroots workers. The paper prototype serves as a tangible visualization of user needs, contextual constraints, and feature requirements before moving into digital prototyping or development.

9.2 Design Goals

The prototype was guided by the following key objectives:

- **Discretion:** The app must appear benign from the outside- resembling a common app like a grocery tracker, weather app, or religious utility.
- **Session-Based Stealth:** Users are given a dummy password each session. If under threat, they can log in using the dummy password to access a fake interface.
- **Quick Exit:** A prominent Quick Exit button on every screen allows the user to immediately leave the app, triggering silent background safety mechanisms.
- **Modular Safety Support:** Features such as legal aid, journaling, cloud storage, emotional support, and dynamic behavior tracking are integrated.

9.3 Prototype Structure and Flow

The prototype was hand-drawn and laid out on paper to simulate screen navigation. Arrows indicated the logical flow between screens. Figure 9.1 presents the full visual layout.

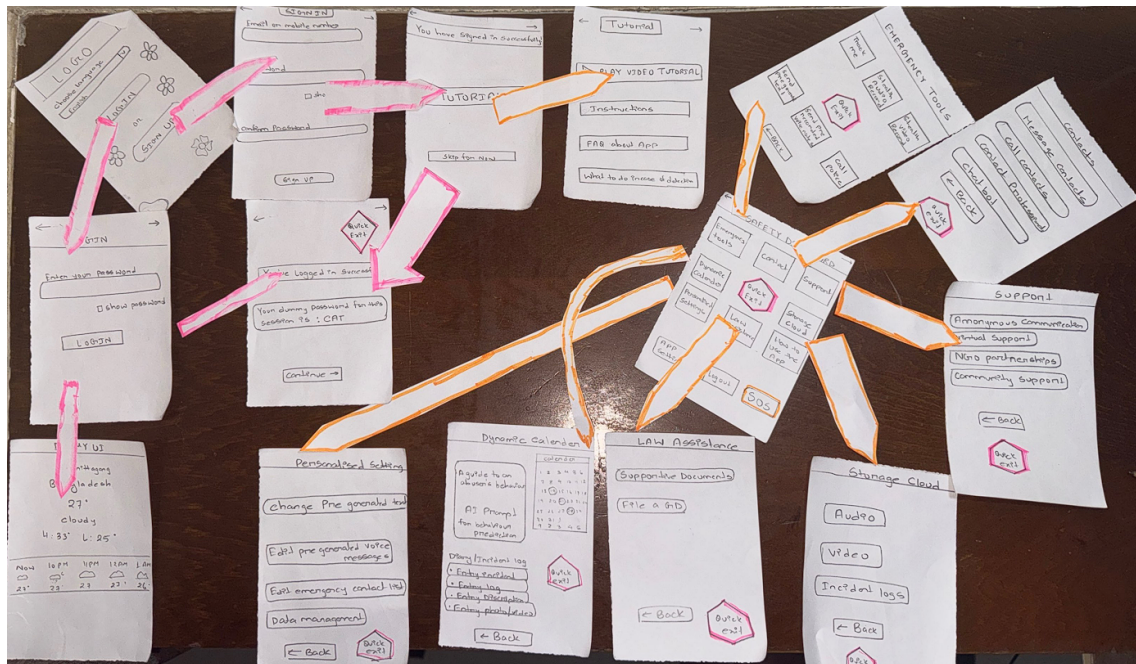


Figure 9.1: Paper Prototype Overview

Authentication and Camouflage Entry

The app begins with a sign-up and login screen where the user enters their phone number or email and password. Upon login, the app assigns a session-specific dummy password (e.g., “cat”, “broccoli”). If the victim later reopens the app under surveillance, they can use the dummy password to enter a harmless-looking interface.

Tutorial and Onboarding

A brief onboarding tutorial offers video guidance, FAQ, and safety instructions. This prepares the user to operate the app even in high-stress scenarios.

Home Dashboard (Real Interface)

The real interface includes:

- **Dynamic Calendar:** Logs behaviors, mood, and warning signs.
- **Law Assistance:** Submit complaints or view legal templates.
- **Cloud Storage:** Audio, video, or written logs saved discreetly.
- **Support:** Mental health, community outreach, NGO contacts.
- **Settings:** Manage emergency contacts, voice triggers, dummy logic.

Quick Exit Function

Every screen includes a large Quick Exit button. If tapped, the session remains active in the background, but the app transitions into a decoy state. In this state,

background safety features like voice monitoring or silent SOS may activate automatically if needed.

Dummy Interface Logic

If the user reopens the app using the dummy password (from the current or last session), they are taken to a benign interface that resembles the camouflage cover (e.g., a shopping list). Only upon safe logout can they re-access the real dashboard with the actual password, at which point a new dummy password is generated.

9.4 Reflection and Feedback from Victims

To validate the functionality and sensitivity of the initial design, the paper prototype was reviewed by seven women who are currently experiencing domestic abuse. These reviews were conducted in conjunction with their in-depth interviews (discussed in 10, and special care was taken to ensure emotional safety and ethical integrity throughout the process.

Participants responded positively to the app’s emphasis on discretion. In particular, the dummy password feature and camouflage interface were praised as intuitive and potentially life-saving. However, several usability concerns were raised that offer critical guidance for future design:

- **Email and Password Concerns:** Many participants expressed difficulty in remembering their own email addresses, and some had no personal email accounts. Furthermore, having to manage both a real and dummy password was seen as overly complex, particularly under stress.
- **Session-based Dummy Password Inconvenience:** Although they understood the intent, generating a new dummy password for every session was described as frustrating and mentally taxing. Participants requested a simpler or fixed stealth mechanism.
- **Bangla Language Preference:** Every participant requested that the app be developed in Bangla. Most were not comfortable navigating English apps and felt that language could be a barrier in critical moments.
- **Quick Exit Button Visibility:** While the quick exit option was praised, users requested that it be made more prominent and easier to access with one hand or a thumb tap.
- **Need for Emotional and Anonymous Support:** A strong and repeated theme was the desire for a way to communicate anonymously with a real person. Victims expressed a need to “be heard” and to find someone who could listen and provide empathy, even if only through anonymous chat.
- **Practical Legal Information:** Participants wanted simplified guidance on how to file a General Diary (GD) or First Information Report (FIR) at a police station, as many were unfamiliar with these processes. Suggestions were made to include a FAQ section or voice-based query tool that could answer such common concerns.

The feedback provided a rich set of design implications that will directly influence the second phase of the app’s development, which will prioritize emotional support, language localization, and streamlined user experience.

9.5 Limitations of the Prototype Phase

While the paper prototype provided an effective means of visualizing the app’s logic and interface structure, it had inherent limitations. The format could not simulate dynamic interactions, animations, or real-time triggers (e.g., shake gestures or voice recognition). Additionally, the review process with active victims posed unique challenges. For some participants, it was difficult to grasp the abstract flow of paper screens, and facilitators had to spend extra time narrating and guiding the experience.

Despite these constraints, the paper prototype exercise succeeded in surfacing both critical usability issues and deep emotional needs, especially around trust, simplicity, and support. These reflections laid the foundation for a more inclusive and trauma-aware design in the next iteration.

9.6 Discussion

The development of this initial paper prototype represents a critical early phase in the design of a user-centered and trauma-aware application for domestic abuse victims. Paper prototyping is a time-tested method in Human-Computer Interaction (HCI) research and user interface (UI) design that enables designers to experiment with structure, functionality, and navigation logic using low-fidelity but highly iterative visuals. In the context of this project, paper prototyping served not only as a design exercise but as a powerful medium for co-creation and empathy-building with end users who face extraordinary constraints and risks.

Value of Paper Prototyping in High-Risk Contexts

For vulnerable populations, traditional digital UX testing may be impractical or even unsafe in early stages. Victims of domestic abuse may not have access to secure devices, may lack digital literacy, or may feel unsafe interacting with unfinished software. Paper prototypes, by contrast, provide a tactile, safe, and low-pressure way to engage these users meaningfully. They allow the interface to be simulated without digital traceability, which is crucial for participants worried about their privacy or safety.

Furthermore, in scenarios where emotional regulation is difficult, especially when recalling traumatic experiences, the simplicity of paper prototyping avoids overstimulation or cognitive overload. It enables participants to focus on the logic, visibility, and discretion of the features rather than being distracted or intimidated by polished digital interfaces.

A Communication Tool for Co-Design

In this project, paper prototyping became an essential communication bridge between the design team and the victims. Most participants were not trained in design thinking or digital UX but responded intuitively to paper screens and flowcharts. The informal, editable nature of paper made it easier for participants to suggest changes, voice doubts, or even physically rearrange features during the sessions. This process transformed the interviews from data extraction into co-design opportunities, where user agency and safety were respected.

For instance, the idea of the Quick Exit button being thumb-accessible emerged directly from physical gestures made during paper walkthroughs. Similarly, preferences about the Bangla interface and simplified dummy password logic were more effectively conveyed through the collaborative sketching and guided navigation on paper.

Reinforcing Trauma-Aware Design Principles

Another critical insight from this phase is the alignment of paper prototyping with trauma-informed design principles. Victims of domestic abuse may experience hypervigilance, anxiety, and emotional fatigue, especially when engaging with technologies designed for their protection. By allowing users to visualize app flows in a controlled, static environment, the prototype helped reduce psychological triggers and gave them more control over how they engaged with the system.

The iterative changes made based on feedback, such as simplifying authentication, reducing memory load, or integrating emotional support - emphasize the need to treat survivors not just as users, but as co-authors of their own safety strategies. The prototype thus evolved from a functional model into a space for ethical engagement, empathy, and trust-building.

Design Methodology and Future Transition

Methodologically, the paper prototype provided a roadmap for translating complex design intentions into user-validated workflows. It highlighted gaps between theoretical feature design and real-life usability under duress. While the prototype could not simulate animations, real-time triggers, or behavioral tracking algorithms, it successfully conveyed structure, navigation logic, and user empowerment strategies. The lessons from this phase will inform the next development stage (Chapter 11), a high-fidelity interactive prototype built using tools like Figma or Android Studio. Key revisions, such as fixed stealth mechanisms, thumb-friendly navigation, anonymous chat modules, and legal FAQs, will be prioritized based on the paper prototype's reception.

Ethical Design and User-Centered Research

Lastly, this phase underscores the importance of ethics in HCI research, particularly when dealing with survivors of abuse. Every effort was made to ensure that participants could engage voluntarily, without emotional harm or pressure, and that the process itself did not compromise their safety or privacy. Paper prototyping,

by virtue of its offline and collaborative nature, enabled ethical participatory design that respected the unique challenges and emotional landscapes of the users.

In conclusion, the paper prototyping phase proved to be an indispensable step in grounding this safety app in the lived realities of its intended users. It enabled early detection of usability issues, facilitated direct user involvement, and guided design choices with empathy and cultural relevance. As the project moves toward digital implementation, these insights will remain foundational, ensuring that the final product remains accessible, protective, and empowering for domestic abuse survivors in Bangladesh.

Chapter 10

Victim's Interview

10.1 Overview

The goal of this stage was to assess how user-friendly, appropriate, and discreet the proposed app is for individuals affected by domestic violence. This assessment aimed to gain insight into the victims' real-life experiences, their access to and familiarity with technology, as well as their preferences regarding particular features of the app. The insights gathered during this phase played a key role in shaping the prototype's design and will help guide the final recommendations.

10.2 Participants

This interview included 7 participants who have been victims of some form of domestic abuse, who belong to various technological literacy backgrounds, which facilitated the study to build an app that is usable by victims of all demographics. This chapter presents the insights from all seven participants, whose interviews offered rich details for design considerations. To maintain ethical measures, each participant was informed about the type of information they would be required to share, which explicitly excludes any personal information. They each were asked for consent before beginning the interview, and confidentiality was strictly ensured regarding the data they shared. Finally, for the sake of their safety and in line with ethical values, the victims will remain anonymous throughout this study. The participant's information has been summarised in the table 10.1.

10.3 Interview Methodology

This phase employed semi-structured qualitative interviews supported by a paper prototype walkthrough. Each session lasted for approximately 20 to 25 minutes, in a safe, private environment of the victim's choosing. Each participant was presented with a paper cutout of the initial design of our app, and they responded to open-ended questions on the usability and the feasibility of the design. The participants were then asked a few questions from a standardized interview guide (see Appendix D). These questions and the responses were initially taken in Bangla, and later

translated into English. The interviews were manually coded to identify recurring themes and needs across the participant group. The analysis focused on features most relevant for high-risk domestic situations.

10.4 Individual Participant's Narrative

The interview session of each victim has been summarised below. Each of the participant were asked questions based on their educational qualifications, technological capabilities as well as type of employment. They were also asked about the duration of their relationships with the abusers, and how long in that relationship did they face abuse. Aside from this, the participants were also asked for their feedback on the proposed app's paper prototype (the initial stages of the design).

Victim 1 (50+, Urban, Unemployed)

Victim 1 resides in a city area with convenient access to hospitals and police stations. She has been married for about two decades and has experienced various forms of abuse, including emotional torment, verbal insults, and financial neglect. The abuse began approximately a year into her marriage and has occurred intermittently since then. She uses an Android smartphone primarily for calls, Facebook, and YouTube. While her abuser monitors her phone activity and knows who she contacts and what apps she opens, he does not have her passwords. She is free to use her apps without restrictions, and her family permits her to speak on the phone openly. Although her familiarity with technology is limited to basic functions, she confidently manages her phone and social media independently. She struggles to remember passwords and tends to write them down rather than memorize them. Fear and societal stigma have prevented her from seeking help from the police or legal authorities. Instead, she prefers to rely on a mobile app for support, especially since making phone calls is not always feasible. She values features that keep the app hidden and secure. During a prototype demonstration, she expressed strong approval for:

- **Quick Exit Button:** A quick-exit feature that allows her to hide the app immediately if needed.
- **Disguised Interface:** An app design that disguises itself as a harmless tool, like the shopping list app (the one developed in the prototype phase), to avoid drawing attention.
- **Automated Guidance:** Automated, AI-based guidance rather than direct interaction with counselors, due to privacy concerns.

Her top priority is ensuring the app remains completely confidential, avoiding any suspicious behavior or requests that might reveal its purpose.

Victim 2 (30, Urban, Maid)

Victim 2 lives in an urban neighborhood somewhat removed from busy markets

but still inside the city. She completed up to fifth grade and works full-time as a maid, handling household duties. She has been in a harmful relationship with her husband for an unknown length of time, experiencing emotional abuse, harsh words, and financial neglect. These hardships have led to feelings of depression and social withdrawal. She owns an Android phone, which she uses regularly for calls and Facebook, although her digital skills are limited. Her abuser and other household members monitor her phone activity closely, including knowing her passwords and who she communicates with. Because of fear and social pressures, she has not reached out to police or legal services. Instead, she prefers to seek assistance through a mobile app, finding it more practical than making direct phone calls. She is open to both discreet and straightforward methods for getting support. During the prototype demonstration, she expressed interest in features such as:

- **Emergency SOS Button:** An emergency button that includes a visible phone number to quickly reach help.
- **Disguised Interface:** An app design that looks like a normal, everyday application to avoid suspicion.
- **Automated Support:** Automated support tools that are simple to use and unlikely to alert others.

Her biggest worries center on the possibility of her abuser discovering the app or her attempts to get help, as well as the fear that asking for support might provoke more problems.

Victim 3 (35+, Urban, Employed)

Victim 3 is a housemaid who lives with her husband and children. She has been in an abusive marriage for over fifteen years, facing both emotional manipulation and strict control over her finances. Although she owns an Android smartphone, her husband monitors her usage, prohibits password protection, and occasionally forces her to unlock apps. She uses Facebook and TikTok but does not engage with platforms that require technical skills like email. Despite limited digital literacy, she engaged actively during the prototype walkthrough. She responded positively to:

- **Quick Exit Button:** Considered this feature crucial for moments when confrontation with her abuser could escalate.
- **Disguised Interface:** Preferred the app to appear as a weather or religious app.
- **Automated Guidance:** Expressed a strong preference for automation due to the risk of being overheard.

Location Tracking and SOS Alerts: Described these as "lifesaving" in the event she cannot speak openly. Her concerns centered around anything that might raise suspicion, including apps with unusual names or password protection.

Victim 4 (40+, Urban, Unemployed)

Victim 4 has been in a two-decade-long abusive relationship. Despite having an honors-level education, she experiences emotional and financial abuse and has limited freedom with her phone. Her device is not shared, but her husband regularly monitors her digital behavior. She found the paper prototype comforting and helpful. In particular, she highlighted:

- Pre-written Messages and Voice Alerts: Found these features practical for initiating help discreetly.
- Incident Logging: Valued the idea of recording abusive incidents privately within the app.
- Emotional Support Chatbot: Had previously used one via a Facebook group and found it emotionally reassuring.

While she was comfortable with both AI and human interaction, she emphasized that app appearance must remain neutral. She preferred online features but did not require offline support.

Victim 5 (30+, Urban, Unemployed)

Victim 5 lives with her spouse, children, and mother-in-law. She has endured both emotional and occasional physical abuse over a 15-year period. She owns an Android phone but is subject to surveillance. Her abuser checks her call logs and restricts access to Facebook during conflict. Though she considers herself fairly comfortable with technology, she uses it mostly for Facebook and YouTube. Her key feedback included:

- Emergency SOS Button: Identified this as a top priority.
- Disguised Interface: Suggested disguising the app as a religious app, which would go unnoticed in her environment.
- Live Support Options: Preferred access to a real person for emotional or legal help.
- Legal Resource Integration: Liked the idea of direct links to legal information or police contact within the app.

She expressed that while she does not often use many apps, the app must remain completely hidden for her to consider using it.

Victim 6 (25+, Urban, Employed)

Victim 6 is a healthcare worker living in an urban area with her husband and children. She has faced emotional and financial abuse for several years but has not sought formal help due to fear of social stigma. Although confident with technology and skilled in using her Android smartphone, she shares the device with her

family, and her husband regularly checks her call logs and app activity. While she can use common apps like Facebook and YouTube, her personal communication is closely monitored, making it essential for any safety app to remain completely hidden. During the prototype walkthrough, she responded positively to several key features:

- **Quick Exit Button:** She viewed this as a vital safety measure in the event she needs to immediately close the app under suspicion.
- **Disguised Interface:** She preferred the app be hidden behind a common utility like a weather app to avoid drawing attention.
- **Automated Support:** Rather than live interaction, she favored automated guidance, as it posed less risk of exposure during use.
- **Location Tracking:** She expressed appreciation for tracking features that could operate passively without requiring her to reach out during emergencies.

She emphasized the importance of low-visibility apps that require minimal interaction. Although she once used in-person counseling, she now believes discreet digital tools could provide safer, faster support. Her feedback shows that even tech-savvy professional women can face serious barriers to seeking help due to constant surveillance and cultural stigma.

