

Designing and Developing CattleSync: A Comprehensive ERP Solution for Cattle Farm Management

by

Gazi Asif Imtiaz
21301616

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

Department of Computer Science and Engineering
Brac University
June 2025

© 2025. Brac University
All rights reserved.

Declaration

It is hereby declared that

1. The internship report submitted is my/our own original work while completing a degree at BRAC University.
2. The report 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 report does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I have acknowledged all main sources of help

Student's Full Name & Signature:



Gazi Asif Imtiaz
21301613

Approval

The thesis/project titled “Designing and Developing CattleSync: A Comprehensive ERP Solution for Cattle Farm Management” submitted by

1. Gazi Asif Imtiaz (21301616)

Of Spring, 2025 has been accepted as satisfactory in partial fulfillment of the requirement for the degree of B.Sc. in Computer Science on June 18, 2025.

Examining Committee:

Supervisor:
(Member)

Rafeed Rahman

Senior Lecturer
Department of Computer Science and Engineering
Brac University

Program Coordinator:
(Member)

Dr. Md. Golam Rabiul Alam

Professor
Department of Computer Science and Engineering
Brac University

Head of Department:
(Chair)

Dr. Sadia Hamid Kazi

Associate Professor
Department of Computer Science and Engineering
Brac University

Abstract

A six-month Software Developer Internship at Skarbol.Tech spanned from October 21 until April 21. The internship period allowed me to collaborate on hospital web applications utilizing ERP platforms and a water filtration system design and the development of impending AI automation software for personal assistant customization. I built applications including an IP tracker and weather app through the use of technologies including JavaScript and PHP and Node.js in addition to HTML and CSS and React and SQL. The internship required participation in three meetings where I partnered with different teams to develop projects planning strategies as well as execute implementation. As an intern I used my academic training to enhance my coding abilities as I worked with development and problem-solving ecosystem at the firm. The experience provided me with excellent possibilities to support meaningful development work along with personal growth as a programmer.

Keywords: Software Developer Internship, Skarbol.Tech, ERP platforms, CattleSync, AI automation software, Portable Water Filtration System, JavaScript, PHP, Node.js, React, SQL, MongoDB, Tailwind CSS, CRUD operations, SweetAlert, Team collaboration, Personal growth, Agile methodology, Postman, Git, GitHub, Ubuntu, Linux terminal.

Table of Contents

Declaration	i
Approval	ii
Abstract	iii
Table of Contents	iv
1 Introduction	2
1.1 About Internship	2
1.2 About this Report	2
1.3 Research Objectives	3
1.4 Aim of the Internship	3
1.5 Methodology	3
1.5.1 Primary Data	3
1.5.2 Secondary Data	4
1.6 Expectations and Outcomes	4
1.7 Key Learnings from the Internship	4
2 Company Profile	5
2.1 Overview	5
2.2 Vision and Mission	5
2.3 How Does Skarbol.Tech Work	5
2.4 Products and Services	6
2.5 Software Development Process	6
2.6 Technology Stack and Tools	6
2.7 Projects	7
2.8 Corporate Culture and Values	7
2.9 Team Collaboration and Communication	7
3 Training and Development	8
3.1 Overview	8
3.2 Work Environment and Culture	8
3.3 Learning and Support	9
3.4 Skills and Tools Learned	9
3.5 Mentorship and Guidance	10
3.6 Personal Growth and Development	10

4	Activities and Responsibilities	11
4.1	Web Development Projects	11
4.2	AI-based Projects	15
4.2.1	My primary responsibilities included:	15
4.2.2	Challenges and Solutions:	15
4.3	Portable Water Filtration Device	16
4.4	Meetings and Collaborations	16
4.5	Challenges and Solutions	16
4.6	Personal Projects	17
4.7	Technical Skills Acquired	18
4.8	Contributions to the CattleSync Project	18
4.9	AI-based Project Contributions	19
4.10	Personal Contributions to the CattleSync Project	19
4.11	Project Planning & Work Flow	23
4.12	Task Breakdown and Responsibility Allocation	25
4.13	Tools and Platforms Used	25
4.14	Security Practices and Authentication Handling	25
4.15	Version Control Using Git & GitHub	26
4.16	Communication and Team Collaboration	26
4.17	Ubuntu Exploration and System-Level Tools	27
4.18	Widget Projects Built on Ubuntu	27
5	Acquired Knowledge	28
5.1	Problem Solving	28
5.2	Technical Skills	28
5.3	Soft Skills	29
5.4	Industry Understanding	29
5.5	Lessons Learned	29
5.6	Industry Insights	29
5.7	Future Skill Development	30
6	Conclusion	31
6.1	Summary	31
6.2	Recommendations for Future Strategic Actions	32
6.3	Future Goals	32
6.4	Reflections on the Internship Experience	32
	References	33

Chapter 1

Introduction

1.1 About Internship

Internships establish essential connections that bridge the gap between academic understanding of theory and practical expertise. During my internship period at Skarbol.Tech, I gained hands-on experience in software development and managing AI automation and ERP systems. My collaboration with industry professionals provided insights into how front-end and back-end programming, along with database administration and AI algorithmic automation, function in real-world scenarios. At Skarbol.Tech, I worked on three major projects: the CattleSync ERP system for cattle farm management, an AI-based virtual assistant, and a portable water filtration system. These projects exposed me to real-world software engineering challenges, significantly enhancing my problem-solving skills.

Expanding upon live projects at Skarbol.Tech involved the development of three key systems: an ERP-based hospital management system combined with AI-driven automation applications together with a portable water filtration system. Through these projects participants gained exposure to software engineering issues that occur in real-life settings which deepened their problem-solving abilities.

1.2 About this Report

The report outlines the entire Skarbol.Tech internship program by describing the completed assignments and educational achievements together with encountered obstacles and vital takeaways. This report uses detailed research to analyze both the skills developed and the chosen development methodologies, with a focus on professional developmental outcomes.

The report details industry-specific technical difficulties along with proposed remedies for web development projects exploring AI-based automation and ERP integration. The document contains a structured evaluation that summarizes the research and learning methods the industry adopted throughout the program for a detailed review of the whole training journey.

1.3 Research Objectives

During my internship I studied research topics that built my practical skills along with industrial expertise. The key research objectives were:

1. **Objective 1:** The research evaluated how ERP systems build web applications for healthcare management through implementation and architectural studies.
2. **Objective 2:** A study of SQL together with Apache database optimization approaches focuses on enhancing system performance metrics.
3. **Objective 3:** A study investigates how full-stack development frameworks such as React and Node.js, PHP together with Laravel enable building web applications with flexible scalability.
4. **Objective 4:** A research investigation focused on assessing the design potential of a portable water filtration system which would combine technological elements for improved performance.
5. **Objective 5:** The expedited analysis examines how AI automation affects business procedure streamlining alongside productivity development.

1.4 Aim of the Internship

As my main objective during this internship I focused on mastering software development skills and automation through project work with access to modern development platforms alongside AI implementation techniques and system optimization methods. This internship gave me the chance to transform theoretical understanding into practical use within a professional setting by working on meaningful projects.

1.5 Methodology

The report incorporates fieldwork data from the internship period combined with disciplinary research about contemporary software engineering methods.

1.5.1 Primary Data

1. Significant development and optimization skill acquisition resulted from software application development work.
2. Observations from team meetings, discussions, and mentorship sessions.
3. The experience of directly participating in system testing processes while optimizing applications and performing debug maintenance.

