Home Automation Exerting Internet of Things with Child Electric Exposure Precaution System

By

Sayannha Barua
17310001
Oshama Omayes Shamab
17121093
Tammim Afri
17121003
Jawad Abdullah
17121048

A Final Year Design Project (FYDP) submitted to the Department of Electrical and Electronic Engineering in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering or Bachelor of Science in Electronic and Communication Engineering

Electrical and Electronic Engineering
BRAC University
January 2023

Home Automation Exerting Internet of Things with Child Electric Exposure Precaution System

By

Sayannha Barua
17310001
Oshama Omayes Shamab
17121093
Tammim Afri
17121003
Jawad Abdullah
17121048

A Final Year Design Project (FYDP) submitted to the Department of Electrical and Electronic Engineering in partial fulfillment of the requirements for the degree of Bachelor of Science in EEE / ECE

Academic Technical Committee (ATC) Panel Member:

Dr. A.S. Nazmul Huda (Chair)

Associate Professor, Department of EEE BRAC University

Nahid Hossain Taz (Member)

Lecturer, Department of EEE, BRAC University

Raihana Shams Islam Antara (Member)

Lecturer, Department of EEE, BRAC University

Electrical and Electronic Engineering
BRAC University
January 2023

Declaration

It is hereby declared that

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

Student's Full Name & Signature:

Oshama Omayes Shamab 17121093	**Sayannha Barua** 17310001
Jawad Abdullah 17121048	**Tammim Afri** 17121003

Approval

The Final Year Design Project (FYDP) titled "Home Automation Exerting Internet of Things with Child Electric Exposure Precaution System" submitted by

1. Sayannha Barua (17310001)
2. Oshama Omayes Shamab (17121093)
3. Tammim Afri (17121003)
4. Jawad Abdullah (17121048)

of Summer, 2022 has been accepted as satisfactory in partial fulfillment of the requirement for the degree of Bachelor of Science in EEE / ECE on 01/09/2022.

Examining Committee:

Academic Technical Committee (ATC): (Chair)

Dr. A.S. Nazmul Huda
Associate Professor, Department of EEE
BRAC University

Final Year Design Project Coordination Committee: (Chair)

Dr. Abu S.M. Mohsin
Associate Professor, Department of EEE
BRAC University

Department Chair:

Dr. Md. Mosaddequr Rahman
Professor and Chairperson, Department of EEE
BRAC University

Ethics Statement

We have checked the plagiarism of our project report in Library. The similarity index of our paper is 9%.

Abstract

In this paper, we present a Home Automation based on IOT with child electric precaution system. This Home Automation ensures a child's safety by using sensor and messaging in the owner's phone through App. The technology also offers the ability to efficiently operate household appliances using IOT sensors and other communication devices. Anywhere in the world, we can operate household appliances using a mobile device, or a laptop with the help of the internet. Various tube lights, fans, home appliances, electrical motors, air conditioners, and air heating systems are simply controlled by web-enabled or internet-capable devices usingthe system.

Keywords: Home Automation System, Micro-controller, Smart Phone App, Internet of things, Programmable Logic Controller, Power-Line.

Dedication

We would like to give a heartwarming Thanks to our beloved parents and family members for giving us support and encouraging us in our difficult moments and A special thanks to our respective teachers or faculty members who help and guide us to make a final output and complete our project successfully.

Table of Contents

List of Tables

List of Figures

List of Acronyms

IOT	Internet Of Things.
PLC	Programmable Logic Controller.
APP	Android Application.
GSM	Global System for Mobile communication.
GPRS	General Packet Radio Service.