Victim 7 (35, Urban, Employed)

Victim 7, a full-time janitor living with her husband and children, has faced emotional and occasional physical abuse during her seven-year marriage. A police warning to her husband helped reduce the abuse temporarily. She confidently uses her Android smartphone for apps like Facebook and TikTok, but her digital activity is sometimes checked without her consent. While she controls her passwords, she is discouraged from contacting certain family members. Her feedback on the prototype highlighted several important needs:

- **Disguised Interface:** Recommended the app appear as a religious tool, which would avoid suspicion in her household.
- **Automated Support:** Preferred automated features over live assistance to reduce the chance of confrontation or being overheard.
- **Stealth Priority:** Emphasized the importance of keeping the app's true purpose hidden to protect her safety.

Victim 7 has never used digital platforms for emotional or legal support but expressed interest in doing so if the tool were subtle and safe. Her feedback reinforced the importance of designing solutions that remain hidden in plain sight—tools that offer help without putting users at greater risk.

10.5 Thematic Analysis

10.5.1 Overview of Analysis Process

This thematic analysis was conducted to explore the lived experiences of domestic abuse survivors and their preferences, constraints, and needs in relation to digital safety and mobile support. The process followed an inductive approach, allowing themes to emerge organically from the data, rather than imposing preconceived categories.

10.5.2 Initial Codes

Table 10.2 presents the initial codes drawn from detailed user experiences, highlighting strategies, behaviors, and challenges faced when using digital devices under surveillance. The codes reflect patterns such as hiding phone use, deleting evidence, relying on stealth methods, and avoiding formal help due to fear or shame. They also reveal emotional struggles like exhaustion, helplessness, and anxiety, as well as coping strategies including using familiar platforms, changing contact names, and relying on children for assistance. These codes capture the complexity of navigating digital spaces in unsafe environments.

No.	Initial Codes
1	Using phone secretly
2	Deleting call history
3	Unlocking phone for abuser
4	Pretending app is harmless
5	Hiding use
6	Sharing device
7	Avoiding calls near abuser
8	Checking phone only when alone
9	Avoiding formal help
10	Avoiding help due to shame
11	Deleting help apps
12	Avoiding police
13	Waiting for abuser to sleep
14	Fear of being overheard
15	Emotional exhaustion
16	Shame after reporting
17	Helplessness
18	Anxiety about being caught
19	Relief after hidden support use
20	Changing contact names
21	Fake app icons
22	Hiding apps in folders
23	Scrolling fake apps
24	Switching SIM cards
25	Using child's account
26	No Facebook
27	Abuser checks installed apps
28	Abuser knows passwords
29	No permission to install apps
30	Phone locked by abuser
31	App usage logged
32	Using Facebook under watch
33	Using TikTok to cope
34	Watching YouTube for escape
35	Calling helplines when alone
36	Deleting chats after help-seeking
37	Writing passwords down
38	Memorizing emergency contacts
39	Letting kids help with signup
40	Saving fake names for support
41	Police gave verbal warning
42	Discontinued counseling
43	App deleted after suspicion
44	Peer group chat offered relief

Table 10.2: Initial Codes Identified from User Experiences

10.5.3 Secondary Codes

Table 10.3 presents the secondary codes identified from participant feedback, which capture recurring behaviors and emotional patterns. These codes reflect how users manage technology under surveillance, seek help indirectly, and prioritize privacy and child safety. The themes also highlight trust-building through stealth features, the importance of familiar platforms, and the varying levels of confidence in using new technology.

No.	Secondary Codes
1	Covert Phone Use
2	Digital Disguise Methods
3	Emotional Suppression
4	Fear-Driven Avoidance
5	Abuser Monitoring
6	Social and Emotional Isolation
7	Support Hesitancy
8	Indirect Help-Seeking
9	Distrust of Services
10	Tech Navigation by Proxy
11	Passive Media Consumption
12	Privacy-Conscious Tech Use
13	Digital Survival Planning
14	Platform Familiarity Reliance
15	Preference for Stealth Apps
16	Contextual Isolation
17	Confidence Gap in New Tech
18	Child-First Safety Priority

Table 10.3: Secondary Codes Identified from User Feedback

10.5.4 Clustered and combined codes

Table 10.4 presents the clustered themes that emerged from the analysis. These themes represent the overlapping concerns around fear of being discovered, the demand for discreet support, reliance on trusted apps, and the need for safety measures that don't increase risk. They reflect how users navigate support without alerting potential abusers, prioritizing platforms that blend into everyday use.

No.	Combined Themes
1	Fear of Discovery
2	Digital Safety Steps Can't Arouse Suspicion
3	Discreet Help
4	Known Apps
5	Control Doesn't Help Unless It Reduces Risk
6	Focus is Given to Familiar Platforms

Table 10.4: Combined Themes

10.5.5 List of Themes

- Digital Surveillance Shapes Daily Behavior

“Even if I delete one message, he notices.” (Victim 3) Survivors live under constant monitoring, forcing them to manage every digital move with caution.

- Disguised Apps Enable Safer Access

“If it looks like a prayer app, I’ll use it.” (Victim 5) Only tools hidden in plain sight feel safe enough to use.

- Children Assist with Tech Navigation

“My daughter helps me sign up.” (Victim 2) Some survivors rely on children to use digital tools due to limited confidence or control.

- Formal Support Often Feels Risky

“They warned him once, and it got worse.” (Victim 3) Police involvement may escalate abuse, reducing trust in institutional help.

- Fatigue Limits Complex Engagement

“I just want something that works fast.” (Victim 4) Emotional exhaustion limits the ability to engage with complicated apps or services.

- Survivors Seek Control Without Visibility

“I want control, but not if he notices.” (Victim 1) Autonomy is only valuable if it doesn’t increase danger.

- Familiar Platforms Feel Safer

“New apps are scary — I know Facebook.” (Victim 4) Trusted platforms are preferred over unfamiliar tools, especially when safety is at stake.

10.5.6 Findings

Survivors of domestic abuse consistently described technology as a double-edged sword—both a tool for danger and a potential avenue for support. Many shared how abusers exploited digital means to monitor their activity, such as reading messages or tracking app use, fostering an environment of constant fear and vigilance. One participant remarked, “He doesn’t even have to take my phone. He just figures out what I’m doing by how long I hold it.” In response, survivors crafted careful and secretive methods to protect themselves. This included deleting call histories, disguising apps behind harmless icons like weather or religious symbols, and timing their phone usage—often only accessing support during quiet, late-night hours. These actions show a deliberate effort to preserve safety in the face of ongoing surveillance. Emotional and psychological challenges were profound. Shame, fear of retaliation, and the exhaustion of maintaining a façade prevented many from seeking help through formal systems. Police interventions often felt superficial, with verbal warnings failing to offer real protection. As one woman shared, “They came once, told him not to hit me, and left. That night was even worse.” Most participants regularly used social media or entertainment apps but were wary of unfamiliar technology. Many relied on their children to navigate new apps, which introduced additional concerns about privacy and safety. Passive media use, such as watching TikTok or YouTube, offered short-term distraction but not solutions. When discussing desired app features, survivors emphasized stealth and discretion. Preferred functions included disguised interfaces, quick-exit buttons, and automated messages—elements designed to avoid arousing suspicion. Offline functionality was less critical than remaining hidden. Ultimately, this research highlights that for survivors, digital safety is not merely about access to resources, but about maintaining invisibility. Their experiences underscore the urgent need for tools that safeguard secrecy, emotional well-being, and personal control in environments where these are systematically compromised.

10.6 Summary Table of Feature Feedback

The responses from the seven interviewed victims reveal clear trends in what features are considered essential for a safe and discreet mobile support tool. Every participant favored an app interface that blends in—such as one disguised as a weather or religious app—indicating a strong preference for stealth. Likewise, a quick-exit option was seen as critical by nearly all, offering a fast way to hide the app if an abuser is nearby. Location-sharing during emergencies and SOS alert functions were also widely supported, especially for those who might not be able to speak or send messages in urgent situations.

Many of the victims expressed concerns about privacy during use, which led to a preference for automated assistance instead of live help. While some users mentioned the value of features like emotional support chatbots, incident logging, or legal help access, these were more individualized needs. Altogether, the feedback highlights a clear demand for tools that are easy to hide, quick to exit, and safe to use even under surveillance. This information has been summarised in the table 10.5.

10.7 Ethical Considerations

All interviews were conducted in safe locations, with prior verbal consent. Participants were reminded they could skip questions or stop the interview at any time. No identifiable personal data was collected. All findings were anonymized and securely stored.

10.8 Discussion

The findings from this study highlight the critical importance of discretion and safety in designing mobile applications for domestic violence survivors. Across all participants, the need for an app that remains hidden and inconspicuous was a recurring theme, with preferences for disguising the app as a common tool like a weather or religious app. This was particularly important given the high levels of phone monitoring reported.

The quick-exit button was another universally valued feature, seen as essential for allowing users to close the app immediately in dangerous situations. Additionally, participants showed a strong preference for automated support features over live interactions, reflecting concerns about privacy and the risk of being overheard.

While emergency SOS and location-sharing functions were also considered lifesaving, participants emphasized that these features must operate quietly to avoid drawing attention. Despite varying levels of digital literacy, all participants expressed confidence in using the app if it was simple and intuitive.

Notably, many survivors preferred using a discreet mobile tool over seeking formal help, citing fear of social stigma, retaliation, and mistrust of legal systems. This underscores the potential of mobile applications to serve as accessible, safer alternatives for those who may not pursue traditional support channels.

Finally, while the study offers valuable insights, its limited sample size and urban focus suggest that future research should involve more diverse groups, including rural participants, to ensure broader applicability. In summary, the app's design must prioritize discretion, ease of use, quick exit options, and customizable features to meet the real-world safety needs of domestic violence survivors.

10.9 Limitations

Although this study gathered valuable insights from participants with varied backgrounds, it was limited by a small sample size and an urban focus. The experiences of individuals living in rural areas, those without access to smartphones and internet, or those who face language or technological barriers were not fully explored. These groups may have unique needs and constraints that remain unaddressed in this research. To gain a more comprehensive understanding, we aim to conduct future studies which will include a broader and more diverse participant base, and consider long-term investigations to see how user preferences and safety concerns may change over time.

ID	Age	Living Area	Tech Literacy	Phone Ownership	Abuse Duration	Type of Abuse	Shared Living	Employment	Education
Victim 1	50+	Urban	Basic (Facebook, YouTube)	Personal but monitored	20 years	Mental, financial	Yes with spouse	Unemployed	Honors degree
Victim 2	30	Urban	Basic (Facebook)	Personal and occasionally monitored	7 years	Mental, emotional, sometimes physical	Yes with spouse	Employed full time	5th grade
Victim 3	35+	Urban	Basic	Personal and monitored	5 years	Emotional, financial	Yes with spouse	Employed full time	Intermediate level
Victim 4	40+	Urban	Lower than basic	Personal, unmonitored	11 years	Emotional, financial	Yes with spouse	Unemployed	Honors degree
Victim 5	30+	Urban	Basic	Personal, monitored	3 years	Emotional, sometimes physical	Yes with spouse	Unemployed	Intermediate level
Victim 6	25+	Urban	Basic	Personal, unmonitored	5 years	Emotional, mostly financial	Yes with spouse	Employed full time	Intermediate level
Victim 7	35	Urban	Basic	Personal monitored	5 years	Emotional, sometimes physical	Yes with spouse	Employed full time	Intermediate level

Table 10.1: Participant Demographics Summary

Feature	# of Users Who Requested/Approved	Notes
Quick Exit Button	6/7	Seen as essential during high-risk situations
App Masking (e.g., disguise)	7/7	Suggested disguises: Weather, Religious, Everyday utility apps
Emergency / SOS Button	4/7	Critical for quick help; some want visible emergency numbers
Emergency Location Tracking	6/7	Trusted feature, especially if abuser controls phone access
Voice or AI Assistance	5/7	Preferred if interaction is minimal and discreet
Pre-written Messages & Voice Alerts	1/7	Useful for discreetly signaling for help
Incident Logging	1/7	Helps privately record abusive incidents
Emotional Support Chatbot	1/7	Provides emotional reassurance
Live Support Options	1/7	Desired by some for emotional/legal help
Legal Resource Integration	1/7	Direct links to legal info and police contacts
Stealth Priority	1/7	Emphasizes complete concealment of app's true purpose

Table 10.5: Summary of Feature Feedback from Victims

Chapter 11

Secondary Design

11.1 Overview

The secondary design phase emerged as a direct response to the insights gathered from victims who interacted with the paper prototype (see Chapter 9 for reference). This phase was critical in refining the app's interface and logic to better suit the lived experiences, limitations, and preferences of domestic abuse victims in Bangladesh. The revised prototype was constructed using a basic digital design tool and incorporated tangible usability improvements based on human-centered interaction principles and trauma-informed design.

11.2 Design Framework: The Four P's Model

From the conceptual stage, the app's feature architecture was intended to serve victims across four support categories: Preparation, Protection, Provision, and Prevention. This structure was adopted to ensure that each component of the application directly mapped to a stage in the victim's journey- from preparing for safety to receiving support and escaping violence.

These four stages served as the framework for reorganizing features during the secondary design. Modules such as tutorial and pre-generated responses aligned with Preparation, while SOS tools and dynamic calendars served Protection. Provision was reflected in community and legal support tools, and Prevention was addressed through AI-based risk prediction and behavior tracking.

11.3 Key Improvements and New Features

The secondary prototype implemented a number of major changes based on the insights gathered from victim interviews and real-world usage constraints. Each change reflects a shift from assumption-driven to user-informed design, grounded in the lived realities of domestic abuse victims.

1. Dummy Password Redesign

One of the most significant updates was the complete removal of the session-based dummy password system. In the earlier prototype, the app would generate a new

dummy password for each session (see figure 11.1). It's a logic that, while theoretically secure, proved cognitively burdensome for most victims. They expressed that memorizing multiple passwords or remembering which one was valid in which session was too difficult, especially during high-stress moments.

In response, the second design phase introduced a more flexible mechanism (see figure 11.2).

- Users can now either set a custom dummy password or let the app generate a simple, memorable one.
- Suggested conventions include using the first three letters of the user's name and the last three digits of their phone number.
- The active dummy password is always visible within the real Safety Dashboard and can be changed at any time.

This approach reduced user confusion while retaining the critical disguise functionality of the dummy interface.

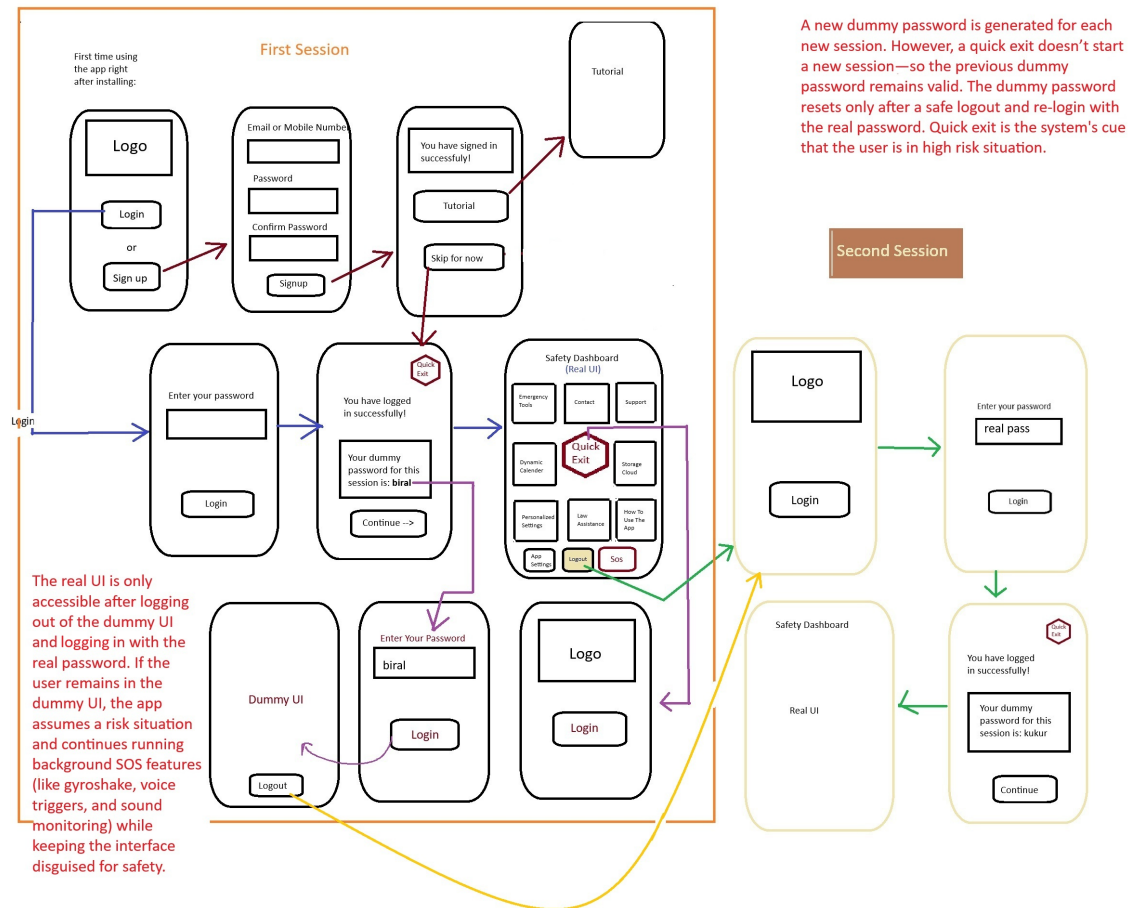


Figure 11.1: Stealth Mode Schema (Before Victim Feedback)

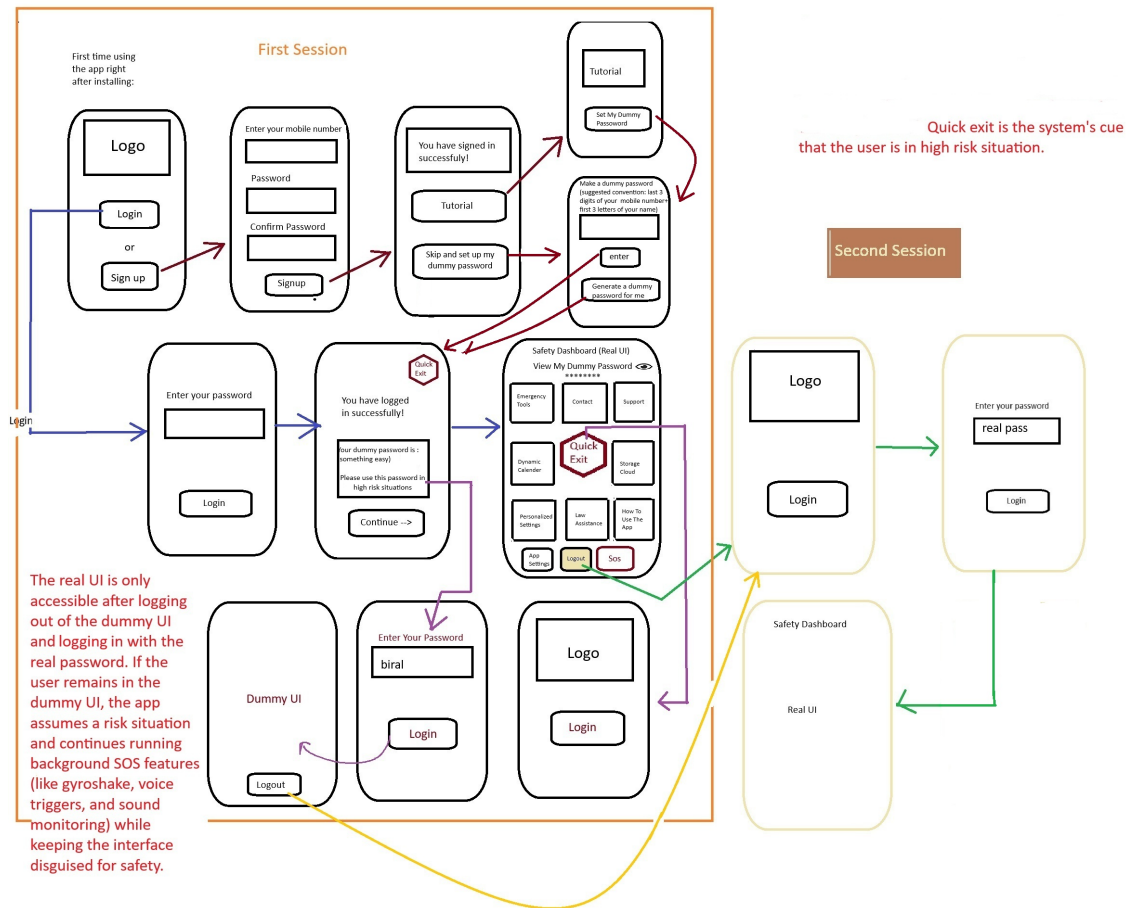


Figure 11.2: Stealth Mode Schema (After Incorporating Victim Feedback)

As some of the victims mentioned that they have a hard time keeping track of their emails, the signing up option using email was also removed. Only phone number and password are needed to sign in.