1.5.2 Secondary Data

1. Research combines data from both company documentation and industry reports and technical blogging platforms.
2. I used official documentation about React together with Node.js, PHP, and Laravel reference materials.
3. Access is available through online learning resources that provide case study materials concerning AI automation and ERP software as well as database management principles.

1.6 Expectations and Outcomes

During my internship period, I established various performance criteria that I hoped to fulfill successfully. My internship delivered three essential objectives, which were practical software development training and enhancements in technical expertise alongside contributions to substantial projects. The software development industry revealed itself to me through my internship, where I managed to reach all my established expectations and learned important perspectives about the field.

1.7 Key Learnings from the Internship

My time at Skarbol.Tech allowed me to acquire crucial insights that enhanced my career development at a significant level. Collaboration proved to be one of the essential takeaways from my internship experience at Skarbol.Tech. Forming the CattleSync system alongside the AI-based virtual assistant showed me how essential proper teamwork is between staff members to successfully reach organizational objectives.

The lesson I learned most during my time at Skarbol.Tech was adaptability. Software development demands fast changes to new requirements and unexpected obstacles because the field remains dynamic. I needed to develop flexible solutions while working on the AI-based project since the AI models produced unpredictable results, which I had to adapt to properly.

Continual learning proved to be essential during my professional development. The software development sector transforms continuously therefore, professionals need to keep updating their knowledge of modern technologies and industry-leading practices. The opportunity to participate in my internship allowed me to develop new skills through learning about tools and frameworks including React, Vite, Tailwind CSS and Postman, thus enhancing my professional capability.

My learning in the company has contributed to my professional advancement toward becoming a software developer.

Chapter 2

Company Profile

2.1 Overview

The technology solutions company Skarbol.Tech creates specialized software solutions to serve businesses in all industries. Through its expertise in enterprise application development the company focuses on delivering ERP systems while also offering web-based platforms as well as integrating artificial intelligence (AI) and machine learning technology. The organization develops advanced technology solutions which help organizations create optimized processes while maintaining their competitive edge throughout modern digital markets. The organization maintains a reputation through its dedication to outstanding service with imaginative solutions that add enduring value to client satisfaction. Working as an intern at Skarbol.Tech allowed me to connect with talented industry experts while helping on projects that bring meaningful change.

2.2 Vision and Mission

Skarbol.Tech positions itself as an industry leader through ongoing development which allows it to follow evolution of new technological trends. Their vision focuses on giving organizations innovative software which advances both business growth and success. The company exists to help businesses unlock technological advantages through solution development of efficient scalable and impactful systems. Their focus on AI and automated solutions supports their mission of developing systems which solve people and businesses' complex problems more effectively and smoothly.

2.3 How Does Skarbol.Tech Work

The agile development approach at Skarbol.Tech enables flexible project management which produces defined milestones of progress. The company fosters team collaboration through its transparent work systems together with regular team meetings to assess project progress and address implementation issues and share team member ideas. A project-based method combines development teams with managers while the Quality Assurance division and designers work together to prepare

superior solutions.[6]

Daily discussions and assessments helped each of the team members collaborate with each other. Real hands-on experience enabled me to master the whole process through software development Life Cycle programming.

2.4 Products and Services

Skarbol.Tech provides a wide range of products and services, including:

- **Custom ERP Systems:** The company develops customized enterprise resource planning software systems for organizations in different market segments.
- **AI and Machine Learning Solutions:** Business solutions use advanced technologies to create automated systems that both streamline operations and deliver sophisticated intelligent help functions.
- **Web Development Services:** Design and development of responsive web applications for different industries.
- **Mobile Solutions:** Our team creates mobile applications for both Android and iOS systems that enhance and support our web-based solutions.

2.5 Software Development Process

Skarbol.Tech uses Agile as its fundamental software development methodology. This includes:

- **Sprint Planning:** The software development process organizes projects into practical compartments called sprints as this practice enables quicker project response times to modifications.
- **Development and Testing:** The development process runs alongside testing activities which ensures top-notch quality throughout every developmental phase.
- **Client Feedback:** Our client feedback process relies on established interaction periods to ensure professional modifications can be implemented.

Through an iterative methodology our projects become more adaptable and deliver better results for users within defined timeframes.

2.6 Technology Stack and Tools

During my internship, I worked with a variety of tools and technologies, including:

- Frontend: HTML, CSS, React, Tailwind CSS

- Backend: Node.js, Express.js
- Database: SQL, MongoDB
- Version Control: Git, GitHub
- Project Management: Jira, Trello
- Design Tools: Figma, Adobe XD
- Others: Docker for containerization, Postman for API testing

2.7 Projects

During my internship, I contributed to the following key projects:

- ERP-based Web Applications for farms and hospitals.
- The research team developed an AI-based system which built customized virtual assistant algorithms.
- The device functions as a mobile filtration system for obtaining clean drinking water outside conventional urban areas.

2.8 Corporate Culture and Values

Skarbol.Tech fosters a collaborative and innovative corporate culture. The organization places equal importance on team working along with creative thinking and self-improvement through ongoing learning. Employees find encouragement at Skarbol.Tech to participate in idea sharing activities that lead them to work collectively for mutual success. High-quality solutions delivery combined with durable client partnerships show how the company expresses its core values.

2.9 Team Collaboration and Communication

All project successes at Skarbol.Tech require both active team support and efficient communication channels. The company encourages team dialogue and arranges multiple group meetings to oversee project advances and solve issues while generating fresh ideas. Staff members used Microsoft Teams and Slack for both daily communications and assignment distribution as well as work tracking purposes. Collaborating in this environment taught me superior methods of communication and outstanding teamwork skills.

The CattleSync project development process included my direct work with both backend developers and both QA team members as well as project managers. Through regular scheduled sessions the team successfully coordinated their work which maintained project schedules while handling problems effectively. The work with AI development team in the AI-based project involved analyzing how the model functions to verify the frontend systems properly processed AI-generated outputs.

Chapter 3

Training and Development

3.1 Overview

The internship program at Skarbol.Tech allowed me to pursue professional development through comprehensive learning opportunities. From the first day I engaged with the company's development processes while completing ongoing projects for the development team. Inside Skarbol.Tech's collaborative workspace I received extensive mentoring as well as training in essential technical methodologies alongside various interpersonal competencies. Throughout my time at Skarbol.Tech my role shifted toward more advanced responsibilities because the organization saw I could deliver valuable contributions to our team. Thanks to this training during my internship I obtained practical experience contrary to theoretical education at the academic level.

3.2 Work Environment and Culture

Inside Skarbol.Tech's workplace community members practice open resource-sharing along with creative innovation and respectful interpersonal connections. At this company employees together with interns experience a supportive workplace atmosphere that promotes idea sharing and collaborative work. Learning remains a primary organizational focus because all feedback serves as a developmental tool for personal growth. Interns received complete access to team member responsibilities which enabled complete workplace immersion and essential software development understanding. My team members maintained an open doorway for queries while giving me access to needed resources to achieve success.

Microsoft Teams and Slack enabled our team to maintain everyday communication for task assignments planning as well as monitoring progress. Remote meetings occurred regularly to help team members keep their focus on project objectives alongside spontaneous group discussions that incremented innovation and dealt with project issues. My ability to use the company's flexible learning model let me establish good time management which aligned my activities between professional duties and individual improvement.