2. Centrally Placed Quick Exit Button

All victims emphasized the need for a more visible and accessible Quick Exit button. In response, the button was centrally placed on every screen, colored red for instant recognition, and styled prominently for thumb-friendly access. This placement is supported by HCI research demonstrating that center-lower zones on mobile interfaces optimize one-handed usability and touch accuracy [16], [37].

3. Risk Prediction Model Integration

The original dynamic calendar was limited to recording abusive events across dates. In the revised prototype, it was extended with a basic ML-based risk prediction model, which analyzes recent incident logs to detect rising danger (see figure 11.3). This feature is planned for implementation in future versions (see Chapter 14), and offers victim-facing insights such as:

- “Today’s Risk Level: High”
- “Avoid being alone. Record if threatened.”

4. Law Assistance Enhancements

After direct requests from victims, the law assistance module was significantly expanded (see figure 11.4 for reference):

- How-to guides for filing a GD (General Diary) and understanding FIRs,
- Access to legal templates,
- Common legal questions answered in plain language,
- Access to verified volunteer legal advisors.

5. Bangla Language Integration

Most users indicated a strong preference for an interface in Bangla. As a result, a Select Language option was added in the Settings menu with culturally and linguistically appropriate Bangla content.

6. Emotional Support Prioritization

Victims consistently asked for a private, non-judgmental space for emotional support. The prototype responded by introducing the following (see figure (11.3)):

- Anonymous chat with professionals,
- Peer community support access,
- Self-care tools and breathing exercises.

7. Safety Dashboard Refinement

The Safety Dashboard was visually and functionally overhauled. Key updates include:

- Clean icon alignment and semantic grouping of functions,
- Clear labeling of modules under the 4-Ps framework (Preparation, Protection, Provision, Prevention),
- Seamless access to Quick Exit, law tools, and emotional resources.

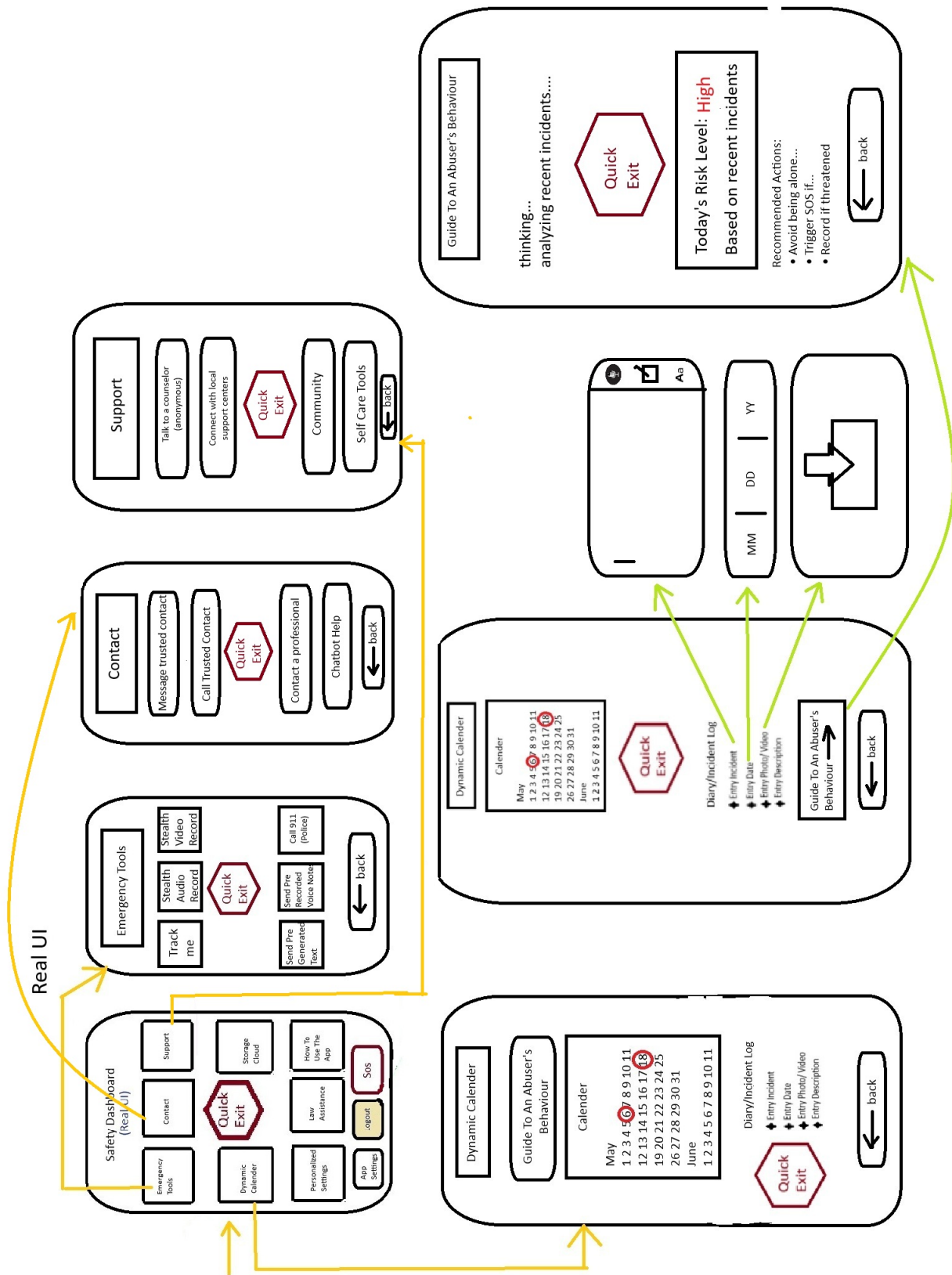


Figure 11.3: Secondary Design: Updated Safety Dashboard Layout

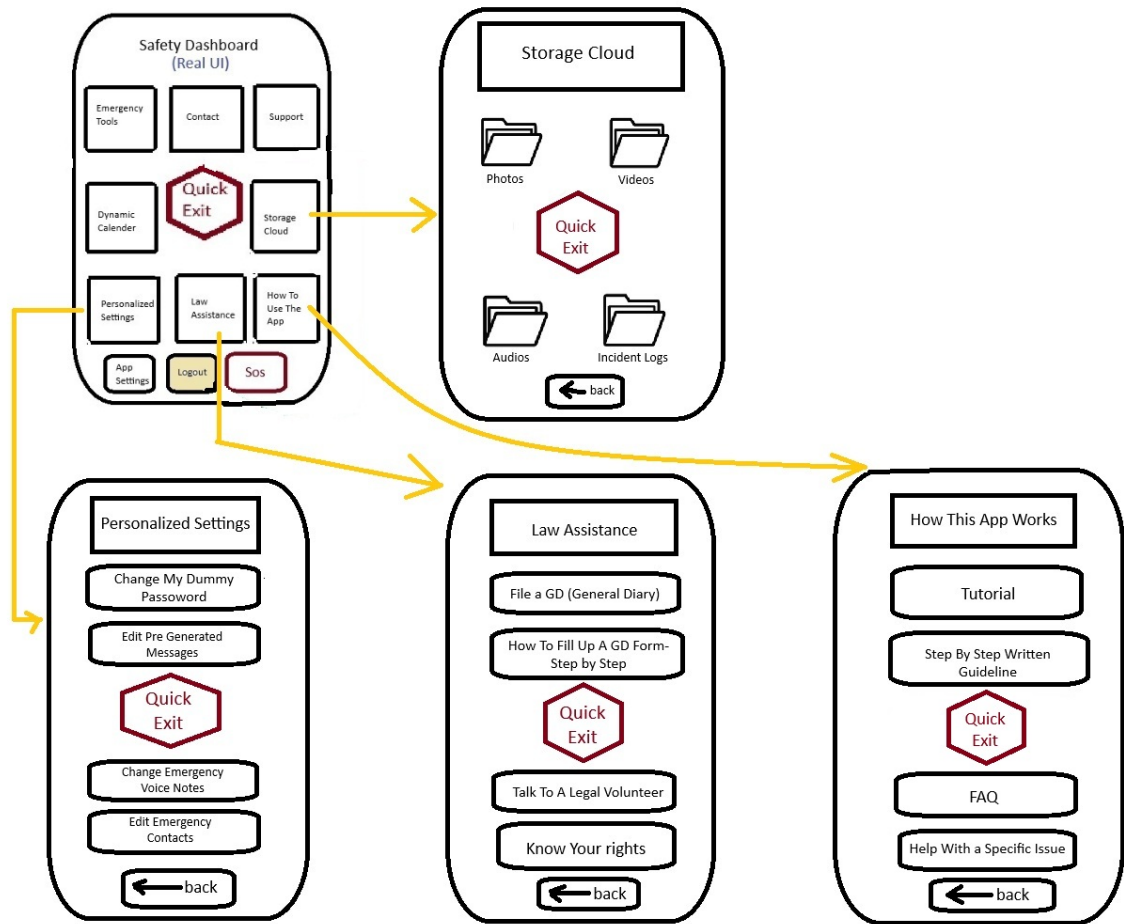


Figure 11.4: Secondary Design: Updated Safety Dashboard Layout

11.4 Discussion

The secondary design phase marks a pivotal transition from low-fidelity ideation to structured, user-informed iteration, guided by both HCI principles and trauma-aware design ethics. Unlike the earlier prototyping stage, which was rooted in abstract hypothesis and exploratory feedback, this phase emphasized implementation of grounded, real-world improvements derived directly from survivor testimonies and expert consultation. As such, the secondary design process exemplifies the value of iterative design—where usability is not merely theorized, but negotiated through layers of lived experience, emotional context, and sociotechnical constraint.

Operationalizing the Four P's Model

The decision to structure the app around the Four P's Model: Preparation, Protection, Provision, and Prevention, proved highly effective in reorganizing and communicating the app's multifaceted feature set. By explicitly mapping app components to user journeys, this framework provided clarity not just to the design team but also to victims, many of whom expressed feeling overwhelmed by other support

tools. The Four P's served as a form of cognitive scaffolding, segmenting a complex and emotionally charged interface into manageable modules aligned with specific survival and recovery needs.

Moreover, this framework offered a coherent narrative for HCI evaluators, legal experts, and mental health professionals who reviewed the prototype. It allowed for more structured critique, as each "P" encapsulated a dimension of the user experience, ranging from emergency exit behavior to long-term psychological care.

From Feature Requests to Design Philosophy

Each major revision in the secondary prototype reflects not only a usability improvement but also a paradigm shift in the underlying design philosophy. For instance, the redesign of the dummy password system was not merely a simplification of logic, but a recognition of cognitive burden under stress—a key tenet of trauma-informed design. Similarly, the shift away from email-based signup foregrounded the economic and digital realities of the target user base, particularly women with limited or shared device access.

The emphasis on flexibility, optionality, and visibility; seen in changes such as central Quick Exit buttons or Bangla-language support—demonstrates a matured understanding that usability is political. The interface must bend to the user's vulnerabilities, not the other way around.

Balance Between Technological Ambition and Practicality

Another central discussion point emerging from this phase is the balance between innovation and accessibility. The integration of machine learning for risk prediction, while still in planning (see Chapter 14), exemplifies a forward-looking design mindset that respects the urgency of abuse detection without overwhelming the user with abstraction. Visual cues like "Today's Risk Level: High" are meant to convey actionable insights, not raw data. Here, AI is framed as an augmenting agent, not a substitute for human decision-making.

Equally important is the reimagined Safety Dashboard, which sought to simplify navigation while enriching functionality. By aligning icons semantically under the Four P's and giving prominence to core safety functions, the design attempted to minimize interaction load while maximizing emotional reassurance and speed.

User Trust, Emotional Labor, and Ethical Interfaces

Perhaps the most critical insight of this stage concerns the emotional relationship between users and the interface. The recurring request for anonymous chat, for example, speaks to a deep social void in victim support networks. Many users did not just need help; they needed to be heard. In response, the secondary prototype embraced the concept of the interface as an empathetic witness, embedding emotional tools and anonymous peer interaction into the technical design.

From an HCI ethics standpoint, this is significant. Trust in technology is rarely just about functionality, it is also about emotional safety, cultural familiarity, and agency. The integration of Bangla as a default language option and voice-guided legal FAQs further reinforces this understanding: the interface must meet victims where they are, linguistically, cognitively, and emotionally.

Broader Implications for HCI and Safety Tech Design

Finally, the secondary design phase contributes to broader conversations within HCI research and safety technology. First, it affirms the importance of designing for trauma, where typical usability heuristics must be reimagined under conditions of fear, shame, and surveillance. Second, it illustrates the power of participatory and iterative feedback, even in resource-constrained environments. When survivors are trusted as co-designers, the product becomes not just safer but more just.

This phase also offers a potential framework for other vulnerable-user contexts—from refugee support apps to elder abuse monitoring tools. The Four P’s model, dummy logic, and emotional scaffolding could be adapted for a range of safety-oriented applications beyond domestic abuse.

In summary, the secondary prototype is not just a refined interface, it is a redefined relationship between survivors and the technologies that aim to support them. It embodies responsiveness, empathy, and realism, grounded in both theoretical principles and field-tested human experience. The lessons from this phase lay the groundwork for the high-fidelity prototype discussed in Chapter 13, where technical detail and aesthetic coherence will further evolve the vision into a deployable, user-safe product.

Chapter 12

Advocate’s Interview

12.1 Overview

This study integrates expert feedback from a criminal lawyer specializing in women, children, and drug-related criminal cases in Chattogram, Bangladesh. The purpose of this interview was to reinforce the extent of usability of the app by victims of domestic abuse from all demographics. Since the lawyer has worked with several victims herself from various backgrounds, she had a definitive idea on what features the targeted audience for this app will be more adaptable with. The lawyer, with over seven years of practical experience in the judge’s court, provided critical insights into the app’s design, the practicality of its legal assistance features, and its potential impact within the Bangladeshi legal system.

The consultation particularly focused on three major areas:

- Emotional support mechanisms for domestic abuse victims.
- The legal validity and effectiveness of app-based General Diary (GD) filing.
- Detailed legal procedures and recommendations that victims must follow to ensure their protection under Bangladeshi law.

12.2 Participant Background

The participant is a practicing criminal lawyer with over seven years of experience at the Chattogram Judge’s Court. Her primary legal focus is on cases related to women and children, including domestic violence, sexual abuse, and drug-related crimes. She is well-versed in the procedural applications of the Criminal Procedure Code (CrPC)[3], the Domestic Violence (Prevention and Protection) Act, 2010, and the Women and Children Repression Prevention Act, 2000 [6]. Her extensive exposure to the socio-legal challenges faced by DV victims in Bangladesh made her an authoritative figure to validate the app’s law assistance module and its practical application in the field.

12.3 Expert feedback on prototype design

The lawyer provided valuable feedback on the prototype designed in the second phase using the victims' feedback on the paper prototype. Key recommendations included:

- **Enhanced Emotional Support Features:** She emphasized the importance of incorporating features that offer immediate emotional relief and psychological support. Specifically, she appreciated the inclusion of chatbots in the app which can provide immediate emotional support to the victim. She recommended training the chatbots to have responses that are suitable to aid a domestic abuse victim. She also mentioned the inclusion of virtual assistance from NGO workers, volunteers, and even domestic abuse survivors to ensure the app goes beyond legal support to provide mental health assistance.
- **Abuse Pattern Recognition:** The lawyer appreciated the integration of machine learning algorithms capable of predicting the risk of physical violence the victim might face at some point in time. She emphasised how majority of the victim groups she has worked with are not aware that they categorise as a victim of DV at all. Since our society normalises verbal abuse, and even in some moderation, physical assault, most of the victims are not aware that they qualify to seek help. According to the lawyer, the app's feature to predict the risk of the victim getting abused based on abusive incident entries that the victim herself can log into the app, can protect the victim from potential harm to certain extent. type and pattern of abuse—whether emotional, financial, or physical. She noted that most victims in Bangladesh are unaware of micro aggressive patterns that typically precede physical violence, and thus suggested the app includes sections which informs the user of types of abuse, and even the basic rights that the government of Bangladesh has allocated for her.
- **Peer and Legal Consultation Spaces:** She strongly recommended adding functionality where victims could communicate directly with legal professionals and domestic violence survivors. Such features could provide both practical guidance and peer-based emotional support, which is often lacking in traditional reporting mechanisms.

12.4 Feedback on Law Assistance Module

The main goal behind this interview was to get the lawyer's opinion on the app's law assistance feature. This particular feature was developed in mind to assist victims with preparation with the required documents needed to file a case against her abuser. In a way, this feature was intended to bolster the process of protecting the victim after she calls for emergency assistance. The lawyer not only provided her valuable insights on what documents a victim will need, and where she can acquire those from, but also gave a sneak peek in to the legal world of the Bangladeshi judiciary system and its stance regarding domestic abuse victims. Her notable feedbacks are as follows:

a. **Online General Diary (GD) Filing**

The lawyer asked to keeping the online GD filling feature, however said that it is not very effective. Her feedback was grounded in both legal provisions and practical limitations:

- **Lack of Legal Recognition:** The Criminal Procedure Code, 1898 (CrPC) does not provide statutory support for online GD filing (The Code of Criminal Procedure, 1898)[3]. The process remains paper-based and requires in-person validation (Hasan, 2015)[30].
- **Operational Failures:** Multiple studies, including a case study by Hasan (2015) and an SSRN working paper (Alam Rahman, 2023)[64], revealed that Bangladesh Police’s Citizen Help Request (CHR) portal suffered from incomplete implementation, lack of identity verification, and limited citizen trust.
- **Ineffectiveness in Practice:** Citizens filing online GDs were often required to later visit police stations to validate their reports (Hasan, 2015[30]; The Financial Express, 2020[54]; Dhaka Tribune, 2025)[82]. This undermines the convenience and efficiency expected from such digital services.
- **Security and Legal Integrity Issues:** Additional research indicated that the CHR system faced security gaps and poor integration with existing policing workflows (Uddin Hoque, 2023)[69].

Despite the online portal’s current ineffectiveness, the lawyer suggested that it is only a matter of time. The online portal is still in its developing stages, and in the future will prove to be helpful. Thus she insisted that the app includes this feature.

b. **Victim Guidance and Practical Legal Tips**

The lawyer stressed the need to include a detailed legal guidance section in the app that educates victims about:

- **Court vs. Thana GD Filing:** Victims should be informed that filing a GD at the court may offer better protection than filing at the local police station, where officers often try to reconcile the victim with the abuser, and resolve the conflict on spot. This, while reduces the hassle of the law enforcers, only drives the victim towards greater harm as the abuser walks free with a few threats and a legal warning.
- **Medical Documentation:** Medical reports must be obtained from government hospitals to ensure legal validity in court proceedings. This is a statutory requirement under the Women and Children Repression Prevention Act, 2000[6] and the CrPC Section 164A[3].

Supporting Legal Provisions:

1. Women and Children Repression Prevention Act, 2000: Requires immediate medical examinations in public hospitals for victims of physical or sexual assault (Parliament of Bangladesh, 2000)[6].
1. Suppression of Violence Against Women and Children Act (2000, amended 2003)[5]: Mandates timely medical documentation and reporting to the police (Ferdousi Jahan, 2022)[58].
1. Domestic Violence (Prevention and Protection) Act, 2010: Requires police to ensure victims are aware of their right to medical services (Parliament of Bangladesh, 2010)[17].
1. CrPC Section 164A: Requires victims of sexual assault to undergo a medical examination within 24 hours of reporting (Government of Bangladesh, 1898)[3].

12.5 Lawyer-Recommended In-App Legal Assistance Guide

Majority of the participants interviewed in the previous chapters recounted that they themselves, or the the victims they had worked with had limited to no idea on the type of documents required to file a case against the abuser. The lawyer, herself being experienced with this demographic showed interest for the app to contain a comprehensive list of legal documents that will be expected from the victim during legal procedures.

The lawyer provided a comprehensive list of documents and steps victims should be guided to collect and follow within the app:

1.Essential Documents:

- National ID Card or Passport: Required for legal identity verification during GD or FIR filing.
- Medical Reports from Government Hospitals: Legally necessary for assault cases under the Women and Children Repression Prevention Act, 2000[6] and CrPC Section 164A[3].
- General Diary (GD) Copies: Prior GDs can strengthen the victim’s claim even if not legally required.
- First Information Report (FIR) Copies: Officially initiates criminal proceedings.
- Marriage Certificates (Nikahnama): Needed to establish the domestic relationship.
- Witness Statements/Affidavits: Strong supporting evidence from neighbors or relatives.

- Digital Evidence: Text messages, call logs, social media threats—admissible under the Information and Communication Technology Act, 2006 [10] and the Evidence Act[1].

2. Legal Awareness Components:

- Victims should be informed that medical reports from private hospitals may not be accepted in court proceedings (Ferdousi Jahan, 2022)[58].
- Victims must be aware that delays in medical examinations can weaken legal standing (Government of Bangladesh, 1898; Parliament of Bangladesh, 2000)[2].
- The app should clarify that police officers have a legal duty to inform victims of their rights to medical services and legal protection (Parliament of Bangladesh, 2010)[6].

12.6 Discussion

The expert feedback from the criminal lawyer provided crucial validation and direction for the app’s design, especially in aligning it with the legal and emotional realities faced by domestic violence victims in Bangladesh. Her experience highlighted that many victims do not recognize verbal or emotional abuse as forms of domestic violence, largely due to societal normalization. This insight reinforced the importance of the app’s risk prediction feature, which can help users identify escalating abuse early, making it not just a response tool but also a preventive aid. The lawyer emphasized the need for emotional support mechanisms, praising features like chatbots and suggesting deeper integration with NGO volunteers and survivor networks. From an HCI perspective, this underscores the importance of designing technology that offers human-centered, empathetic interaction, particularly in high-stress, high-risk contexts.

Her evaluation of the law assistance module raised critical concerns about the current limitations of online General Diary (GD) filing in Bangladesh, which lacks formal legal standing and reliable implementation. Despite this, she supported keeping it as a future-ready feature, recognizing the direction of legal digitization in the country. A key recommendation was to strengthen the app’s legal literacy features. Most victims are unaware of the required legal documents or the steps needed to file a case. Including detailed, clear, and accessible legal guidance within the app can help bridge this gap and empower users to take action.

Overall, the interview confirmed the value of combining emotional support, legal education, and predictive risk assessment within a discreet, culturally appropriate interface. The lawyer’s insights helped ground the design in real-world usability, reinforcing the app’s potential as both a support system and a pathway toward justice.

12.7 Limitations

This interview was only conducted with one lawyer due to time constraints. Initially, the study would have been conducted with professionals working with victims, however these professionals were not needed to be strictly people of law enforcement.

During the interviews with professionals in chapter , and the surveys, legal counsel was not seen as something the victims would require. They simply mentioned the necessity of speaking to a legal volunteer through the app. However, during the interview with actual victims it was very clear that almost all the victims had very little idea about their rights, the legal documents needed and the procedure that follows when police are involved. At that point of our study, time was short for us to consult several lawyers, especially ones who work directly with abuse victims, who could review our law assistance module. Thus, we worked with the one that was available. In our future work we intend to include many more lawyers to achieve more clarity and reliability.

Chapter 13

The Final Prototype

13.1 Overview

The final high-fidelity prototype was developed in Figma to deliver a fully interactive and user-navigable version of the safety and support app. Unlike the static paper and secondary sketches, this prototype replicates real app behavior, enabling users to experience interface flow, navigation logic, and visual hierarchy. Every component was derived from insights gained during interviews with victims and professionals, literature review, usability principles in Human-Computer Interaction (HCI), and ethical considerations specific to high-risk domestic violence contexts. The app is also available in Bangla for maximum accessibility, usability, and trust among its target users.

13.2 Entry and Disguise Mechanism

The app opens to a disguised signup login interface (see figure 13.1) My Grocery List app. This interface was designed to appear mundane, reducing the chance of detection by abusers. From this screen, users can either sign in (see figure 13.2) with their mobile number or log in with their real password or use a dummy password.

- A real password grants access to the full Safety Dashboard.
- A dummy password opens the disguised interface- grocery tracking, budgeting, reminders, and settings, without displaying any safety-related tools.

The inclusion of dual authentication (real vs. dummy password) addresses the need for layered protection in highly monitored environments.



আমার বাজার সদাই

Login

Or

Sign Up



Figure 13.1: Disguised entry screen

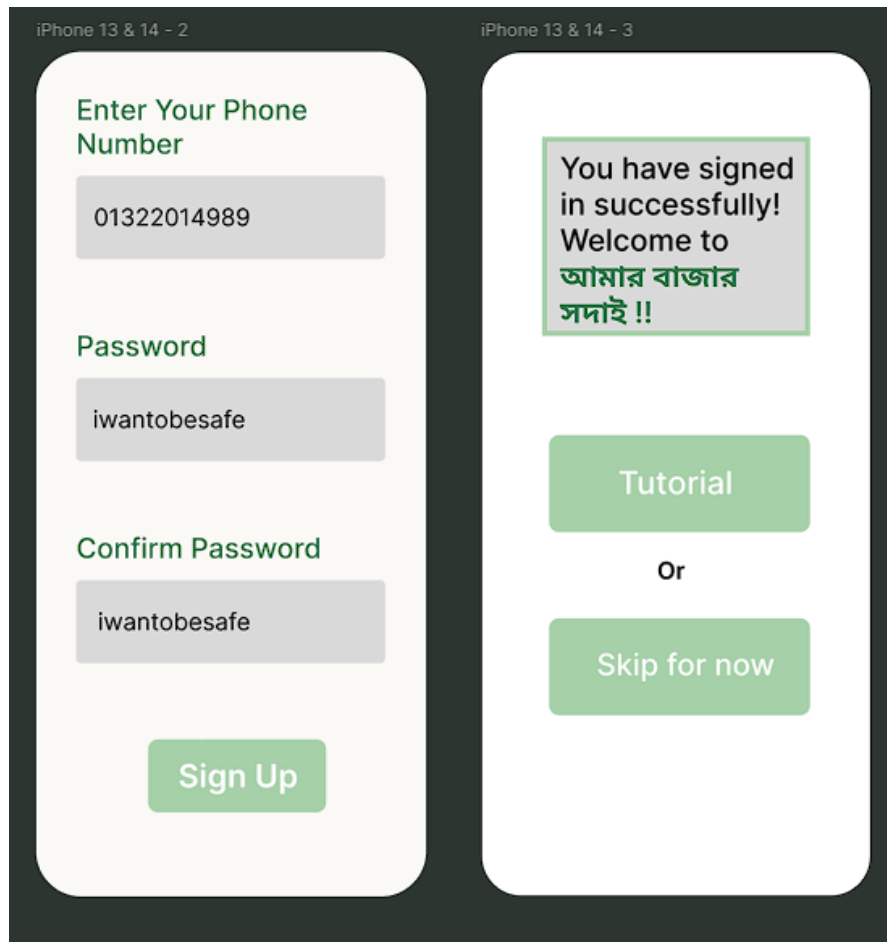


Figure 13.2: Signup

13.3 SOS Button and Consent-Based Configuration

After completing the tutorial (see figure 13.3), the app presents a consent screen outlining the SOS system. It explains that the SOS button is designed for extreme emergencies- such as ongoing physical abuse, being followed, or locked in; and asks the victim to configure their preferred automatic actions (see figure 13.4 for reference). This approach ensures the user remains in control while offering automated emergency response when needed. In real-life high-risk situations, users may have different comfort levels regarding police interaction, stealth recording, or location sharing. Therefore, the system offers granular control.

This enables users to define which actions are triggered when they press the SOS button—or if the app auto-detects distress using voice recognition.

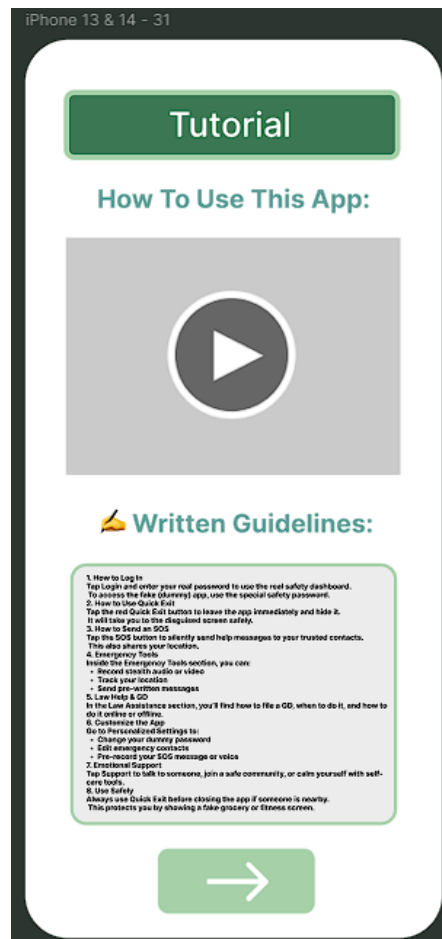


Figure 13.3: Tutorial

Available SOS actions include:

- Calling 911 (police)
- Sending signal to emergency contact
- Sharing live location
- Audio or video recording silently
- Sending pre-written text or voice messages

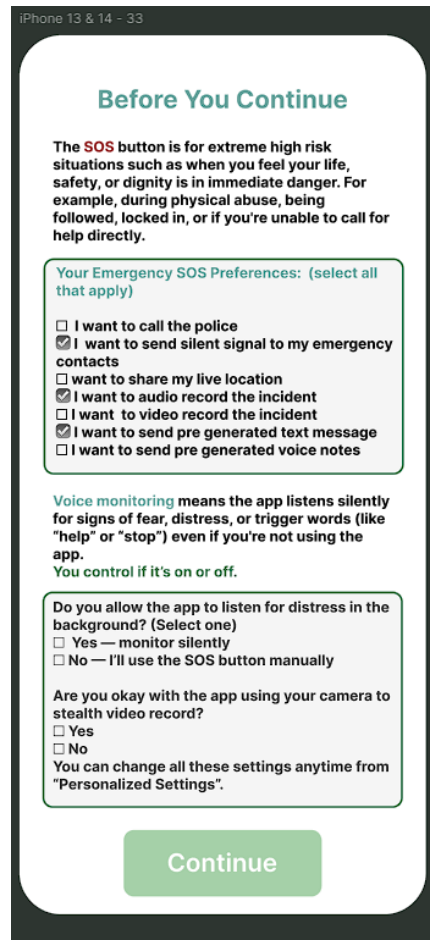


Figure 13.4: User Consent and SOS Preference

The app supports passive monitoring through voice recognition. If enabled, it activates SOS behavior based on distress detection, even without the user manually pressing the SOS button.

13.4 Quick Exit Design

The centrally placed, round red Quick Exit button is present on every screen of the real UI. Designed according to mobile ergonomics research, its central placement ensures thumb accessibility during panic situations. Pressing it redirects the user to the disguised grocery interface login page (see figure 13.5), while the app continues background monitoring if configured to do so.



Figure 13.5: Quick Exit button

13.5 Safety Dashboard Modules

The Safety Dashboard includes the following modules (see figure13.6):



Figure 13.6: Safety Dashboard

13.6 Emergency Tools

Provides one-tap crisis responses:

- Call 911
- Send pre-generated voice/text
- Activate stealth audio/video recording
- Track and share location

See figure 13.7 for reference.

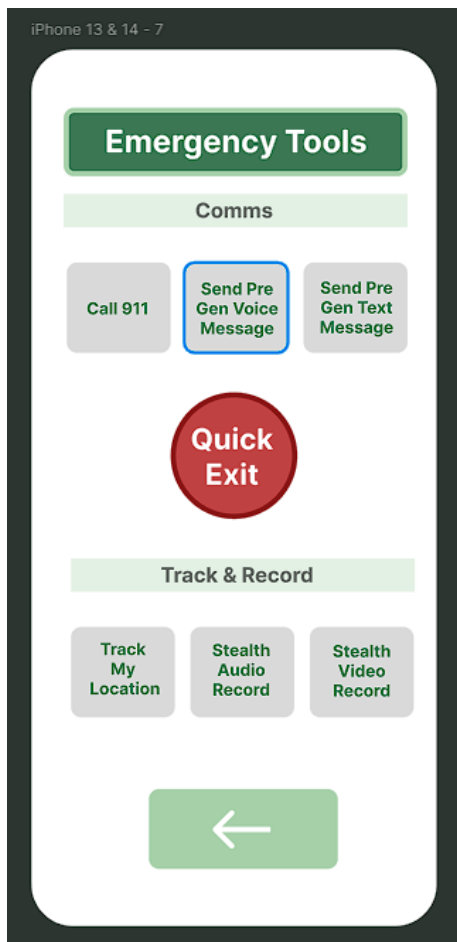


Figure 13.7: Emergency Tools

13.7 Dynamic Calendar

The dynamic calendar (see figure 13.8) is designed to identify abuse patterns over time. Victims can input daily logs that include media and time. A machine learning model then interprets these to offer predictive risk-level insights. This prepares victims to take preemptive action or use additional safety settings on high-risk days. It includes:

- Logging incidents with title, time, and media
- Seeing abusive event distribution on calendar
- Viewing ML-predicted daily risk level (red = high, yellow = moderate, green = low)
- Suggested actions (e.g., avoid isolation)

13.8 Contact Module

This module (see figure 13.9) allows communication with trusted individuals or professionals, even when contact is otherwise restricted by abusers. Logs are wiped automatically to ensure invisibility.

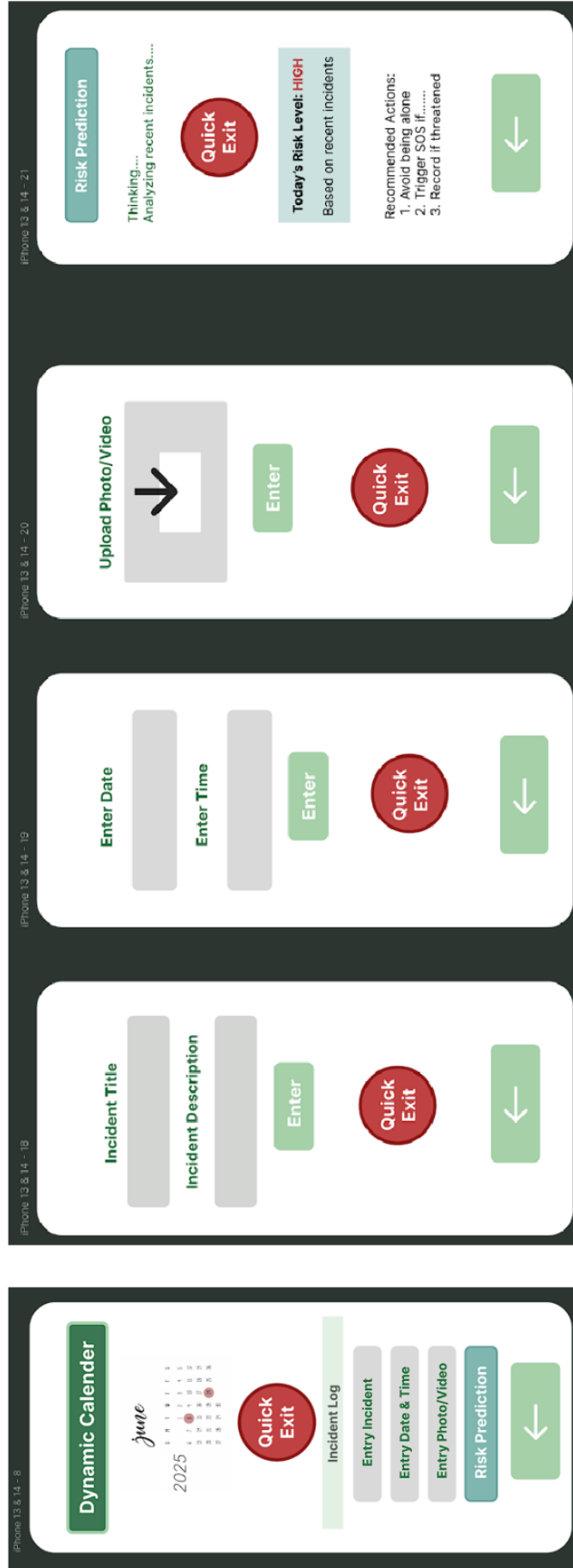


Figure 13.8: Dynamic Calendar

- Call/message trusted contacts anonymously
- Chat with professionals
- Access NGO hotlines (e.g., BRAC)

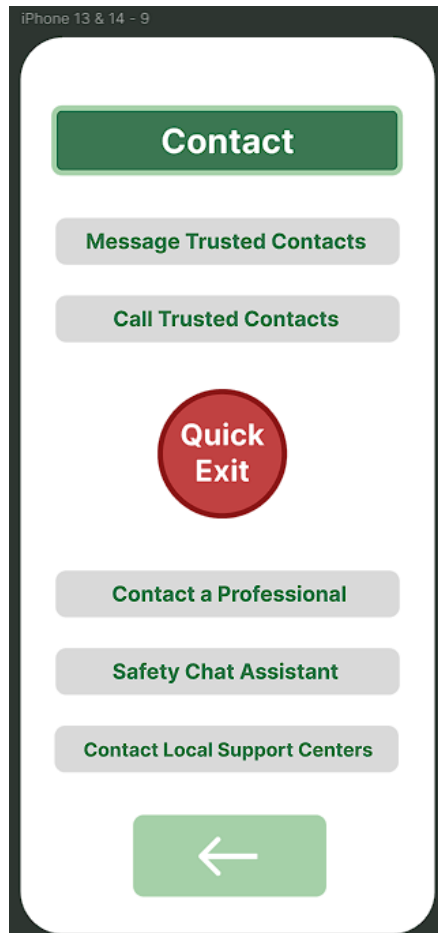


Figure 13.9: Contact

Calls and messages are not saved in call/message logs.