3.3 Learning and Support

The entire team at my internship provided steady support that ensured my learning journey moved forward. My supervisor devoted particular effort to teach me about sophisticated programming principles alongside technical systems. My supervisor's guidance revealed detailed understandings about web development and game development along with other development areas that interested me. Resources like online courses documentation alongside technical articles which my supervisors made available allowed me to learn more efficiently.

Through Skarbol.Tech's organized onboarding training along with regular development sessions I gained insight into the entire development cycle process. My understanding of professional standards and tools progressed thanks to company documentation concerning coding approaches with development frameworks and project management elements. All my colleagues showed complete willingness to teach me new things plus provide help with tasks at hand.

3.4 Skills and Tools Learned

During my internship period I had practical exposure to multiple tools and technologies. Some of the key skills and tools I learned and improved upon include:

- **Frontend Development:** I learned the entire spectrum of HTML along with CSS and JavaScript to create user interfaces. I built competency in both React development for building responsive component-based interfaces while Utilizing Tailwind CSS for quick elegant user interface implementations.
- **Backend Development:** I implemented backend system development utilizing Express.js modules and Node.js as my framework to construct web applications. Through this experience I gained insights into how databases can be managed alongside understanding HTTP request handling capabilities and developing serverside architectures for scalability.
- **Database Management:** The experience allowed me to master SQL database and MongoDB implementation while developing effective database design methods and query and management abilities.
- **Version Control:** I gained mastery in both Git version control and GitHub collaborative tools. Git-powered version control let me handle code changes together with my team members while sustaining a clean development process that operated efficiently.
- **Project Management Tools:** Through my experience I learned how to leverage Jira and Trello as tools that help organize tasks while tracking project progress to achieve timely task deliverables.

My acquired skills together with tools have developed me for progressing in my software development career.

3.5 Mentorship and Guidance

The entire duration of my internship I received essential advice and instruction from my supervisors as well as my team members. My supervisors along with team members supported me by giving essential resources which contributed to my skills development. I built better performance alongside enhanced software development understanding by receiving ongoing feedback alongside modeling sessions from my mentors.

3.6 Personal Growth and Development

The internship at Skarbol.Tech allowed numerous possibilities for personal self-improvement. The area in which I made the greatest growth during my internship experience was time management. I needed to establish task priorities and manage my time efficiently when juggling between CattleSync project work alongside AI-based project development and team meeting participation.

The development of my problem-solving abilities was an important part of my growth. During my internship, I faced multiple obstacles in my work, including API integration work and complex code troubleshooting and ensuring the functionality of outputs generated by AI systems. The challenging situations I faced motivated me to apply critical thinking to generate innovative solutions. I designed a responsive data management system for unpredictable input during AI-based project development.

Through my experience, I gained confidence in my software development skills. Under the guidance of Skarbol.Tech, I strengthened my self-assurance to tackle advanced responsibilities and enhance my value to the projects I worked on through their supportive work culture and mentorship program.

Chapter 4

Activities and Responsibilities

4.1 Web Development Projects

As an intern I performed diverse web development tasks which enabled my skill development through specific challenges along the way. Some of the key projects I worked on include:

- **Website Layout and Design:** During my internship at Skarbol.Tech I was tasked to build the user interface for their website as part of my task. Instead, I dedicated myself to improve layout and overall design with HTML, CSS, and JavaScript. Here are the screenshots of the homepage, with a design of my website below.



Figure 4.1: Homepage of Skarbol.Tech in Dark Mode

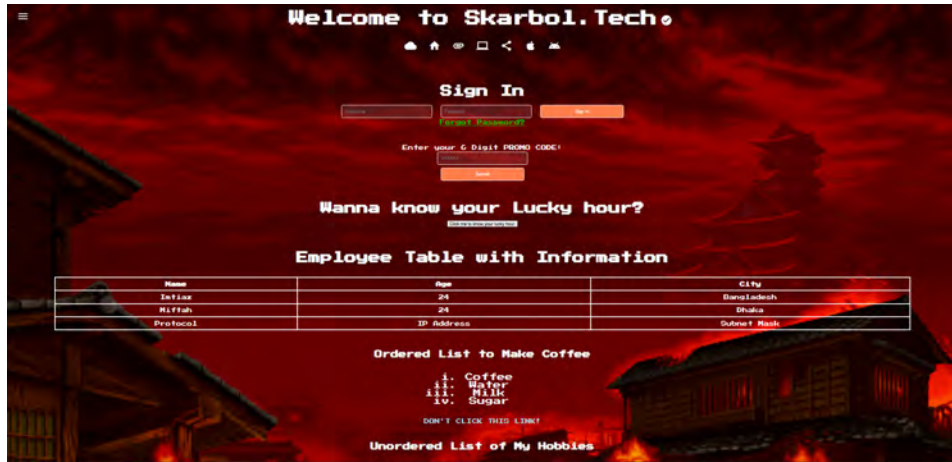


Figure 4.2: Homepage of Skarbol.Tech in Light Mode

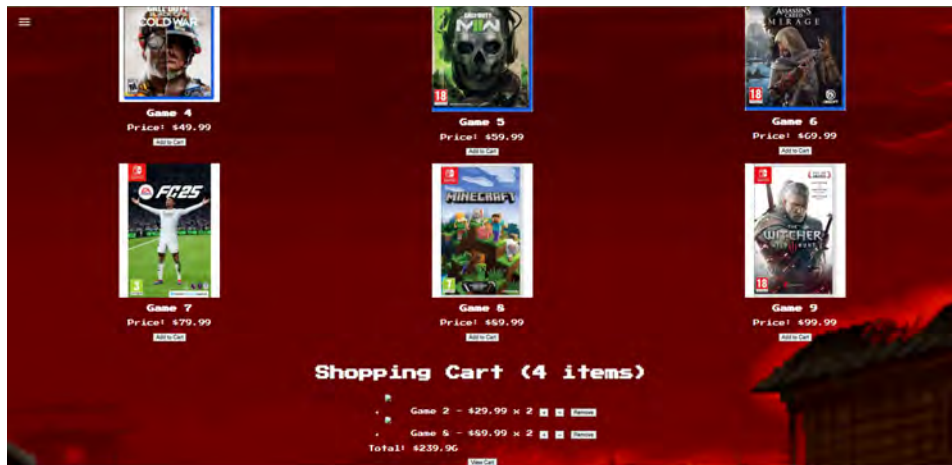


Figure 4.3: Shopping Cart Interface

- **Weather App:** I built a weather tracking application which utilized both React and Tailwind CSS technologies throughout development. A real-time API delivers weather data to the application after which users see forecasts and temperature and humidity readings. The project required me to develop expertise in API integration and asynchronous data management while creating design layouts that responded appropriately to different screen sizes.
- **IP Tracker:** I built an IP address location tracker which enables users to detect where any IP address resides. The practical utilization of APIs for location data retrieval helped me deepen my understanding of front-end construction while enabling enhanced user interface design capabilities.