13.9 Storage Cloud

Victims requested a dedicated space to store sensitive documentation away from abuser access. This section (see figure 13.10) is password-protected and inaccessible via dummy login.

It is a secure, app-internal space for:

- Photos
- Videos
- Audio recordings
- Incident logs

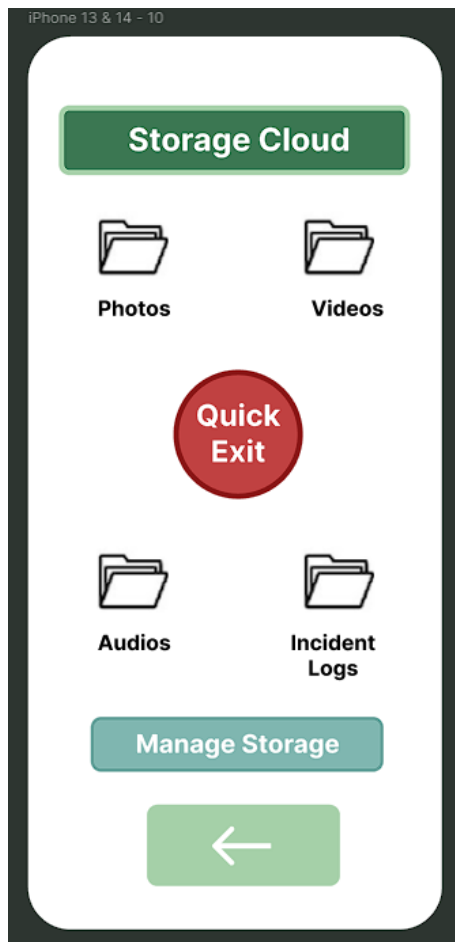


Figure 13.10: Storage Cloud

13.10 Personalized Settings

This module (see figure 13.11) allows victims to change their disguise UI (e.g., weather app, fitness tracker), dummy password, emergency preferences, and contacts. It empowers them to maintain autonomy and confidentiality even as circumstances evolve.

- Change dummy password or UI (e.g., fitness tracker, religious app)
- Edit pre-written voice or text messages
- Add/edit emergency contacts
- Define distress trigger words (e.g., help, stop)
- Configure SOS preferences

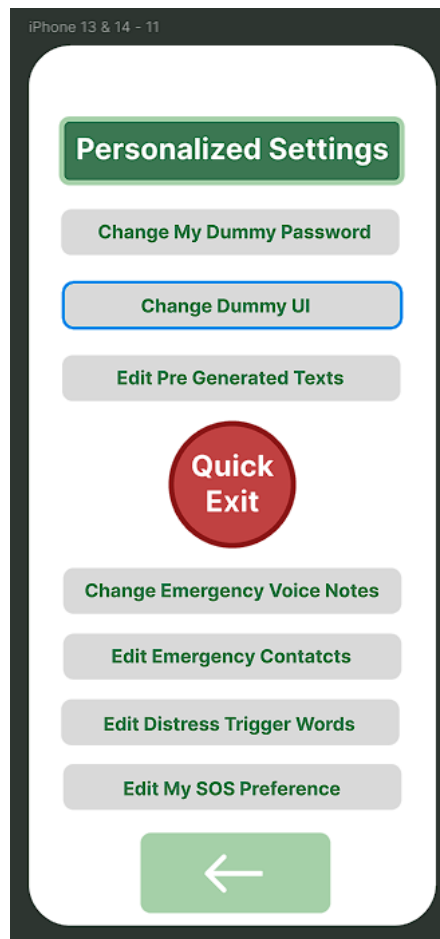


Figure 13.11: Personalized Settings

13.11 Support and Emotional Tools

Emotional support was repeatedly emphasized in victim feedback. This section (see figure 13.12) provides resources for self-reflection, mental health, and understanding abuse in a low-pressure format.

- Anonymous counselor chat
- Community support tools
- Quiz to identify abuse type
- Self-care features (breathing exercises, affirmations, distraction activities)
- Mental health FAQ

13.12 Law Assistance

After interviews with legal professionals, this module was developed (see figure 13.13) to simplify access to justice. Many victims were unaware of how to file a General Diary (GD), what documents are needed, or where to get legal help.

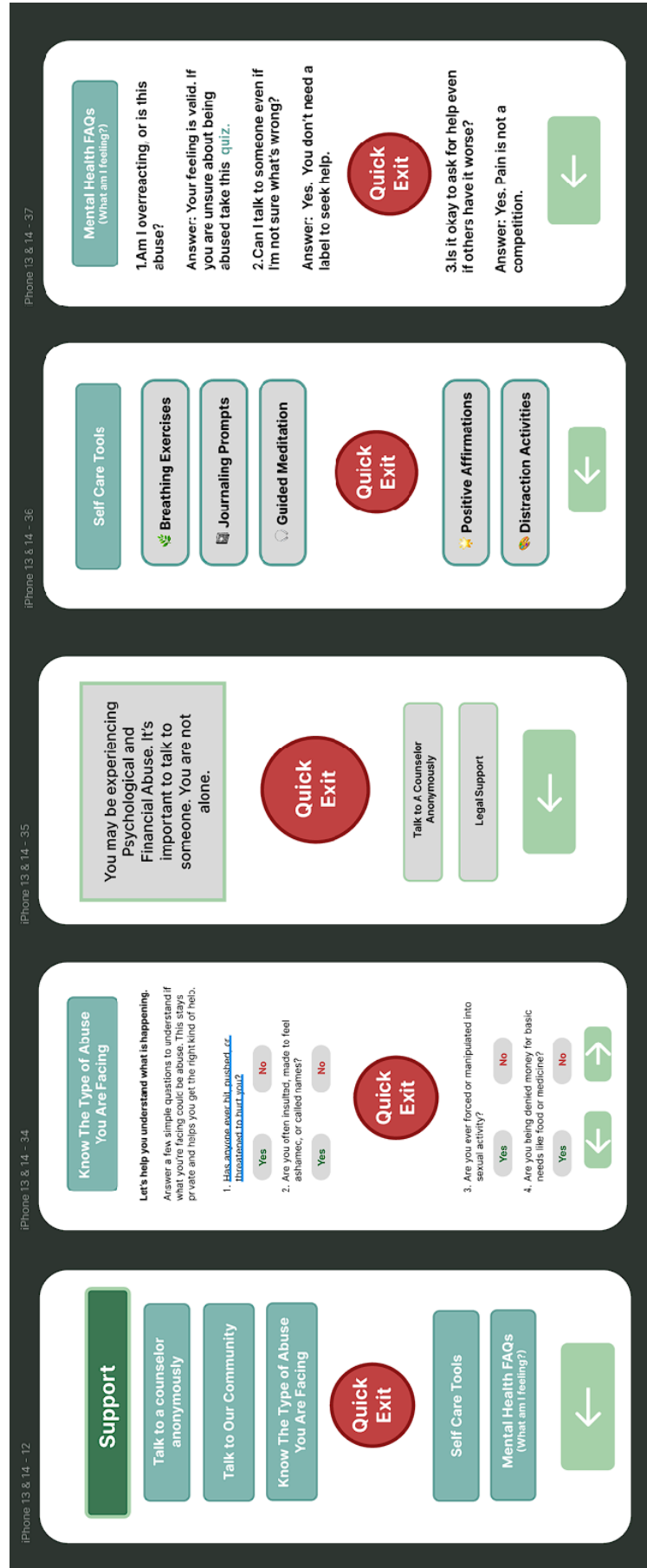


Figure 13.12: Support Tools



Figure 13.13: Law Assistance Module

- Online GD filing access
- Step-by-step offline GD instruction
- Legal rights and volunteer access
- Legal FAQ on what documents are required

13.13 How to Use This App

The onboarding guide includes:

- A video tutorial
- Step-by-step written instructions

13.14 Disguised Dummy UI

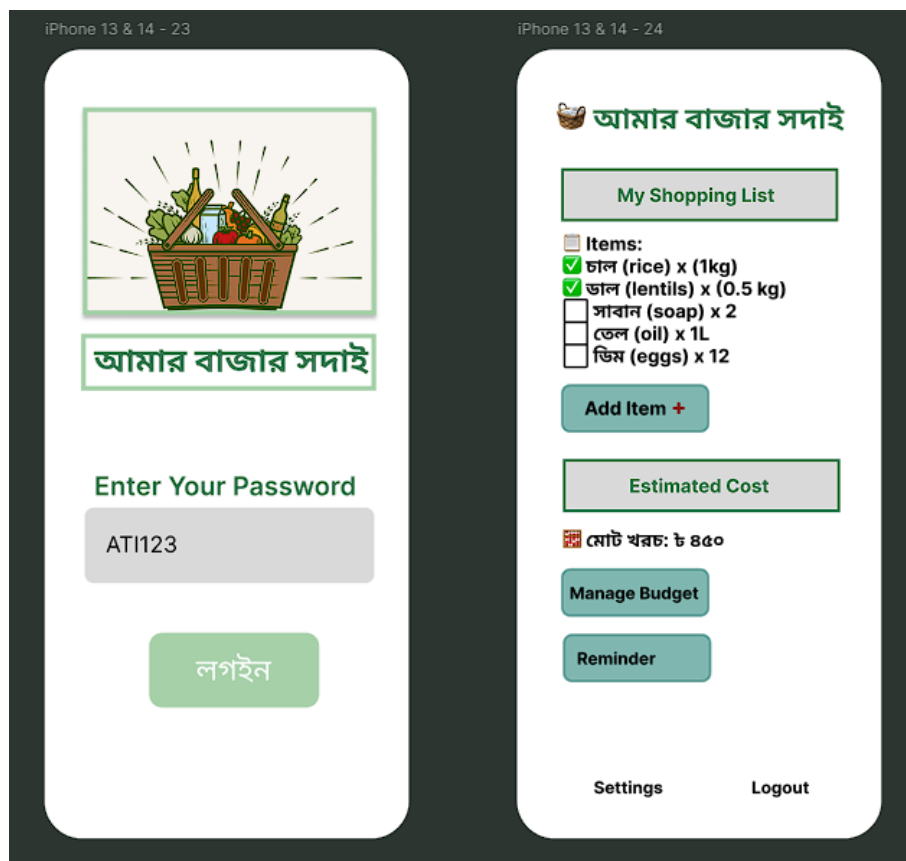


Figure 13.14: Dummy interface (grocery mode)

If the dummy password is entered, the app launches a disguised utility. See 13.14 for reference. Here:

- Users can manage a shopping list

- View estimated budget
- Set reminders
- Navigate to working settings or logout

13.15 Cognitive Load Minimization and Feedback Transparency

Domestic abuse victims often operate under high-stress conditions, where fear, confusion, or physical constraints impair cognitive processing. Recognizing this, the prototype was intentionally designed to reduce cognitive load across all modules. The interface follows minimalist design principles- limited content, intuitive flow, and reduced decision-making, to reduce task friction during emergencies.

During user testing, NASA Task Load Index (TLX) measures were applied to evaluate perceived workload. Feedback confirmed that the simplified structure, sparse information density, and gentle visual style significantly eased user interaction, especially in crisis simulations.

The color palette- a combination of muted greens and calming neutrals- was selected to create a non-threatening, psychologically soothing visual environment. These choices were guided by trauma-informed UI design frameworks, which emphasize emotional regulation and visual clarity during high arousal states.

To address ambiguity about system response, the app provides real-time, unobtrusive confirmations after every user action. For example:

- Upon logging an incident: *“Your incident description was added.”*
- After pressing the SOS button: *“SOS sent according to your preference.”*
- When submitting emergency contact info: *“Contact successfully saved.”*

Such acknowledgements ensure feedback visibility without increasing interaction cost—reaffirming user control and preventing repetitive, stress-induced re-entry of actions.

13.16 Disguise Integrity and Functional Parity in Dummy UI

A key insight from the final design phase was the importance of disguise realism. If a victim is being closely monitored, even a minor inconsistency between dummy and real interfaces can result in exposure. Therefore, the dummy UI was developed to achieve both visual and functional parity with the real interface.

First, the color palette of the dummy UI mimics the real UI exactly. This prevents suspicion from casual observation and supports interface continuity. Second, every interactive component within the dummy interface is fully functional.

These features were chosen to reflect a credible utility app while avoiding any content that could reveal the safety system beneath.

One notable feature is the presence of a working settings module within the dummy UI, which allows password changes. If an abuser attempts to “help” the victim by changing the app password, their action will change only the dummy password—leaving the safety system undisturbed but updating the disguise logic. This update is reflected visibly at the top of the real UI’s Safety Dashboard, where the current dummy password is always shown to the user for reference.

This layer of plausible deniability is an advanced form of camouflage, informed by real-world victim concerns. The ability to change the dummy UI (e.g., to a weather app or fitness tracker) through the Personalized Settings module further empowers users to respond dynamically to evolving risk environments.

13.17 App Community: Peer-Shared Learning and Validation

One of the most requested features during later design consultations was a space for victims to learn from one another without compromising their identity or safety. This insight gave rise to the App Community section - a closed, moderated environment where users can anonymously share their experiences, strategies, and encouragement with others who are also navigating abusive situations.

Unlike conventional social features, this community does not allow real-time messaging or direct contact between users. Each user is assigned a unique, auto-generated User ID that is not traceable to their real name or credentials. Posts made in the community are not published immediately; instead, they are routed to a backend moderation system. An admin will review submissions to ensure that no personally identifiable information is disclosed and that the content is appropriate and supportive in tone. Approved posts are then published in a scrolling feed visible to other users.

- **Posts:** Victims may share success stories, prevention strategies, emotional victories, or tips on using the app features effectively.
- **Comments:** Users can leave supportive, anonymous comments on others’ posts.
- **Moderation:** A critical safety layer ensures all content is filtered before becoming public to reduce risk and avoid re-traumatization.

This community acts as a virtual support network, providing validation, hope, and collective intelligence, especially for victims who may feel isolated or lack in-person support systems. It also reinforces positive app usage by showcasing real-life impact, thereby encouraging victims to explore features such as incident logging, legal filing, or self-care tools.

The design avoids any unmoderated interaction to minimize the risk of identity exposure or emotional harm. As an insight-driven addition to the app, the community reflects both trauma-informed practice and participatory design principles, amplifying the lived experiences of survivors to guide future users.

13.18 Categorizing Functionalities: The Four P's Framework

To better understand how the app addresses the needs of domestic abuse victims, all features were categorized using the Four P's Framework, often used in trauma-responsive design: *Preparation*, *Protection*, *Provision*, and *Prevention*. This framework helps illustrate how the app holistically supports users across different stages of risk and recovery. See table 13.1 for reference.

Preparation

These features aim to educate, orient, and empower the user to understand their situation, navigate available tools, and prepare for critical decision-making. Given that many victims may not recognize certain behaviors as abuse due to cultural normalization or psychological manipulation, the app first provides clear explanations of different types of abuse- psychological, financial, emotional, and sexual. Interactive onboarding (via video or step-by-step guides) builds app literacy, while SOS preference configuration empowers users to define what actions should occur during a crisis. Users are also equipped with legal and mental health knowledge (e.g., how to file a GD, rights as a citizen, FAQs on trauma). In addition, a built-in quiz helps users identify patterns of abuse, allowing for cognitive acknowledgment of their experience. These preparatory tools are designed to reduce confusion and hesitation during high-risk moments.

Protection

Features under this category are designed to offer immediate, discreet, and reliable mechanisms to safeguard the victim during real-time abuse or escalation. The Quick Exit button allows users to instantly shift the screen to a benign dummy UI, preventing abusers from identifying the app's real purpose. One-tap tools enable rapid deployment of police calls, emergency messages, stealth recording, and GPS tracking. A key protection feature is the background monitoring system, which listens for distress signals or pre-configured trigger words and activates SOS actions automatically. This level of automation ensures safety even when manual interaction is impossible, such as when the victim is being physically restrained or closely monitored.

Provision

Provision-oriented features focus on connecting victims with trusted support systems. These include calling or messaging pre-saved trusted contacts, reaching local NGOs and verified legal volunteers, and chatting anonymously with professionals. A significant addition in this prototype is the App Community, a moderated space where users can share non-identifying stories, tips, or encouragements under anonymized IDs. These interactions provide emotional reinforcement and counter the isolation often experienced by victims. Unlike unregulated messaging systems, the provision tools in this app are deliberately structured to avoid potential misuse while ensuring that users always have access to help, guidance, and social validation.

Prevention

Preventative features in the app focus on helping users avoid repeat harm by tracking and anticipating patterns of abuse. The Dynamic Calendar allows for detailed logging of abusive incidents, including date, time, descriptions, and media evidence. These logs are used by an integrated machine learning model to estimate the likelihood of future incidents and generate risk-level predictions (high, medium, low). These predictions are color-coded and accompanied by suggested actions (e.g., “avoid isolation,” “enable SOS”). Additionally, the app can monitor ambient sound for keywords associated with danger, allowing preemptive action even before the user manually reports or activates features. By reinforcing routine tracking and early warning, prevention-oriented features help victims regain control over their safety trajectory.

Table 13.1: Mapping App Functionalities to the Four P’s Framework

Category	Functionalities
Preparation	App tutorial SOS consent and preference setup Language selection Legal assistance resources (GD guide, rights, law FAQ) Mental health and abuse FAQs Self-care tools (breathing, affirmations, journaling, distractions) Personalized dummy UI and password setup Quiz to identify type of abuse Community browsing for peer insight
Protection	Quick Exit button Stealth audio/video recorders Live location tracking One-tap emergency tools (e.g., call 911) SOS configuration and trigger Trigger word detection Background voice monitoring
Provision	Contact trusted individuals (calls/messages) NGO hotline and local support center access Anonymous professional chat Legal volunteer assistance App community posting and viewing (moderated)
Prevention	Dynamic calendar with incident logging ML-based risk prediction Visual risk level indicators (red/yellow/green) Photo/video/audio logging Personalized trigger word input

This categorization ensures that all app functionalities serve a defined purpose within the user’s journey- preparing them, protecting them, supporting them, and helping prevent future harm.

13.19 Discussion

The final prototype represents the culmination of a deeply participatory, trauma-informed design process rooted in the lived realities of domestic abuse victims in Bangladesh. Unlike traditional app design pipelines, which often emphasize feature completeness or visual polish, this prototype centers the cognitive, emotional, and situational constraints of victims operating under high-risk conditions.

Every layer of the interface - from the disguised login to the minimalistic layout and personalized emergency configurations, was shaped by iterative feedback loops involving survivors, legal professionals, and grassroots service providers. This approach ensured the development of a product that is not only technically functional, but also contextually meaningful and practically usable in life-threatening scenarios.

A central achievement of this design is the balance between visibility and discretion. The dual-entry login system, Quick Exit button, and configurable dummy interface offer immediate protection while maintaining plausible deniability. These features acknowledge that for many users, secrecy is not optional but essential for survival.

The prototype's commitment to minimizing cognitive load is another defining strength. Informed by NASA TLX evaluations, all visual, structural, and interactive elements were carefully designed to reduce mental effort. This ensures that users can complete safety-critical tasks quickly and intuitively, without being overwhelmed. Additionally, the app's responsive feedback messages reinforce a sense of control and provide reassurance after each user action.

Another critical advancement is the dynamic configurability offered through the Personalized Settings module. Victims can manage dummy UI variants, trigger words, emergency contacts, and SOS behavior. This flexibility allows the app to evolve alongside the user's changing needs, ultimately increasing long-term effectiveness and user autonomy.

The prototype also introduces predictive and preventive capabilities through the Dynamic Calendar, which uses machine learning to anticipate risk based on recent abuse logs. This feature empowers victims to proactively protect themselves, transforming the app from a reactive tool into a forward-looking support system.

Finally, the emotional support and legal empowerment tools embedded in the Support and Law Assistance modules highlight the app's holistic design philosophy. Victims are not only offered immediate safety features, but also access to healing, information, and community resources that contribute to long-term resilience.

In conclusion, this prototype demonstrates how careful, research-driven, and empathetic design can transform a mobile application into a critical safety mechanism. Future development will focus on integrating secure backend infrastructure and machine learning systems, which are detailed in Chapter 14.1 and Chapter 14.2, to fully realize the app's potential.

Chapter 14

Machine Learning Integration

14.1 Distress and Trigger Word Detection

14.1.1 Overview

This section conceptualizes the integration of a machine learning (ML) system into the app for distress detection and trigger word recognition. The system is designed to activate background SOS features when the user is in a high-risk situation but unable to trigger an alert manually. The ML model enables passive emotional monitoring through voice input and identifies acute distress using emotion classification.

14.1.2 Dataset Description

The proposed model is based on the **BASER Dataset** (Bangla Adolescent Speech Emotion Recognition) [60], available on Kaggle **baser_dataset**. The dataset includes labeled audio samples of Bangla speech annotated for five core emotions:

- Neutral
- Happy
- Angry
- Fearful
- Sad

This dataset is particularly suited for our context as it includes adolescent voices in Bangla, making it culturally and demographically appropriate for domestic abuse scenarios in Bangladesh.

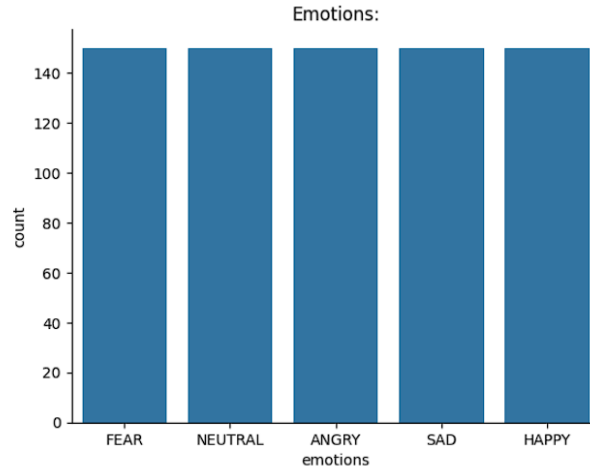


Figure 14.1: BASER Dataset Overview [60]

14.1.3 Distress Classification Logic

While the original model [61] classifies five discrete emotions, we extend it to derive a distress label using the following custom logic:

```
if fear > 0.7 and sadness > 0.7 and anger > 0.7, then distress
= True
```

This three-emotion thresholding allows better accuracy in distinguishing regular emotional states from actual high-risk distress events, which are critical for triggering silent emergency protocols.

14.1.4 Model Implementation Plan

The model can be deployed in two possible ways:

- Client-side: Using a TensorFlow Lite model for offline processing.
- Server-side: Via FastAPI and REST endpoints that handle preprocessed 5s audio bursts.

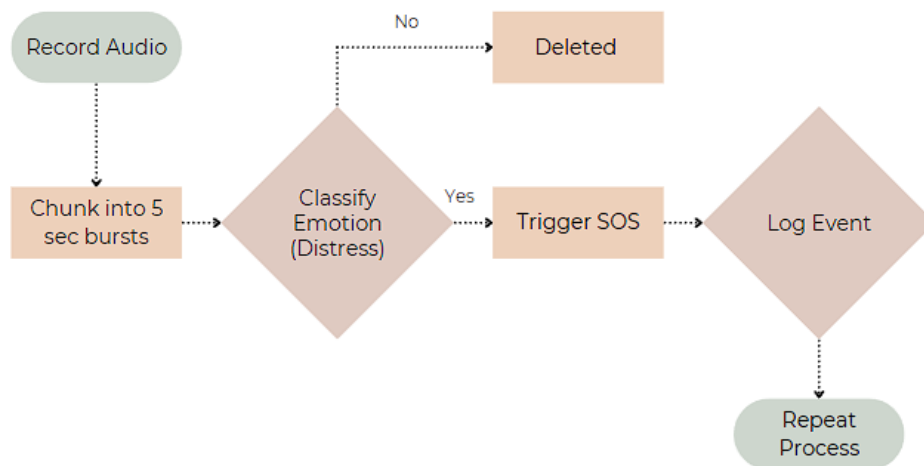


Figure 14.2: Flowchart: Distress Detection Model Integration

Key Components

- Audio Recording: Background recorder with 5-second bursts (optional toggled from settings).
- Chunking & Privacy: Records are deleted automatically if no distress is detected.
- Emotion Model: BASER-based classifier extended with threshold logic.
- Trigger Logic: If `distress = true` → trigger SOS & log the timestamp.

Code Modifications

The original Kaggle notebook outputs emotion probabilities as a dictionary:

```
output = {"neutral": 0.1, "happy": 0.05, "angry": 0.82, "sad": 0.91, "fear": 0.79}
```

The following function (see figure 14.3) extends the logic by using threshold-based detection of distress from the predicted emotion probabilities:

```
def is_distress(output):
    return output['fear'] > 0.7 and output['sad'] > 0.7 and output['angry'] > 0.7
```

Figure 14.3: Code snippet: Distress detection logic

14.1.5 Trigger Word Detection (Hotwords)

In parallel to emotional distress detection, we propose using a lightweight hotword engine such as:

- Porcupine by Picovoice
- Vosk Offline ASR Engine

Custom trigger words (e.g., "help", "no", "stop", "bachao") can be configured in Personalized Settings by the user. When detected, they trigger the same emergency action pipeline as the emotional distress classifier.

Trigger Logic

```
if detected_word in trigger_words_list:
    trigger_sos()
    log_event("Trigger word activated")
```

Figure 14.4: Code snippet: Trigger word detection logic

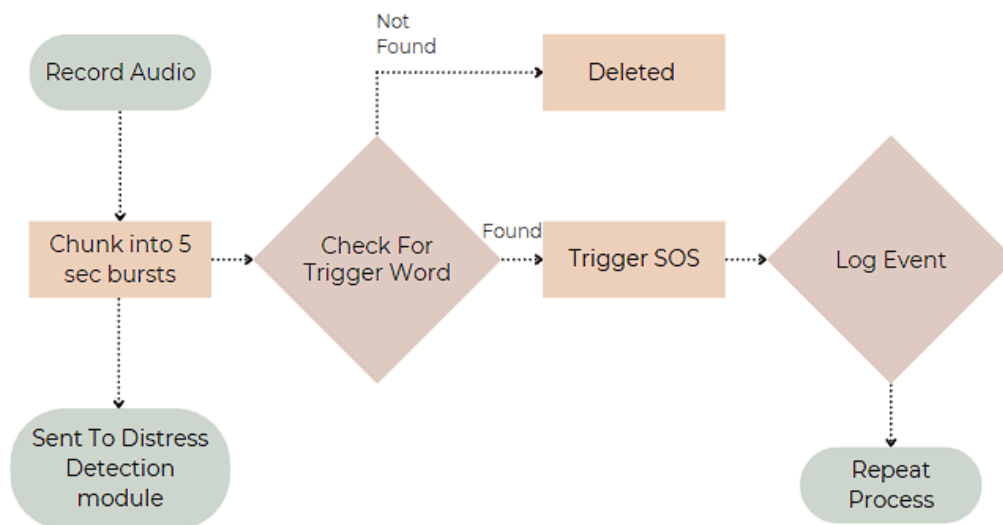


Figure 14.5: Flowchart: Trigger Word Detection Model Integration

14.1.6 User Privacy and Safety

Given the sensitivity of background monitoring, we propose strict privacy-preserving measures:

- All audio recordings are ephemeral and deleted if no threat is found.
- Users can disable monitoring entirely from settings.

- Microphone access is never used without consent.
- Silent recording modes (no UI change) to prevent abuser suspicion.

14.1.7 Battery and Performance Optimization

To ensure low battery consumption:

- Audio sampling is performed every 1–2 minutes.
- Compressed 16kHz WAV files (5s bursts) are used.
- TensorFlow Lite is prioritized for on-device execution.

14.1.8 Advanced (Optional) Extension

For improved trigger speed and offline functionality:

- Use quantized CNN-based TF Lite model on-device.
- Include fallback hotword-only mode if emotion detection fails.

14.2 Conceptual Framework for Risk Prediction Model

14.2.1 Overview

This section is to predict the risk level (High / Medium / Low / Unknown) for a domestic abuse victim based on multi-modal incident data logged in the app. This prediction will guide users to take preventive measures and trigger backend safety logic (like voice monitoring, stealth mode, or recommended actions).

14.2.2 Input Modalities (Collected from the App)

Table 14.1: Input Modalities Collected from the App

Data Type	Description
Timestamp	Time and date of incident (e.g., 3 AM on a Saturday)
Incident Description Text	Free-form text input by user (natural language)
Type of Incident	Selected label: Physical / Verbal / Sexual / Psychological / Financial
Presence of Media	Boolean flag: image / video / audio uploaded
Frequency & Escalation	Count of incidents per week / detection of recent spikes
Physiological Tags	Optional: heart rate, reported sleep hours, if wearable data is connected
Voice-based Fear Level	Average distress score from voice ML model (if enabled)

14.2.3 Preprocessing

Text Cleaning and Vectorization

- Use spaCy or NLTK for tokenization, lemmatization.
- Use TF-IDF or embeddings (BERT if feasible) on Incident Description.

Time Normalization

Convert timestamp into features like “hour of day,” “weekend/weekday,” “late night” etc.

Binary Encoding

For presence of media, one-hot encode types of abuse.

Feature Scaling

Normalize numerical values (heart rate, fear scores, frequency) for model input.

14.2.4 Model Architecture

Base Model

The primary model selected for risk classification is a Random Forest Classifier, due to its robustness, interpretability, and ability to handle mixed feature types (categorical and numerical).

Alternative Options

- Logistic Regression: Suitable when model interpretability is prioritized.
- Gradient Boosted Trees (e.g., XGBoost): Offers better performance on structured data.

Target Variable

- Risk Level (categorical): {Low, Medium, High, Unknown}
- Labels are either assigned manually or generated through a rule-based proxy method during training phase.

14.2.5 Prediction Logic

The risk level is computed based on recent patterns of abuse incidents and severity. The model follows these heuristic (see table 14.2) conditions:

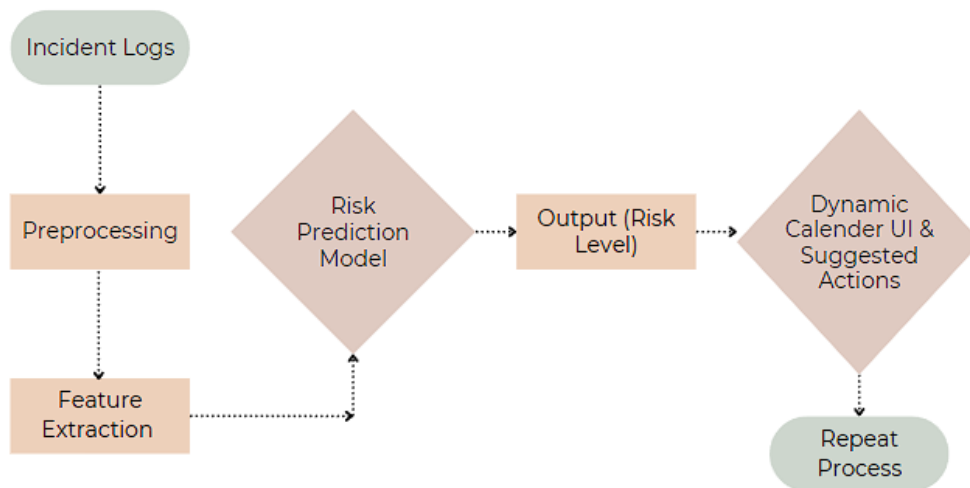


Figure 14.6: Flowchart: Risk Prediction

Table 14.2: Heuristic Rules for Risk Level Classification

Risk Level	Typical Conditions
High	≥ 3 incidents in 7 days, abusive language detected, and activity during night hours
Medium	1–2 incidents per week with moderate severity
Low	Less than one recent incidents or only low-severity ones
Unknown	No logged incidents

Handling Missing Data:

- If no data is available, the model defaults to Low Risk.
- The app will prompt the user to continue logging incidents for better personalization.

14.2.6 Output and UI Integration

The output from the risk prediction model is integrated into the Dynamic Calendar UI using intuitive color-coded signals:

- Red: High Risk
- Yellow: Medium Risk
- Green: Low Risk
- Grey: Risk Unknown

Suggested Actions:

- “Avoid isolation”
- “Enable stealth SOS”
- “Talk to support center”
- “No logged incidents, please log incident for risk prediction”

14.2.7 Justification for Conceptual Framework and Limitations

Conceptual Implementation Justification

Despite the unavailability of a fully labeled real-world dataset and time constraints limiting the development of a production-grade model, the proposed framework remains practically feasible. Using open-source libraries like `scikit-learn`, `spaCy`, and `FastAPI`, the outlined multimodal risk prediction system can be implemented and deployed with sufficient time and resources. With access to annotated data or simulated incident logs using expert-crafted rules, model training can be approximated for pilot testing. Moreover, this research lays the conceptual groundwork for future implementation in humanitarian, high-risk contexts where interpretability, privacy, and precision are non-negotiable.

Challenges in Handling Missing User Data

One of the critical ethical challenges arises when a new user installs the app but has not logged any abuse incidents. In such cases, a naive approach may default the predicted risk level to “Low.” However, this assumption is highly dangerous, it could falsely reassure a victim in an actual crisis and result in life-threatening inaction.

To mitigate this:

- **Default Warning Protocol:** If no data is available (e.g., first use or lack of recent input), the app will display a “*Risk Unknown*” status rather than assigning Low Risk. Users will be informed that predictions cannot be made without data.
- **Prompted Logging:** The system will regularly prompt the user to log any relevant incidents, even minimal ones, to help calibrate personalized risk prediction.
- **Caution Alerts:** Until meaningful data is logged, the app will recommend users behave as if they are in a Medium-to-High Risk scenario as a safety default.

Impact of Prediction Accuracy on Safety

Risk prediction accuracy directly impacts user survival. An incorrect Low Risk prediction could delay action in a critical situation, while a false High Risk could induce panic or raise suspicion from an abuser monitoring app usage. Therefore:

- The system must err on the side of caution: in ambiguous or borderline cases, Medium or High Risk will be prioritized over Low Risk.

- User-facing disclaimers will remind victims that the model is supportive, not a substitute for intuition or judgment.
- The user interface will always offer real-time emergency tools, regardless of the predicted risk level, ensuring no user is blocked from critical features.

This architecture ensures that predictive assistance enhances, rather than undermines victim autonomy, offering aid while respecting uncertainty and risk variability.

14.3 Discussion

The integration of machine learning into the safety app introduces a transformative dimension to victim-centered design, one that leverages data to act preemptively, not just reactively. Unlike conventional support tools that rely entirely on user input or manual alerts, ML systems can detect hidden signals of risk and distress, thereby enhancing survivability when the victim is unable to act. However, as this chapter has explored, the inclusion of such advanced technologies brings not only technical challenges but also profound ethical and contextual responsibilities.

From Reactive to Proactive Safety

The most significant conceptual advancement introduced in this chapter is the shift from a reactive to a proactive model of protection. Through voice-based emotional surveillance and data-driven risk modeling, the app can intervene silently during moments when a victim is incapacitated, silenced, or under observation by an abuser. This reimagines what it means for an application to be ‘supportive’ which is no longer a passive tool, but a semi-autonomous agent capable of recognizing and responding to danger.

This proactive posture is particularly relevant in domestic abuse contexts where victims often face dynamic constraints, situations can escalate rapidly, and opportunities for help-seeking may be few and brief. By embedding background audio monitoring and hotword detection that function even in silent modes, the app ensures that safety mechanisms are available not just when the user reaches out, but also when the system senses they cannot.

Designing for High-Stakes Ambiguity

Unlike most consumer ML applications, where prediction errors are often tolerable, in this domain prediction accuracy can be a matter of life and death. This chapter thus addresses the unique imperative of designing for ambiguity under high risk. The architecture is deliberately conservative, choosing to overpredict rather than underpredict danger, prioritizing false positives (which may cause inconvenience) over false negatives (which may cause harm).

Moreover, the chapter introduces a novel ‘Risk Unknown’ category for users with insufficient data, a powerful deviation from conventional ML systems that default to the safest-looking class. This acknowledges the limitations of data availability in humanitarian contexts and emphasizes ethical humility in machine prediction.

Rather than feigning certainty, the system communicates uncertainty transparently and adaptively.