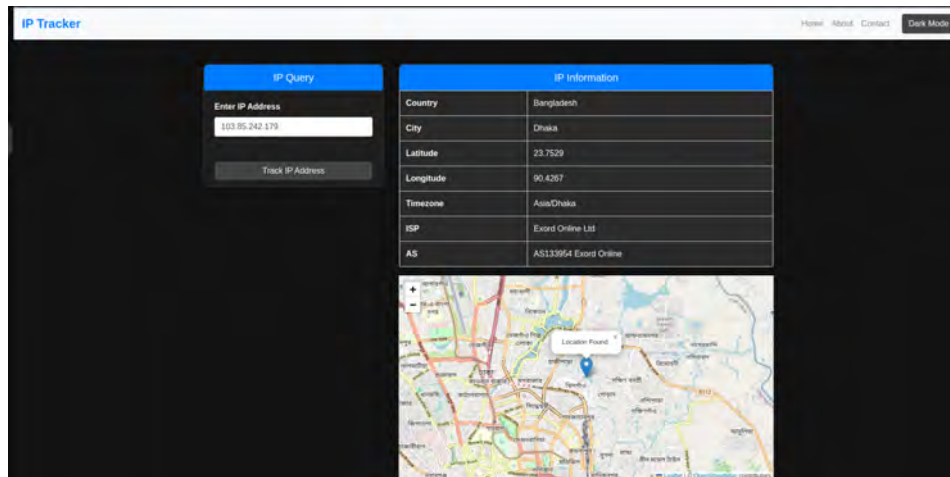


Figure 4.4: IP Tracker interface

- **Login Page:** The simplest login interface I built incorporated front-end design elements along with fundamental backend validation standards. I gained expertise in form administration with data verification while developing protected user interfaces through this project.

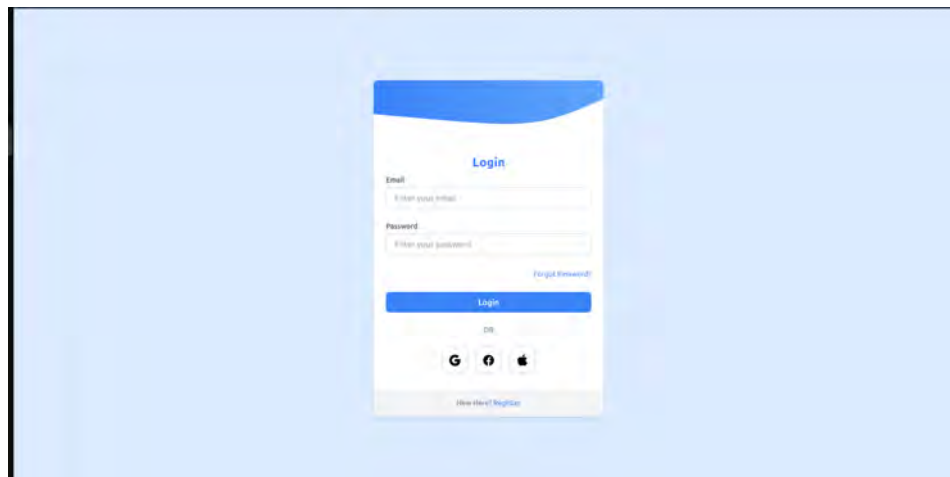


Figure 4.5: Login Page

- **To-Do App:** I built a to-do application through which users had the ability to perform tasks such as creation and management together with deletion support. I used this project to learn how to perform CRUD Operational tasks while improving my React state management abilities in application development.



Figure 4.6: To Do App

- **Game Development:** Through game development I built two applications: A 2D Car Racing Game along with a Hand Cricket Game which I made using JavaScript. Game development required me to create game mechanics while managing user interactions along with learning fundamental game development concepts including animation and collision detection and physics logic.

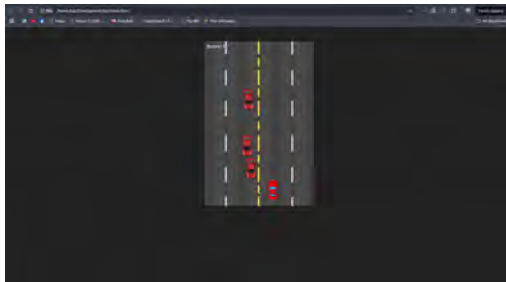


Figure 4.7: 2D Car Racing Game

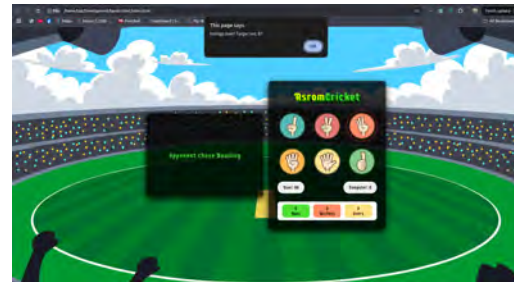


Figure 4.8: Hand Cricket Game

- **CattleSync Project:** I built an extensive software system for cattle farming operations which managed inventory and classified animals while tracking their health status and sales together with their pricing requirements. I dedicated my work to improve the application's user interface and testing phase to make the system both accessible and operational. The development involved the combination of React and Vite and Tailwind CSS together with PHP as frontend and backend solutions. The selected database for my work was MySQL. Implementing APIs required additional assistance yet I addressed them through proper guidance and testing alongside debugging procedures. The QA assurer from the team verified both functional quality and operational capability of our system.[7][3]



Figure 4.9: CattleSync Dashboard

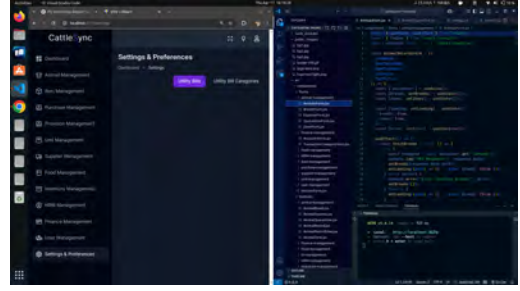


Figure 4.10: Codebase

I used these projects to develop my technical abilities leading to web applications which I can include in my professional work future.

4.2 AI-based Projects

I made substantial contributions to an AI project during my internship, which functioned as a ChatGPT or Gemini AI alternative that focused on developing a full-scale AI virtual assistant. The system contained sophisticated elements that generated context-sensitive responses to user inquiries and performed task automation while generating suggestions for businesses and users alike.

4.2.1 My primary responsibilities included:

To make the system framework I worked on designing the system architecture which allowed complex AI processing functions to execute efficiently and scale effectively. I created responsive user interfaces that displayed and allowed interaction with AI-generated data through a process of UI/UX design. I worked on creating wireframes that led to better interaction between users and the system through mockups.

Postman served as my tool for carrying out extensive API testing that determined how well the AI backend operated alongside the frontend. The system features input validations with display logic to present AI recommendations to users.

I cooperated with engineers building AI functions to normalize API delivery protocols for frontend applications and maintain system compliance with specifications.

4.2.2 Challenges and Solutions:

The main difficulty came from maintaining consistency between design specifications and the irregularities in AI system outputs. To overcome unexpected data the frontend used a flexible system that handled unusual data responses in a methodical manner.

Effectively testing the AI model required developers to understand its behavioral dynamics. Working jointly with AI engineers enabled me to understand model training and expected inputs/outputs so I could enhance both frontend responses and error

management.

Working on this project allowed me to develop essential know-how regarding both software integration of artificial intelligence modules and user interface creation for AI-powered applications.

4.3 Portable Water Filtration Device

The portable water filtration device received contributions from me for both the design development and problem-solving activities alongside my web development and AI-based work. An innovative portable water filtration system has been designed for use in distant areas where drinking water quality remains uncertain. As part of my team I worked together to develop breakthrough engineering solutions before producing an operational portable filtration system. The responsibilities of my position included cooperating with engineers to develop solutions and search for potential challenges that engineers should consider throughout development. This project provided me deep insights regarding how technology merges with actual practical solutions.