Human-in-the-Loop and Semi-Automated Autonomy

Another critical contribution of this design is the balance struck between automated intelligence and human intuition. The model supports, but does not override user agency. Victims are continually reminded that ML outputs are advisory, not definitive. Even if the system predicts “Low Risk,” the user always retains access to emergency tools. Conversely, a “High Risk” prediction does not lock them into any path, as they can choose to ignore it, seek help, or simply record more data.

This reflects a broader HCI principle of “human-in-the-loop” safety automation, where machine learning augments but never displaces user control. Particularly, in trauma-sensitive environments, such autonomy is not only ethical but also therapeutic.

Localized Data and Cultural Adaptation

The reliance on the BASER dataset[60], one of the few emotion-labeled Bangla corpora, represents a deliberate act of localization. In a global landscape where most AI systems are trained on English-language or Western-centric datasets, this chapter’s commitment to context-aware modeling is crucial. Bangladeshi speech rhythms, emotional cadences, and social cues differ significantly from Western patterns, making the use of BASER not just ideal but necessary for emotional accuracy.

Similarly, trigger words like “bachao” (help) or culturally specific emotional expressions offer a strong case for customizing both the linguistic models and the user-facing logic of ML in safety tools. This sets a precedent for AI ethnography, where algorithms are tuned to local norms and distress expressions.

Hybrid Sensing Architecture for Privacy-Preserving Safety

One of the critical architectural features described in this chapter is the hybrid sensing architecture, a dual-layered system of passive voice surveillance and active hotword detection. While either system could function independently, their tandem deployment maximizes both sensitivity and specificity. The hybrid approach also introduces graceful degradation: if emotion recognition fails due to ambient noise or processing limits, the hotword engine remains a fallback safety net.

Crucially, this chapter also anticipates and addresses surveillance backlash by baking in privacy features: ephemeral recordings, toggle-based consent, and default-disabled monitoring. These safeguards protect not just user data, but also trust, which is foundational in any intervention involving domestic abuse survivors.

Anticipatory Design and Model Transparency

Finally, this chapter proposes a rare and insightful design philosophy: anticipatory design, wherein users are treated as future data contributors, not merely present consumers. Through reminders to log events, warnings about incomplete predictions, and visual transparency of current risk assumptions, the app educates users about the logic behind ML while encouraging deeper engagement.

This transparency is particularly important in low-trust, high-risk contexts like domestic abuse, where opaque automation can provoke anxiety or mistrust. By foregrounding explainability (e.g., showing why a risk level was assigned), the app democratizes access to intelligence, making machine learning feel less like a black box and more like a supportive companion.

In summary, the integration of ML does more than describe technical capabilities - it lays out a vision of ethical, localized, and survivor-aware machine intelligence. It charts a course for how predictive systems can be designed not just to function, but to care, offering timely, interpretable, and culturally grounded support in the most vulnerable moments of a victim's life. As the project transitions into deployment and testing, this conceptual groundwork will remain vital in ensuring the system serves not just safety, but dignity.

Chapter 15

Final Prototype Evaluation

15.1 Overview

To assess the usability, emotional safety, and cognitive load of the proposed app, a comprehensive user evaluation was conducted using the Figma prototype developed in the previous chapter. The interviewees were then asked to fill up a form as given in appendix E. This assessment involved seven participants from diverse background, and the evaluation combined both quantitative assessments, using the NASA Task Load Index (NASA-TLX)[4] and emotional trust scales, and qualitative analyses, using open-ended responses and the participants' overall feedback. The purpose was to investigate how effectively the app balances discreet safety features with user accessibility across varying levels of technological familiarity.

15.2 Participant Profile

To assess the usability and emotional impact of the app, we engaged seven participants representing a range of age groups and varying levels of technological proficiency. This diversity was intentional, ensuring that the evaluation reflects the range of real-world users who may benefit from such a discreet platform, especially in a context like Bangladesh where digital literacy can vary significantly across age and socio-economic backgrounds.

Participants' familiarity with mobile technology was used to categorize them into three groups:

- **Demographic 1 (Tech-Adaptive):** Individuals who were confident in using smartphones and could navigate the app independently.
- **Demographic 2 (Tech-Cautious):** Users who showed hesitation or mild difficulty with unfamiliar technology but could complete tasks with occasional support.
- **Demographic 3 (Tech-Struggling):** Participants who found smartphone use challenging and required consistent assistance throughout the evaluation.

The inclusion of participants from diverse age groups and digital skill levels provided critical insight into how different users interact with the system. In Human-Computer Interaction (HCI), designing for inclusivity is essential—particularly for

sensitive use cases like domestic abuse intervention. By involving users who may not be tech-savvy, this evaluation identified design elements that need simplification, clearer guidance, or alternate input methods (e.g., voice commands). Similarly, responses from tech-adaptive users helped validate core features like disguised UI, rapid access shortcuts, and chatbot-based support. Individual participant data is shown in table 15.1, while a summary of the participants by demographics is given in table 15.2.

Participant	Approx. Age	Demographic Group	Tech Usage Capability
P1	30	Demo 1 (Tech-Adaptive)	Confident with smartphones and apps
P2	35+	Demo 2 (Tech-Cautious)	Required light guidance on some tasks
P3	20	Demo 1 (Tech-Adaptive)	Quickly adapted to all app features
P4	40+	Demo 3 (Tech-Struggling)	Depended on support to navigate the interface
P5	45+	Demo 2 (Tech-Cautious)	Faced minor difficulty, improved with prompting
P6	50+	Demo 3 (Tech-Struggling)	Needed step-by-step assistance for most interactions
P7	30+	Demo 1 (Tech-Adaptive)	Handled all interactions without assistance

Table 15.1: Participant Demographics and Technological Familiarity

Demographic	No. of Participants	Age Range	Summary of Tech Familiarity
Demo 1	3	20–35+	High – Comfortable with smartphones and modern app features
Demo 2	2	35–45+	Medium – Cautious but generally capable with guidance
Demo 3	2	40–50+	Low – Significant difficulty using mobile interfaces

Table 15.2: Summary of Participants by Demographic Group

15.3 Qualitative Evaluation

Participant Feedback Discussion

The feedback collected from participants gave a polished insight in to how the app is to be received by users of different technological literacy background. These responses offer a nuanced understandings of user experiences that are critical for refining the design. Through think-aloud user testing, task completion analysis, and emotional safety assessments, several patterns emerged regarding user control, confusion points, and emotional reassurance.

A. Insights from Think-Aloud User Testing

The Think Aloud Protocol is a usability evaluation method in Human-Computer Interaction (HCI) where participants are asked to verbalize their thoughts, feelings, and decision-making processes while using a system or completing tasks. Participants of this interview were asked to perform five critical tasks for this testing :

- Logging in with a dummy password to enter stealth mode.
- Triggering the silent SOS feature.
- Sending a voice message.
- Locating legal help (specifically General Diary filing options).
- Exiting the app quickly without drawing attention.

A. 1. Observations:

- Dummy Login (Stealth Mode):

Tech-adaptive participants (1, 3, 7) navigated the dummy login smoothly, often commenting that it felt natural and secure. Participant 1 stated she could "quickly access the dummy interface" without raising suspicion. However, participants from Demographics 2 and 3 hesitated during the login process, initially unsure whether their actions were correctly triggering stealth mode.

- Silent SOS Trigger:

Across all demographics, the SOS button was considered the most empowering feature. Participant 3 appreciated that the SOS function could "do all without fuss. Participants in Demographic 3 struggled to locate the hidden SOS feature during their first attempts, but once guided, they recognized its life-saving potential

- Voice Message:

Tech-adaptive users (1, 3, 7) found the voice message feature intuitive. However, tech-struggling participants were unfamiliar with this interaction method and needed additional explanation. One participant mentioned that "voice would be better" in panic situations where typing becomes difficult.

- Finding Legal Help (GD Filing):

Participants from all demographics could eventually find the GD filing option, but tech-cautious and tech-struggling users expressed hesitation when navigating the app’s deeper menus. Participant 4 noted she “needed more time to understand all the features”.

- Quick Exit:

The quick exit feature was consistently praised, especially by participants 3, 6, and 7, who saw it as a critical tool for safely disengaging from the app when necessary. Participants paused occasionally when using this feature, unsure if their exit had been successful due to the absence of overt confirmation.

B. Key Points of Friction Identified

- Hidden feature discoverability:

Participants 4 and 6 from Demographic 3 struggled with identifying hidden buttons like the SOS trigger without guidance.

- Lack of visual/tactile feedback:

Several participants expected confirmation (visual or haptic) after sending an SOS, which was intentionally subtle to maintain discretion. Participant 1 mentioned that “first-time users may feel slightly unsure” when the app does not provide immediate visual responses.

- Navigation depth:

Users from Demographics 2 and 3 sometimes paused or backtracked when tasks required moving through multiple layers of menus. Participant 2 stated that “the features are fairly easy to grasp” but initially needed repeated tries to feel confident.

15.3.1 Emotional and Safety Perceptions

To assess the level of emotional ease the users are at, the interview included a few targeted questions to identify whether the users will feel safe and protected while using the app. The user responses to emotion-centred questions are noted below:

- Q1. “Did you feel safe using this app?”

All participants responded positively. Participant 1 and Participant 5 specifically highlighted that the app’s design does not collect personal information and maintains anonymity

- Q2. “Would this app help you during an unsafe situation?”

Every participant answered "yes" with high confidence. Participant 2 and Participant 4 stated that the emergency calling and quick contact features would provide real help in real-life emergencies

- Q3. "What feature made you feel most secure?"

Participants shared that the feature which made them feel the safest was the SOS button, as it allowed them to quietly send for help without drawing attention. Some, like Participant 2 and 5, felt most secure knowing they could quickly reach trusted contacts such as family or emergency services in urgent situations. Others pointed out that the disguised or dummy interface gave them peace of mind by making the app look like a harmless tool, reducing the risk of someone discovering its true purpose. These features combined to give users a strong feeling of safety, privacy, and control.

15.3.2 Usability Pain Points and User Suggestions

From both the think-aloud protocol and written feedback, two recurring challenges were noted:

- Navigation Complexity:

Participant 4 and 6 suggested adding subtle visual hints or soft glow effects to guide them while navigating the app

- Language Barrier:

Participants 5 and 2 requested the app to be made in Bangla for better comprehension.

15.3.3 Emotional Comfort and Overall Impact

Across all demographics, participants consistently said that simply having the app on their phone gave them a sense of safety, even if they were not actively using it. Participants 5 emphasized that as a victim herself, the presence of such an app provided psychological comfort and privacy protection in her daily life. Tech-struggling participants, who initially faced more difficulty, shared that they would feel reassured using the app after further practice. This shows that while the app has some learning curve for certain users, its emotional value and safety potential remain strong throughout the user base.

15.4 Thematic Analysis of Usability Testing

15.4.1 Overview of Analysis Process

This analysis explores how people with different levels of tech experience (Demographic 1 to 3) interacted with a safety app prototype designed to support domestic abuse victims. We took an open, qualitative approach, letting the themes emerge naturally from the participants’ experiences around mental effort, emotional trust, and their thoughts on the app’s features. By looking at how people with varying tech skills responded, we reveal not only what works and what gets in the way, but also important feelings around safety, control, and trusting the app.

15.4.2 Initial Codes

These codes were drawn from participants’ real-time reactions and follow-up reflections during testing. They reflect a range of user experiences—from early uncertainty and effort to growing comfort and trust. Many users noted that features like voice activation, stealth mode, and the SOS button made them feel more in control and emotionally supported. Over time, repeated use reduced frustration and boosted confidence, especially for those less familiar with technology. Anonymity and visual clarity also played a key role in helping users feel safe without needing to share personal information. This is summarised in the table 15.3

No.	Initial Codes
1	A bit confused at first
2	Voice activation was really helpful
3	Easier to use after repeating
4	Dummy interface made feel safe
5	Frustration dropped after trying again
6	Felt mentally light for tech-savvy users
7	SOS button made feel empowered
8	More mental effort for those struggling with tech
9	Emotional safety came from anonymity
10	Didn’t ask for any changes
11	Felt the app would help in a real emergency
12	Liked the clear visuals
13	Fear and panic eased with use
14	Stealth mode made trust the app more
15	Preferred not to share personal information

Table 15.3: Initial Codes from User Feedback

15.4.3 Secondary Codes

The secondary codes summarize key patterns that emerged from participant feedback. These codes highlight how users gradually became more comfortable with the

app, felt empowered by essential features, and valued the stealth design for added safety. The feedback also revealed differences in tech confidence across user groups, with some needing more support than others. Simplicity and emotional reassurance were repeatedly emphasized, showing that trust in the app increased with continued use and that a straightforward design was preferred over complexity. This is summarised in the table 15.4.

No.	Secondary Codes
1	Getting familiar with the app over time
2	Feeling empowered by key features
3	Using stealth as a way to feel safe
4	Gap in tech confidence between users
5	Feeling emotionally reassured by design
6	Trust grows with repeated use
7	Keeping it simple beats complexity

Table 15.4: Secondary Codes from User Feedback

15.4.4 Combined and Clustered Codes

The combined and clustered codes bring together recurring ideas from user feedback into broader themes. These codes reflect key user experiences, such as differences in learning speed, the growth of emotional trust when users feel in control, and the consistent reliability of SOS and emergency features. The importance of stealth in reducing fear was also emphasized, and the absence of major change requests suggests that most users found the app acceptable and well-suited to their needs as it is. This is portrayed in the table 15.5.

No.	Combined & Clustered Codes
1	User learning differences
2	Emotional trust grows when users feel in control
3	SOS and emergency tools are reliable and easy to use
4	Stealth features reduce fear directly
5	Lack of change requests shows users accept the app as it is

Table 15.5: Combined and Clustered Codes from Thematic Analysis

15.4.5 Themes

- Learning Builds Confidence

“It got easier with each use,” said Participant 1 (Demographic 1). People from all tech backgrounds, even those less confident with smartphones, improved after a few tries. Practice and a guided introduction helped lower the mental load significantly.

- Emergency Features Offer a Sense of Control

“The SOS button gives me peace of mind,” shared Participant 4 (Demographic 3). The simple, one-tap emergency tools—like SOS, voice commands, and quick exit—made users feel most in control, especially when thinking about crisis situations.

- Stealth Equals Safety

“I like that it looks like something else,” said Participant 5 (Demographic 2). The app’s anonymous design, disguised interface, and not needing to provide personal info were strongly connected to feelings of emotional safety and trust. The less noticeable the app, the safer users felt.

- Complexity is a Barrier, Simplicity Builds Trust

“I don’t want to panic figuring it out,” explained Participant 6 (Demographic 3). Users who struggled with tech really valued simplicity and clear visuals. Apps that required fewer steps or less memory were preferred—especially by older users or those less confident with technology.

15.4.6 Findings

Overall, the app received positive feedback across the board. While tech-savvy users found it easy right away, others needed two to three guided tries before feeling comfortable. Frustration levels stayed low throughout, and most participants were satisfied with how the app worked by the end. Most importantly, the emergency features, stealth mode, and privacy-focused design came out as key reasons people trusted the app emotionally. Users believed the app could genuinely help them in dangerous moments—not because it was flashy or complicated, but because it quietly offered safety and control.

15.5 Quantitative Evaluation

15.5.1 NASA-TLX Based Assessment

Participants rated their cognitive and emotional load across six NASA TLX dimensions. The NASA Task Load Index (NASA-TLX)[4] was used to measure the cognitive and physical workload experienced by participants while using the app. After completing the assigned tasks, participants rated six key areas: mental demand, physical demand, time pressure, performance satisfaction, effort required, and frustration level. These ratings, collected on a five-point Likert scale, helped assess how challenging or smooth the app felt to users from different technological backgrounds.

Key observations from the assessment revealed that the participants from Demographic 1 consistently found the app simple to use, reporting that it required minimal mental and physical effort, which shows that the app is well-suited for users

who are comfortable with technology. On the other hand, those in Demographic 3 faced more difficulty, often feeling frustrated and needing extra effort, especially when trying to access hidden or less obvious features. Despite these differences, most users across all groups felt they were not rushed while using the app, suggesting that the time provided to complete each task was generally sufficient and did not create additional pressure. The average scores from all seven participants are summarized in the table 15.6.

Metric	Average Score (out of 5)
Mental Demand	2.71
Physical Demand	2.57
Temporal Demand	2.00
Performance Satisfaction	4.71
Effort Required	1.71
Frustration Level	1.43

Table 15.6: NASA-TLX Based Assessment Results

15.5.2 Emotional Safety and Trust Evaluation

This assessment also noted the degree of emotional safety and trust the participant’s felt while using the app. To understand the emotional impact of the app, participants were asked specific safety-related questions. They rated how safe they felt using the app, whether they believed it would help in a real emergency, and if they experienced confusion or panic at any point. These responses, gathered on a five-point scale, provided valuable insights into the app’s ability to offer emotional comfort and build trust—an essential factor when designing tools for vulnerable users. Key observations from this assessment revealed that most participants from Demographics 1 and 2 shared that they felt safe and emotionally comfortable while using the app, strongly believing it could support them in real-life emergencies. Their feedback showed a high level of trust in the app’s ability to offer quick and discreet help when needed. In contrast, some users from Demographic 3 faced occasional confusion, especially when moving between the hidden interface and the emergency functions, which caused brief moments of hesitation. Still, the overall response across all participants was very positive, suggesting that the app’s quiet, protective design successfully builds a reliable sense of safety and confidence. This evaluation is depicted in the table 15.7 showcasing the average score for the ratings each participant gave for emotional safety questions.

Statement	Average Score (1–5)
Felt emotionally safe using the app	4.86
Believed the app would help in a real emergency	5.00
Felt confused or panicked at any point	2.14

Table 15.7: Emotional Safety and Trust Evaluation

15.6 Discussion

The evaluation of the proposed app provided important insights into how users with different levels of technological familiarity engaged with its features. Tech-comfortable participants found the app easy to use, reporting low mental effort and smooth navigation, while users with lower digital confidence faced more challenges, especially when interacting with hidden features like the silent SOS trigger or switching between disguised and emergency screens. Despite these differences, most users across all groups felt they had enough time to complete tasks and expressed a strong sense of emotional safety while using the app. The think-aloud sessions revealed that some participants paused or hesitated when they were unsure if they had successfully activated emergency functions, showing that adding subtle feedback like soft vibrations or visual cues could help. Features such as the SOS button, emergency contacts, quick exit options, and the stealth interface made users feel most in control, with many stating that simply having the app installed gave them quiet reassurance. However, some participants, especially from less tech-confident groups, suggested simplifying navigation and introducing voice-based triggers for faster access during emergencies. These findings confirm that while the app’s core design is effective, improvements like clearer onboarding, easier feature discovery, and alternative input methods would make it more accessible. Overall, the app was seen as a valuable safety tool, providing not just practical support but also emotional comfort for users navigating unsafe situations.

Ultimately, this research lays a strong conceptual and design foundation for a contextually rooted safety application. With future technical execution and collaboration, the app can evolve into a life-saving tool for thousands of vulnerable users in Bangladesh and beyond.