4.4 Meetings and Collaborations

I attended multiple team meetings throughout my internship to assess project progress while our team found solutions to overcome engineering challenges. Meeting participation built my teamwork abilities while launching me into worthwhile idea generation and solution planning. Interactions with team members and supervisors let me both maintain my project responsibilities and develop deeper knowledge about my work assignments. At code reviews I gained practical feedback about my work along with industry standards related to writing clean and efficient code.

My team member and supervisor meetings allowed me to maintain project direction while expanding my knowledge base about the projects we worked on together. Through code reviews I received important feedback about my work alongside learning the best practices for writing clean efficient code.

4.5 Challenges and Solutions

My internship brought various obstacles when I worked on multiple projects. My work included three major obstacles to overcome using AI algorithms and complex code debugging and API functionality testing. Here are some specific examples:

Integrating AI Algorithms:

- **Challenge:** Integrating the AI algorithms into the existing system proved to be difficult due to the demanding testing process.
- **Solution:** Through collaboration with the AI team I studied algorithm functions to implement smooth integration which required complete testing and

debugging procedures. We utilized Postman to conduct API testing which allowed us to verify the correct operational status of all APIs.

Debugging Complex Code:

- **Challenge:** Complex code debugging for the CattleSync project took extensive time because it required extensive knowledge of the system's architectural elements.
- **Solution:** The problem required me to collaborate with my team members to locate and solve software defects. Git version control enabled our team to track modifications while maintaining a secure code foundation.

Ensuring API Functionality:

- **Challenge:** Testing the APIs until they operated properly as well as their seamless integration with front-end and back-end components proved to be a major hurdle in this case.
- **Solution:** My API testing involved extensive use of Postman while I worked with back-end colleagues to fix detected problems. We tested the APIs with methodical procedures to guarantee their reliability and correct behavior.

Implementing APIs in CattleSync:

- **Challenge:** Executing APIs within the CattleSync project proved difficult because the system contained many complex elements.
- **Solution:** Through testing and guidance and necessary debugging I successfully addressed these issues which resulted in producing a high-quality functioning system. The QA assurer from the team proved essential in executing this process.

Through these experiences I built my problem-solving expertise while enhancing my technical proficiency.

4.6 Personal Projects

I undertook several individual projects which aided my skills development in addition to the main assigned work. I built small programs during my educational experience along with testing emerging technologies and studying various coding languages. The personal projects helped me put classroom knowledge into practice so I could gain experience working with real-world scenarios.

4.7 Technical Skills Acquired

Frontend Development: I gained proficiency in HTML, CSS, JavaScript, React, and Tailwind CSS to build responsive and dynamic user interfaces. I also learned how to use Vite for faster development and optimization.

Backend Development: I worked with Node.js, Express.js, and PHP for backend development and managed databases using SQL, MongoDB, and MySQL. These skills allowed me to build scalable and efficient backend systems.

API Testing: I used Postman extensively for API testing, ensuring seamless communication between frontend and backend systems. I also implemented input validation and display logic to support AI-generated recommendations.

Version Control: I became proficient in using Git and GitHub for version control and collaborative development. These tools helped me manage code changes efficiently and work effectively with my team.

Project Management: I learned to use Jira and Trello to organize tasks, track project progress, and ensure timely deliverables of tasks.

These technical skills have prepared me for a career in software development and equipped me with the tools and knowledge to tackle complex projects in the future.

4.8 Contributions to the CattleSync Project

CattleSync project delivered a full-scale software solution for cattle ranch management by providing inventory control tools alongside animal classification features and health monitoring alongside sales operations and pricing functions.

The development project benefited from my extensive work, including frontend development alongside backend development along with API implementation and extensive testing and debugging procedures. I designed the user interface and implemented it through React and Vite and Tailwind CSS during frontend development to create an interface that is both user-friendly and responsive. The design of my layouts and interactive features served to improve user experience within the system. I developed the backend using PHP and MySQL to establish an efficient system for data management which supported proper functionality. My work included building functionality that monitored inventory levels alongside animal wellness together with handling sales operations. API integration served as my essential contribution through implementation that enabled smooth communication between frontend and backend systems.

The development team implemented thorough testing and debugging sessions that the APIs met the project specifications and worked properly. The QA team proved essential in identifying and resolving problems by working through the entire development process. Working on the CattleSync project provided me with practical software development training through the implementation of my technical expertise

in actual project programming.

4.9 AI-based Project Contributions

Featuring AI functions through the frontend while maintaining consistent dialogue between the AI backend and user interface was the main responsibility of my AI-based project work. My principal tasks involved designing the framework alongside user interface and user experience elements and performing API testing while integrating these APIs with the AI development team and creating designs. I collaborated with others during system architecture design to establish an effective solution that would deal with complex AI functionality while maintaining efficiency and scalability. I joined forces with the AI team to have discussions about machine learning algorithms applied to the project. I concentrated on developing interactive user interfaces with responsive design for showing and interacting with AI-generated data during the UI/UX design phase. My role consisted of making wireframes and mockups that demonstrated to users how AI recommendations would display in the interface. API testing and integration were essential elements in my work where I executed comprehensive API testing through Postman to maintain proper data exchange between the AI backend and frontend. The implementation included input validation together with display logic for the AI-generated recommendations system. Working together with the AI development team proved crucial to integrate API responses with the frontend needs while checking that the system fulfilled project specifications. The team held scheduled meetings for discussing obstacles and dealing with emerging problems. A significant obstacle during my work involved matching the changes in frontend specifications against unpredictable results from AI. I created an adaptive error management system which lets the frontend handle irregular data patterns without problems. I worked with the AI engineers to enhance the frontend by knowing better how the model operated while making improvements to both error handling and response times. My contributions enabled me to obtain important knowledge about how to embed AI functions into software frameworks along with how to design interfaces that enhance the user experience with AI-powered solutions.[4]

4.10 Personal Contributions to the CattleSync Project

At my internship at Skarbol.Tech, I was able to participate in one of the major projects, CattleSync, a full-stack enterprise-level ERP solution exclusively dedicated to use in a cattle farm. It is a hybrid framework with MERN stack (MongoDB, Express.js, React.js and Node.js) being primarily used, however with some backend features being implemented with Laravel and MySQL. This hybrid structure enabled us to integrate the best in both technology stacks which meant a stable and extensible setup. CattleSync was aimed at simplifying operations at the cattle farm by digitally representing and centralizing cattle farm activities such as buying, livestock data, sales, people management, and customer tracking.[2]

Being a part of the frontend team, I was involved in working on and testing some of the most important modules of the system. We implemented the component-based architecture on React with the UI designed to be responsive on different devices via Tailwind CSS. Some of my work in the project was on the CRUD (Create, Read, Update, Delete) functionality which was needed in handling the data in the application system. I also incorporated Sweetalert to have a better user experience which offers attractive designs and easy to use alert boxes when editing, deleting, or updating records.

User Management:

Within the module of User Management, I created a UI design that is safe and convenient to work with because it enabled the users with the permission of admin to create and construct accounts. In this section, roles and credentials including usernames, emails, and passwords could be allocated so that new staff or operators could have a secure access to the ERP. I was working on form validations, assignment logic of roles, and smooth communication with the backend API to store the data. We have tried to use the CRUD operations here to handle the user data in an efficient manner.

ID	Name	Email	Actions
6	Orland Hoppe	gggrimes@example.org	[Edit] [Delete]
5	Prof. Sharon Yost	huelis.filiberto@example.org	[Edit] [Delete]
4	Wendell Hill	ykwelling@example.net	[Edit] [Delete]
3	Prof. Virginia Schmeler II	natalia30@example.org	[Edit] [Delete]
2	Arnaldo Koss V	mstracke@example.com	[Edit] [Delete]
1	Test User	test@example.com	[Edit] [Delete]

Figure 4.11: User Management Interface

HRM (Human Resource Management):

The HRM module was well-rounded and the admin had an option to add new members of staff with as much information as possible including name, email, phone number, birthday, address, joining date, role, and monthly salary. I have developed the front interface of the form where the staff can be added and modified and have also worked on UI components of managing the payslip details. An actual application area is in the staff payroll where the system could compute and produce payslips, as well as allocate staff by department or position. I also worked very closely with the backend team to map the components of the front end with the correct data. SweetAlert was implemented to give feedback on the successful operations as well as to ensure actions taken such as deletions and updates.

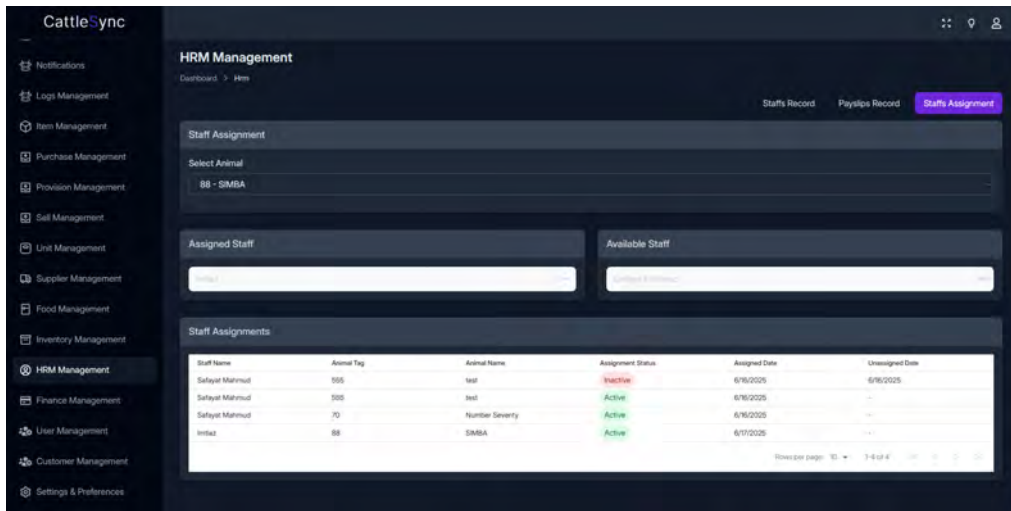


Figure 4.12: HRM interface

Customer Management:

The Customer Management section enabled us to kept some basic information of different customers along with their purchase history. It showed the total sales per customer, payment dues, and breakdown of each transaction. I created tables to display this data and I added pagination and searching features. The knowledge offered in this module enabled farmers to monitor the best customers and outstanding balances. Here, the CRUD operations played a very important role in maintaining customer records and history of transactions.

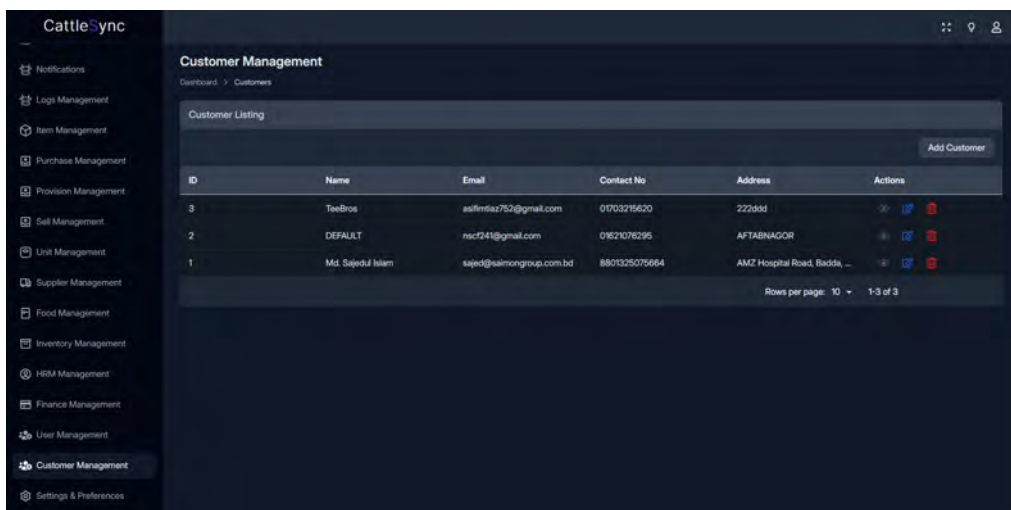


Figure 4.13: Customer Management interface

Supplier Management:

Supply Management module used to store data about the suppliers, such as name, contact data, type (food, veterinary, animals, equipment), as well as about transactions performed with suppliers. Just like the Customer module, it showed the total payment and due. I used dynamic forms to classify suppliers and deliver related financial information in tables and charts. The functions of CRUD were necessary

in controlling the information of suppliers and the records of their transactions.

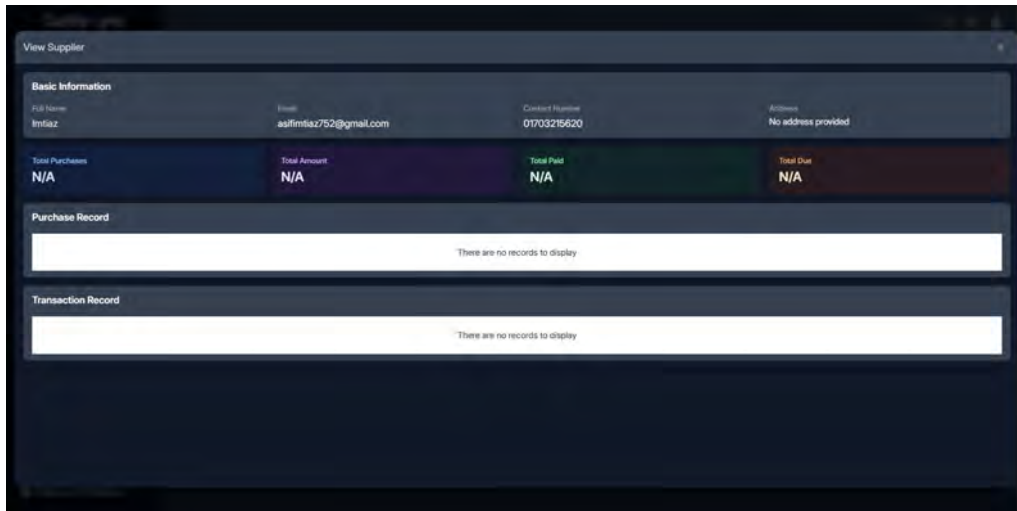


Figure 4.14: Supplier Management interface

Each of these modules was developed based on dynamic frontend parts and was linked together with the API endpoints through Axios. I made sure that every form and table all consumed and showed data correctly because the backend team managed the relationships between models with both Laravel Eloquent and MongoDB. The use of SweetAlert also contributed positively to the user experience as it presented a clear and good looking reaction to the users according to the actions that were performed.