Chapter 16

Conclusion

16.1 Limitations

While this research aimed to develop a comprehensive, discreet, and culturally sensitive safety application for domestic abuse victims, several limitations remain - both at the design and implementation levels.

- **Figma-Only Prototype:** The final prototype exists solely within Figma, limiting the ability to assess real-world usability, performance under pressure, hardware access (e.g., mic, camera), or latency issues. As a result, many practical challenges that could arise during real-world deployment (e.g., battery optimization, OS-level restrictions, sensor permission failures) remain untested.
- **Unimplemented Machine Learning Models:** Although two ML extensions - distress detection via voice and dynamic risk prediction - were conceptually developed, they were not integrated or tested with live data. Their performance, edge-case accuracy, and false positives remain unvalidated.
- **Lack of Longitudinal Testing:** Due to time and ethical constraints, the application could not be evaluated in real-time high-risk scenarios across an extended period. Therefore, longitudinal impacts such as user fatigue, habit formation, or stealth breakdown remain unknown.
- **No Back-End or Secure Storage Layer:** The prototype did not include backend functionalities such as encrypted cloud storage, authentication layers, or offline-first operation. Thus, questions of data persistence, synchronization, and breach protection were not explored.
- **Community Moderation Workflow Undefined:** Although a community posting feature was proposed, its moderation pipeline - especially the admin's approval logic, abuse filtering, and fail-safe measures, has not yet been implemented.
- **Limited Personalization and Accessibility Testing:** The design was tested with a small group of victims and professionals. Broader testing with users of varying literacy levels, disabilities, or older devices has not yet been conducted.

- **Gender-Specific Focus:** This research focused exclusively on female victims of domestic abuse due to both statistical prevalence and practical challenges in reaching male survivors. Existing literature and national statistics consistently indicate that women are significantly more affected by domestic and interpersonal violence. Additionally, strong societal stigma surrounding male victimhood, particularly in patriarchal societies like Bangladesh, makes it extremely difficult for male victims to self-identify or participate in research. Despite multiple outreach attempts, no male participants could be included in the user studies. As a result, while the application is theoretically usable by individuals of all genders, its design, language, and features were developed specifically based on the needs, risks, and feedback of female victims. This gender specificity limits the generalizability of the findings and may overlook unique needs of male or gender-diverse survivors.

16.2 Future Work

To address these limitations and expand the app’s capabilities, the following avenues for future work are proposed:

- **Full App Development and Deployment:** A critical next step is transforming the Figma design into a functional Android/iOS application using Flutter or React Native. This includes building a secure back-end system for encrypted data storage, user authentication, and real-time emergency dispatching.
- **ML Model Integration and Evaluation:**
 - Distress Detection: Future iterations can integrate a novel or fine-tuned model built using Bangla emotion datasets like BASER, optimized for background voice classification. The model should be optimized for edge devices (e.g., TensorFlow Lite), support chunked audio processing, and trigger alerts only when emotion thresholds are crossed.
 - Risk Prediction Model: A multi-modal risk model using text, time-series, and metadata (e.g., time of day, event frequency, severity) could be trained using synthetic data or partnered field logs. Techniques like Random Forest, logistic regression, or lightweight neural networks can be considered. Explainability and safety-critical precision should be prioritized.
- **Advanced Dummy Interface Logic:** A promising improvement is to allow dynamic switching between dummy UIs - users should be able to change the disguise into prebuilt modes (e.g., prayer tracker, weather app, calendar, shopping list) from the Personalized Settings module. This improves long-term stealth by reducing pattern recognition from abusers. A scheduling system can be implemented for periodic dummy UI changes.
- **Community Module Implementation:** A moderated community space should be deployed using a lightweight CMS that allows victims to share anonymized insights using user IDs only. All posts should pass through admin approval to prevent doxxing, identifiable media, or harmful content.

- **Broader Testing and Localization:** Expanding the app to other South Asian regions or linguistic communities can increase impact. Additionally, partnerships with NGOs and legal institutions can help validate legal guidance and provide localized support resources.
- **Usability Under Distress:** Future user testing should focus on high-fidelity evaluation during simulated distress scenarios to assess how users navigate the UI under fear, panic, or pressure. Features like confirmation messages, color consistency, and voice triggers should be evaluated for real-world effectiveness.
- **Expanding Support for Male and Gender-Diverse Victims:** While the current study was limited to female victims due to statistical prevalence and the difficulty of locating male participants (see 16.1), future research should also focus on understanding the experiences and needs of male and gender-diverse survivors of domestic abuse. The discreet and anonymous nature of the app makes it a promising medium for those who may be reluctant to disclose their abuse publicly due to stigma or fear of judgment. In future iterations, specific design considerations - such as inclusive language, broader persona testing, and validation with male survivors, should be incorporated to ensure the platform is equally safe, relatable, and effective for users of all gender identities.

16.3 Conclusive Discussion

This research set out not merely to design an application, but to reimagine how technology can serve as a silent ally in situations where visibility puts the user at risk. At its core, this work recognizes a difficult reality: for many domestic abuse victims, help must not only be available, but discreet, intuitive, and immediate. The high-fidelity prototype developed through this study reflects a thoughtful integration of empathy, design thinking, machine learning, and survivor feedback.

One of the most important themes that emerged throughout this project is the need for safety technology to be rooted in the lived experiences of its users. The discreet design elements, such as personalized dummy interfaces, a centrally placed Quick Exit button, and background distress detection, are not technical luxuries. They are direct responses to real needs shared by survivors, shaped through interviews and guided walkthroughs. These features demonstrate that listening to users leads to more life-saving design than any assumption-driven approach could.

Cultural relevance was also a central priority. Every aspect of the app, from its use of Bangla language and voice data to the inclusion of local legal support tools, was carefully adapted for the Bangladeshi context. This research shows that safety solutions must do more than function technically; they must function culturally, linguistically, and socially. The success of this prototype lies not only in its features, but in how well those features reflect the lives and constraints of the people it is built for.

From an HCI perspective, the project contributes a clear and repeatable framework for trauma-aware design. By organizing features under the Four P's model (Preparation, Protection, Provision, and Prevention), the application creates an intuitive structure that supports users across different stages of crisis and recovery. This model offers a scalable blueprint for developers working on similarly sensitive applications, whether in the areas of domestic violence, mental health, or refugee protection.

A major insight from the design process was the central role of trust. In situations of abuse, victims are often cautious not only of their abuser but also of unfamiliar or untested technology. For this reason, every decision in the design had to reinforce the user's sense of safety and control. Features were evaluated not only for their functionality, but also for their predictability, subtlety, and ease of dismissal if needed.

While this research explored advanced tools such as emotion-based distress detection and multi-modal risk prediction, the aim was never to overwhelm users. These systems were developed to operate in the background, offering support without demanding interaction. This prioritizes calm, confidence, and cognitive relief during moments of high stress.

Most importantly, this work highlights how good design can restore a sense of agency. In environments where victims are routinely stripped of control, even the smallest interaction can become a turning point. A disguised app that listens quietly, protects silently, and responds only when asked can be the difference between danger and safety. It is not the visibility of technology that saves lives, but its reliability and respect for the user's autonomy.

This project represents the beginning of a larger effort. It provides a strong foundation for real-world deployment, but also opens the door for interdisciplinary partnerships, long-term evaluation, and continued user-led development. The ultimate goal remains clear: to create technology that supports without exposing, empowers without overwhelming, and listens even when the user cannot speak. In doing so, this platform becomes not only a tool, but a quiet force of hope and resilience for those who need it most.

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Appendix A

Focus Group Interview Questions for Professionals

1. Can you share your current role and how long you've been working with domestic abuse victims?
2. What types of cases do you typically handle (e.g., physical, emotional, financial abuse)? Do you mostly work with victims from urban or rural areas?
3. What strategies or resources have you found most effective in helping victims?
4. Based on your observations, what are the most common challenges victims face when seeking help?
5. How do victims typically try to ensure their privacy or safety while reaching out for support?
6. Are there any barriers specific to certain demographics (e.g., rural women, young victims, or those in financially dependent relationships)?
7. Do victims use smartphones? If they do, what percentage of them use it?
8. Have you noticed victims using digital tools (e.g., apps, social media) to seek help? If yes, which tools, and how effective were they?
9. What concerns do you think victims have about using technology for support?
10. How can we ensure the app is accessible to victims in low-resource settings?
11. How can support systems avoid overwhelming victims while still providing effective help?
12. What safety precautions are critical when offering support to victims?
13. Are you aware of any existing apps or platforms designed for domestic abuse victims? What features work well, and what could be improved?
14. How comfortable are victims with using technology like apps, messaging services, or websites for help?

15. What features should a domestic abuse prevention app include to be most effective?
16. How can we design the app to encourage victims to use it without fear or hesitation?
17. What measures should we prioritize to protect victims' privacy and prevent unintended discovery?
18. What kind of long-term support is typically needed by victims?
19. Should the app integrate with existing hotlines, shelters, or legal aid services? If yes, how?

Appendix B

Feature Assessment for Victim Support Mobile Applications by Professionals

B.1 Participant Information

1. Your district (of SELP):
2. Your profession:
3. Years of experience working with victims:
 - 1-3 years
 - 4-7 years
 - 8+ years

B.2 Feature Evaluation

B.2.1 Real-Time Location Sharing

Victims can share their real-time location with trusted contacts or responders. This feature often relies on GPS and network availability and may include continuous tracking until manually turned off.

4. How easy is it for victims to use this feature under stress? (1 = Very Difficult, 5 = Very Easy)
5. How accessible is this feature for victims in low-signal areas? (1 = Very Inaccessible, 5 = Very Accessible)
6. What improvements would you suggest to make this feature more effective?
(*Optional*)

B.2.2 Location Sharing & Tracking with Live Recording

Victims can record live video/audio during emergencies for real-time evidence.

7. How effective is this feature in aiding quick response during emergencies? (1–5)
8. How usable is this feature for victims in high-stress situations? (1–5)
9. Suggestions for improvement:

B.2.3 Panic Trigger (SOS Button)

Victims can activate emergency alerts by SOS button.

10. How reliable is the trigger in high-stress scenarios? (1–5)
11. Suggestions for improvement:

B.2.4 Emergency Alerts (Pre-generated Text Prompts)

Pre-generated emergency messages can be automatically sent to contacts.

12. How useful is this feature in tense situations? (1–5)
13. Is it accessible for victims with minimal tech literacy? (1–5)
14. Suggestions for improvement:

B.2.5 Evidence Collection (Secure Multimedia Storage)

Victims can securely store photos, videos, and recordings with metadata for legal use.

15. How accessible is this feature for storing evidence securely? (1–5)
16. Does it adequately maintain privacy and confidentiality? (1–5)
17. Suggestions for improvement:

B.2.6 Community Support & Resources

Provides directories for local helplines, shelters, and counseling services.

18. Are the directories easy to navigate and comprehensive? (1–5)
19. Suggestions for improvement:

B.2.7 Specialized Tools (Bluetooth Trigger)

Allows victims to send discrete alerts using a Bluetooth device without unlocking the phone.

20. How effective is this feature for quick and discreet safety alerts? (1–5)
21. Does reliance on Bluetooth limit usability? (1–5)
22. Suggestions for improvement:

B.3 General Feedback

23. Any other features you would suggest?

Appendix C

User Preference Survey for Domestic Abuse Support App

C.1 Background Information (For All Respondents)

1. What is your age?
2. What is your living situation? (Alone, With partner, With family, Shared accommodation)
3. Is your area urban or rural?
4. What is your highest education level?
5. Are you currently employed? (Full-time, Part-time, Freelance, Unemployed)
6. Do you own a smartphone? (Android, iOS)
7. How comfortable are you with using technology such as mobile apps, websites, or social media?
8. How often do you use your smartphone for daily activities like communication, shopping, or entertainment?

C.2 Section for Victims

C.2.1 Relationship and Abuse History

1. How long were you in the abusive relationship?
2. What kind of relationship was it? (Spouse, Partner, Family Member, Other)
3. What type(s) of abuse did you experience? (Mental, Physical, Financial, Other)
4. When did the abuse begin, and how long did it last?
5. Did you seek help from authorities? If yes, was it helpful? If no, what prevented you?
6. Would you prefer to call hotlines directly or use an emergency app? Why?

C.2.2 App Feature Preferences for Victims

Please rate each feature on:

- Comfort of Use (1-5)
- Usefulness in Ensuring Safety (1-5)

Discreet Interface

- Disguised apps (appears like a grocery app, calendar, etc.)
- Camouflage mode (blends into phone background)
- Dynamic appearance changes to prevent detection

Emergency Features

- Quick exit button to close app and open a safe app
- Silent alarm to alert emergency contacts discreetly
- Panic trigger (e.g., phone shake)

Communication Tools

- Stealth texting (hidden messages under normal text)
- Voice-activated emergency alerts
- Real-time location sharing with trusted contacts

Evidence Collection

- Stealth audio/video recording with automatic encryption
- Secure storage of multimedia evidence with metadata

Support and Resources

- Anonymous connection with counselors, doctors, or support groups
- Access to NGO services (shelters, legal aid)
- Educational resources about domestic abuse, rights, and safety planning
- Weekly mental health check-ins
- Community directories for local shelters and helplines

Specialized Features

- Bluetooth trigger for quick emergency activation
- Incognito mode (hides from recent apps)
- Password protection for sensitive features
- Offline functionality

Preferences

- Which disguised app would you prefer to keep? (Grocery, Weather, Period tracker, Games, Religious app, Other)

Open Feedback

- Are there any additional features you would like to suggest?

C.3 Section for Survivors

C.3.1 Reflection on Past Experiences

1. What support features do you think would have helped you the most during your abuse experience?
2. What type of app features do you think are critical for ensuring victim safety now?
3. Which app features would you prioritize for victims in high-risk situations?

C.3.2 Survivors' App Feature Preferences

Please rate each feature based on *Perceived Importance* for victims (1-5 scale):

- Discreet interface
- Emergency escape tools
- Real-time communication and evidence collection
- Access to immediate support (safe zones, emergency contacts)
- Mental health resources and weekly check-ins
- Educational tools and safety planning

C.3.3 Open Feedback

- What improvements would make these features more effective for current victims?
- Are there any features you would add, remove, or simplify?
- How can the app better support long-term recovery and empowerment?

C.4 Section for Advocates and Professionals

C.4.1 Professional Background

1. What is your profession?
2. How many years of experience do you have working with victims of domestic violence?

C.4.2 App Feature Evaluation

Please rate each feature based on *Relevance and Practicality for Victims (1-5 scale)*:

- Disguised apps and stealth modes
- Quick exit and silent SOS features
- Stealth texting and voice-activated alerts
- Real-time location sharing
- Stealth evidence collection (audio/video)
- Anonymous support networks and NGO partnerships
- Emergency contact lists and safe zone locators
- Mental health resources and weekly check-ins

C.4.3 Professional Feedback

- Which features would you recommend prioritizing for maximum safety?
- Are there any features that seem difficult to use for victims under stress or with low tech literacy?
- Do you foresee any privacy or security risks with these features?
- What suggestions do you have to improve the app's usability, discretion, or overall safety?

Appendix D

Semi-Structured Interview Questionnaire for Victims

D.1 Demographics and Background Information

1. What is your current age?
2. Do you currently live alone, with a partner, family, or in a shared household?
3. Would you describe your living area as urban or rural?
4. What is the highest level of education you have completed?
5. Are you currently employed?
 - If yes, what is your employment status (e.g., full-time, part-time, freelance)?
 - What type of job do you do?

D.2 Relationship and Abuse History

6. How long were you in the abusive relationship?
7. What type of relationship was it (e.g., spouse, partner, family member)?
8. What type(s) of abuse did you experience (e.g., emotional, physical, financial)?
9. At what point in the relationship did the abuse begin? How long did it continue?
10. Did you reach out to any authorities (e.g., police, legal aid)?
 - If yes, were they helpful? How so?
 - If no, what prevented you from seeking help?
11. Would you prefer calling a hotline or using an emergency app? Why?
12. Would you rather seek help face-to-face or through a discreet method?

D.3 Familiarity with Technology and Usage

14. How comfortable are you with using technology such as apps, websites, or social media?
15. Do you use a shared device?
16. Do you own a smartphone? If yes, what kind (Android or iOS)?
17. How often do you use your smartphone for daily tasks (e.g., shopping, chatting)?
18. What types of apps do you use regularly?
19. What types of apps does your abuser use regularly?
20. Do you remember your email or phone number better?
21. How good are you at remembering passwords?
22. Do you write down your passwords?

D.4 Digital Monitoring and Restrictions

23. Do you face any restrictions on phone usage? If yes, what kind?
24. Are you allowed to talk to your family members and friends on the phone?
25. Does your abuser know your passwords?
26. Does your abuser check your phone frequently?
27. Do they monitor your app usage or calls?
28. Are you restricted from using specific apps (e.g., Facebook, YouTube)? Which ones?
29. Which apps would you prefer to disguise a safety feature under (i.e., apps that appear harmless)?

D.5 Experience with Support Apps

30. Have you used any app, website, or platform for support (e.g., hotline, chat, in-person counseling)?
31. What features were useful or unhelpful in those tools?

D.6 Desired Features for a Safety App

- 32. What features would you find most helpful in a safety app?
- 33. How important is it that the app hides its real purpose?
- 34. Would you prefer to talk to a real person through the app, or is automated guidance sufficient?
- 35. Should the app work offline or with weak internet?
- 36. Are there any other features you would like to see?

D.7 Closing Question

- 37. Is there anything else you would like to share that could help improve this app or service?

Appendix E

Final App Prototype Evaluation Form

E.1 Cognitive Load

1. **Mental Demand:** How mentally demanding was the app? (1 = Very Low, 5 = Very High)
2. **Physical Demand:** How physically demanding was the app (tapping, scrolling)? (1 = Very Low, 5 = Very High)
3. **Temporal Demand:** Did you feel rushed or under time pressure while using it? (1 = Not at all, 5 = Extremely)
4. **Performance Satisfaction:** How successful were you in using the app to complete tasks? (1 = Very Unsatisfied, 5 = Very Satisfied)
5. **Effort:** How hard did you have to try to use the app effectively? (1 = Very Low Effort, 5 = Very High Effort)
6. **Frustration Level:** How irritated, stressed, or annoyed did you feel? (1 = Not at all, 5 = Extremely)

E.2 Emotional Safety & Trust

7. Did you feel safe using the app? (1 = Not at all, 5 = Extremely)
8. Would this app help you in a real emergency? (1 = Not likely, 5 = Definitely yes)
9. Did the app feel confusing or cause panic at any point? (1 = Not at all, 5 = Very much)

E.3 Qualitative Feedback

10. Which feature made you feel most in control?
11. What changes would you like to make?

E.4 Think-Aloud Protocol Questions

1. How would you log in using a dummy password to enter stealth mode?
2. How would you trigger the silent SOS feature?
3. How would you send a voice message through the app?
4. How would you locate legal help, specifically the General Diary filing options?
5. How would you quickly exit the app without drawing attention?