API Testing and Quality Assurance

I incorporated a lot of requests to Postman to confirm endpoints prior to frontend integration. I tested status codes, response schema, validation rules and error processing conditions. This is a QA step that has prevented integration problems and ensured the consistent data between modules.[5]

Team Collaboration

CattleSync was a large project that needed collaboration. Still, we had a team of four members: two frontend and two backend developers. Teamwork was a must and we had divided the work module wise and had regular sync calls. Task planning was performed with the help of Notion and Trello, and daily communication was achieved with the help of Slack. As a team, we discussed bugs, proposed UI/UX enhancements and reviewed GitHub pull requests during team review.[1]

Real-World Use Case

One backend developer reported a cool example when an error in the payslip generator code was reported during the generation of staff payroll. With Postman and the frontend test environment that we created, we could identify a mismatched data binding in the staff salary input. By resolving this problem, not only did we make the system more reliable but also learned the importance of communication between

frontends and backends.

Deployment and Client Satisfaction

The final stage of the project was one of the most joyous tasks because the company succeeded in introducing CattleSync before Eid Ul Adha, a major milestone in the life of our client. The project was vital since it was completed on time and thus helped in facilitating the management of its cattle in a thriving business season. The product was very satisfying to our client who on day dreams of owning his own firm. The successful installation not only beat but surpassed his expectations, giving him a solid tool in managing his cattle farm activities with great deal of efficiency.

Reflections and Learning

- In User Management, I understood the concepts of secure authentication flows and access control with role-based control.
- Through the HRM module, I learned about payroll and employee information addressing real world ERP systems.
- As part of Customer and Supplier Management, I learned about the ways in which business software changes the financial records, the way in which it tracks, categorizes and presents it.
- Using React, I enhanced my working knowledge of component reuse, prop drilling, and the state.
- Learning the CRUD operations improved my knowledge on data management and manipulation of data into web applications.
- The modification of SweetAlert enhanced my skills of developing user-friendly and interactive web interfaces.

The cooperation helped me to understand team dynamics, professional communication, and peer feedback better. Generally, the CattleSync project was an amazing chance to dive into full-stack projects, API integration, and product testing within the team structure and on real industry projects. It defined my experience as a front-end developer and made me feel more comfortable in providing to production-level systems. The effectiveness in conduct and client satisfaction was also worthwhile since it proved the significance of our performance to the business aspirations of the client.

4.11 Project Planning & Work Flow

The construction of the CattleSync project at Skarbol.Tech was planned very carefully, with frequent communication with the clients. It began by the preliminary contact between the client and ourselves in order to know and record down his requirements. Such meetings played a key role in the discussion because this gave us

the opportunity to get every necessary inch of information regarding the needs and expectations of the client relating to the CattleSync system.

Client Meetings and Requirement Gathering

We had extensive meetings with the client to complete the Software Requirements Specification (SRS). Such meetings were things necessary to figure out the vision of the client and to translate his requirements into a detailed SRS document. The SRS described the goals of modules, user roles, and the targeted data flows and, as a result, the team could estimate the workload and schedules.

Internal Team Meetings and Implementation

After the client meetings, we held internal team meetings in which we would discuss the requirements collected and formulate an implementation strategy. These internal meetings took place twice a week because everyone was supposed to make adjustments according to the project goals and resolve any issues that were encountered during development. Such frequent feedback allowed us to be on the right course and make a correction in time.

Agile Methodology and Sprint Planning

It was built following an Agile methodology, in which features were built as part of a sprint. This made the response quicker and we could iterate. We simplified complicated requirements and created smaller steps and handled them using such tools like Trello and Notion. This methodology really added to our development effectiveness and project management.

Deployment Timeline

The whole procedure including initial meetings through to eventual deployment took about six months. This schedule had several stages that included gathering of requirements, planning, developing, testing and deployment. The cycle of our Agile process and the frequent client feedback meetings played a significant role in the final production of a product that satisfied the expectations of the client and occurred within the agreed time.

Client Satisfaction and Feedback

During its development, we used to ensure open communication channels with the client, keep in touch with possible updates, and use his opinion in the way it develops. This partnership strategy meant that the end product did not only meet the expectation of the client but surpassed it. It was satisfying that CattleSync was successfully implemented before the Eid Ul Adha, and benefited the client to assist in its cattle management business at its peak. The fact that the client was satisfied with the product was an indicator of the effort and commitment of our team.

4.12 Task Breakdown and Responsibility Allocation

Logical separation of tasks between frontend and backend teams was done so that every development was efficient. Each new feature was divided into smaller parts as to make sure that each part was easily manageable. Take the case of Supplier module:

- The db team on the backend designed the schema and Restful APIs.
- I created the frontend form on the basis of React, managed state, and validated form data.
- I tried the API via Postman and assisted in reporting bugs or proposing changes.

This well-organized division of work made the process of development more efficient and taught me what a defined task ownership helps to achieve collective success in a team.

4.13 Tools and Platforms Used

During the internship, I came across different tools and websites that brought a new quality of technical expertise:

- **Frontend Development:** React.js, Tailwind CSS, Vite
- **Backend Testing:** Postman
- **Version Control:** Git and Github
- **Operating Systems:** Ubuntu and Windows dual boot
- **Collaboration Tools:** Notion, Slack, Google Meet

These technologies facilitated the development, communication, and testing which became easier. This experience of developing with contemporary stacks gave me real-life experience in the actual working practices and best software development practices.

4.14 Security Practices and Authentication Handling

Security is an issue of high precedence in our development cycle. In the project, I received information regarding several security practices such as:

- Securing the API routes by tokens or sessions

- Safe storage of credentials via environment files
- Curation of frontend revealing of internal logic
- Testing endpoints on possible mistakes and abuse

Such exercises made me realize how I could secure software at the frontend or back end to make it secure to any vulnerabilities that may occur.

4.15 Version Control Using Git & GitHub

My code was managed with the help of Git and collaboration done using GitHub. All the work was done in their own feature branches and pull requests were created to perform the code review. With the given process, I acquired the knowledge:

- How To resolve merge conflicts How To
- Writing valuable commit messages
- Keeping Git history clean and comprehensible

This experience has enhanced my confidence in using collaborative coding environments and opting to work with version control best practices significantly.



Figure 4.15: Core Tools Used in Internship Project

4.16 Communication and Team Collaboration

The communication within the team was productive because it applied different tools:

- Slack as a fast pace of messaging and updates
- Google meet on weekly meetings
- Code reviews and suggestions through GitHub PRs
- Notion for shared documentation

This showed me how the teams can keep themselves aligned around common goals and this has made me also communicate better in a professional environment. Communication played vital role in the completion of our projects and made each person work on common ground.

4.17 Ubuntu Exploration and System-Level Tools

In the quest to enhance my technical flexibility, I installed Ubuntu to work in parallel with windows. That enabled me to:

- Linux command line Navigation
- Applying the command line interface (CLI), such tools as Git and Node.js can be used
- Ubuntu provides run and test developed environments

This experience helped me to have more insight into alternative operating systems and how a developer can abide by Linux to be more productive and time efficient.

4.18 Widget Projects Built on Ubuntu

I completed two mini projects on Ubuntu too:

- **Uptime Widget:** It displayed the time that the system had been up, together with CPU figures.
- **Weather Widget:** It was a widget that retrieved fresh weather information by connecting to an API and showed the weather state on the desktop.

These scripting projects were provided with the help of Python and Linux commands. They made me experiment with real-time data process, APIs, and user interface logic at a system level, which not only improved my technical skills but also helped me develop a system-level development knowledge base.

Chapter 5

Acquired Knowledge

5.1 Problem Solving

I used my internship to tackle genuine practical difficulties in real-world scenarios. During my time at Skarbol.Tech I learned how to detect system errors in code as well as recognize programs' performance restrictions and resolve technical problems. I learned to solve problems step by step starting from component division followed by possibility evaluation and testing various solutions. The whole experience at Skarbol.Tech helped me develop my problem-solving abilities both when fixing code problems and when looking to maximize system efficiency.

5.2 Technical Skills

Throughout my internship, I gained valuable technical skills that have enhanced my career prospects:

- **Frontend Development:** I succeeded in learning how to build applications that are both dynamic and responsive by becoming proficient with React and Tailwind CSS.
- **Backend Development:** I learned how to work with Node.js together with Express.js and SQL or MongoDB configurations to take care of data storage needs.
- **Game Development:** Through my studies I mastered fundamental game development concepts alongside animation principles within the JavaScript programming language.
- **AI and Automation:** My experience included development with AI-based project development as well as machine learning algorithms.

My technical skills enable me to start a career in software development through different areas including web development and game development and AI systems integration.

5.3 Soft Skills

In addition to technical skills, I also developed key soft skills that are crucial for success in the workplace:

- **Communication:** I strengthened my skill of presenting ideas by verbal and written communication and learned how to work cohesively with my team members.
- **Time Management:** Managing multiple responsibilities together with punctuality skills developed powerfully during my internship experience. Along with my internship I developed effective methods to organize my tasks together with improved time management abilities.
- **Adaptability:** The quick-paced operational flow demanded fast response-time alongside quick acceptance of evolving directives and emerging workplace obstacles.

5.4 Industry Understanding

My internship allowed me to better understand the steps associated with software development that start with planning all the way to deployment. My experience showed me how successful projects require teamwork and agile methodologies with active client feedback processing. Through my experience I developed an understanding of how businesses use AI together with machine learning to add functionality to their products and services.

5.5 Lessons Learned

During my internship experience I accumulated multiple essential lessons to keep. The internship taught me the fundamental value of team collaboration and reliable communication skills as well as the necessity of constant educational development. Adaptability with problem-solving capabilities play essential roles in the software development field according to my internship experience. The lessons learned at this internship have both developed my professional competence and will significantly impact my professional career.

5.6 Industry Insights

Through my internship I gained essential knowledge about the operations of the software development sector. I discovered how agile project management methodologies base their approach on flexible development strategies that combine collaboration and iterative testing practices. The internship provided me with knowledge about continuous integration and deployment (CI/CD) methodology for developing software while running tests and implementing updates smoothly.

The internship provided me valuable knowledge about how AI together with machine learning supports modern software solutions. The AI-based project showed how Artificial Intelligence can perform automated operations and deliver intelligent suggestion features and improve system usability. The experience provided me with industry knowledge about the current focus on user-driven design and efficient scalable systems.

My knowledge has grown deeper concerning current industry practices and market variations and these understandings will help me succeed in my software developer career path.

5.7 Future Skill Development

I intend to advance my ability in software development throughout the next years. I will ensure to maintain current knowledge of industry advances including AI technology along with machine learning and cloud computing applications. I have set goals to participate in complex tasks and lead projects which will advance my career development.

The skills obtained through this internship will enable me to become a proficient software developer who knows how to perform front-end and back-end development tasks. The continuous learning and professional development that I pursue motivates me to bring my acquired internship knowledge into upcoming work projects.

Chapter 6

Conclusion

6.1 Summary

During my time at Skarbol.Tech I experienced a total professional and personal transformation that presented me with numerous important growth opportunities. During six months I acquired hands-on experience developing software while working on an assortment of applications starting with ERP-based web solutions through AI-based automation solutions and ending with a portable water filtration device. Working on these projects showed me how to bridge classroom concepts with practical challenges thus boosting my technical competencies and problem-solving techniques.

During my internship the CattleSync software project emerged as a major achievement because it provided full cattle farm management solutions. Through implementing React together with Vite and Tailwind CSS I designed and built the user interface as well as created a responsive user-friendly design. I worked at the backend with PHP and MySQL to build modules which handled inventory tracking, animal health observing and sales regulation. The project demanded extensive API integration work and testing and debugging procedures which led me to gain stronger knowledge of full-stack development principles.

The AI-based virtual assistant project stood out to me because I dedicated my energy to adding AI capabilities to the interface. The project required me to create straightforward user interfaces for which I took Postman's help in conducting API testing and jointly worked with the AI development team to achieve clear communication flows between the AI backend and frontend systems. Through this project I gained important knowledge about how AI along with machine learning operates within contemporary software systems.

The internship tests included AI algorithm integration and complex code debugging tasks and API functionality verifications. Through the help of my team along with mentors I surpassed these difficulties to create workable solutions. My experiences at this lab enabled me to enhance both my problem-solving capabilities and technical proficiency at a noteworthy level.

My experience equipped me with essential soft qualities that included effective com-

munication skills and teamwork and adaptability abilities. The team-oriented workplace at Skarbol.Tech sustained frequent team gatherings while promoting open communication thus enabling me to gain excellent teamwork and communication abilities. The experience showed me why constant learning matters along with remaining knowledgeable about modern industry standards.

I maintain my dedication to ongoing professional development as well as learning activities. I aim to develop complete software development skills for frontend and backend while maximizing the lessons learned at this internship. The valuable skills from my internship experience will fuel my work for upcoming projects as I aim to bring significant developments to the software development sector.

6.2 Recommendations for Future Strategic Actions

- **Organization:** Investigate emerging technologies specifically artificial intelligence to elevate your product value proposition.
- **Personal/Professional:** My professional growth strategy involves studying how AI and machine learning work to maintain market leadership in my field.

6.3 Future Goals

I intend to move forward by developing both my software development capabilities along with technical mastery. I want to remain updated regarding current market trends and technologies within my field. I intend to advance my career through challenging projects which also include leadership positions for additional growth. My ambition extends to mastering the capabilities of front-end and back-end development despite the learning experience I gained during this internship.

6.4 Reflections on the Internship Experience

I am truly thankful for all the learning possibilities I experienced during my Skarbol.Tech internship period. Both the CattleSync system project and the AI-based virtual assistant required me to implement my technical abilities as well as problem-solving capabilities in practical professional contexts. The supportive workplace together with mentorship opportunities I received allowed me to grow professionally and develop self-confidence and advanced professional abilities.

The experience from this internship will strongly support my professional path ahead since it granted me essential abilities and practical knowledge. I am enthusiastic about continuing my software development education while pursuing important projects in the future.

References

- [1] *Github documentation*, <https://docs.github.com/en>, Retrieved January 30, 2025, n.d.
- [2] *Node.js documentation*, <https://nodejs.org/en/docs/>, Retrieved January 30, 2025, n.d.
- [3] *Php documentation*, <https://www.php.net/docs.php>, Retrieved January 30, 2025, n.d.
- [4] *Postman documentation*, <https://learning.postman.com/docs/>, Retrieved January 30, 2025, n.d.
- [5] *React documentation*, <https://reactjs.org/docs/getting-started.html>, Retrieved January 30, 2025, n.d.
- [6] Skarbol.Tech. “Skarbol.tech.” Accessed: 2025-01-30. (n.d.), [Online]. Available: <https://skarbol.tech/>.
- [7] *Tailwind css documentation*, <https://tailwindcss.com/docs>, Retrieved January 30, 2025, n.d.