Glossary

Terms	Definition
App (Android Application)	The term "app" is a shorthand for "application." An application is a piece of software that is designed or created specifically to carry out a certain task for the user or, in certain situations, for another application program. A software program that runs on the Android platform is known as an Android app. A standard Android app is created for a smart phone because the Android platform was created for mobile devices.
IOT (Internet of Things)	The Internet of Things (IoT) is a network of interconnected computers, mechanical and digital equipment, people, and other devices that may exchange data across the network without requiring human-to-human or human-to-computer interaction.
Siemens LOGO!	Siemens defines Siemens LOGO! as an all-purpose logic module. It is also known as a tiny PLC or a PLC with a specialized function.
GSM	GSM is Global System for Mobile communication is a digital mobile network that is widely used by mobile phone users.
GPRS	Data transfers across mobile networks are made possible by the packet-switching technology known as General Packet

	Radio Service. MMS, mobile internet, and other data transmission all use it.
GSM / GPRS Communication	In order to create connection between a mobile device or computer and a GSM or GPRS system, a microchip or circuit known as a GSM module or GPRS module is required.

Chapter 1: Introduction [CO1, CO2, CO10]

1.1 Introduction

In recent years, home automation has become popular in daily life and has been easier as a result of the rapid development of technology. Almost everything has been automated and digitalized. It is a dynamic technology that allows us to control hardware devices through the internet. There are numerous home automation systems that employ various microcontrollers and use various parameters to track and manage household appliances. The technology offers the ability to efficiently operate household appliances using IoT sensors and other communication devices. Anywhere in the world, we can operate household appliances using a mobile device, or a laptop with the help of the internet. Various tube lights, fans, home appliances, electrical motors, air conditioners, and air heating systems are simply controlled by web-enabled or internet-capable devices using the system. Due to their gradual decline in implementation costs and ability to provide flexible functionality that can be easily customized by everyone in accordance with their needs, all of these types of systems are growing in popularity.

Although there are loads of home automation systems available in the market, we have developed an IOT-based home automation system that has the feature to provide child safety when they get closer to any electrical socket connected to our home automation system. It will assure parents that their wards are safe from any electrical hazard while they are in close proximity to their children.

1.1.1. Problem Statement

Parenting requires immediate attention to a child's needs and regular supervision of them up to the age of 18 months. In the past, parents relied on hearing their children's cries. When parents were less busy and homes were smaller, this was very simple. Parental carelessness can have serious consequences, especially because children are known to get into trouble. Many deaths and accidents of children incur due to sticking their hands into live electrical sockets throughout the world. In this era of total rush, it is very much difficult to look after babies constantly.

This requires the development of a home automation system that is appropriate for the modern era and serves as a parenting aid for working and single parents who find it challenging to care for their children constantly while also engaging in other activities like cooking, housework, office work, and so forth. Nevertheless, it is not meant to Replace the babysitter or parent entirely. Rather, it aids them.

The demand for child safety is growing, especially, where houses are now more installed with electric sockets and junctions. This report focuses on an important idea that the development of a home automation system with child protection and a notification system through SMS to the parents is needed more than ever.

1.1.2. Background Research

The control of electricity-driven appliances in a household is made possible through 'Home Automation', also commonly known as "Smart Home". This technique assists us in monitoring electric devices at home such as lights, fans, air conditioners, heaters, electric kettles, iron, and so on. Not only does a Smart Home allow us to control a wide range of common household electrical devices, but it also improves the security system of the home in many ways. For instance, emergency alarms for different purposes can be placed to alert the house members. A home automation system addresses the distance factor by effectively aiding customers in operating from all distances, an important consequence of which is saving electricity and energy [1].

Through the Home Automation system, users can access their home devices and turn them on or off through internet connectivity. This can be done through a mobile application, laptop, or any other device that is connected to an internet network. Users will be able to see the status of their devices on their smartphones and change them according to their preferences through advanced discovered algorithms. This 'Home Automation System' is based on IOT, which is short for "Internet of Things". IOT is a system that creates a connection between various computing devices and machines. It can assign UIDs (unique identifiers) to living creatures (animals and people) as well as to nonliving objects. As a result, it allows the transmission of information over a network in the absence of actual physical interaction between people and devices [1].

Among the many advantages of a Smart Home, "raised living standards" and 'saving energy' are two evident ones. The ability to monitor home appliances from any part of the world at any time only with internet connectivity surely adds an advanced and modern edge to the users' lifestyles.

There are several ways to design a Smart Home, three of which will be highlighted in this report- (1) PLC (Programmable logic controller), (2) Power line, and (3) IOT. In terms of multiple analyzed parameters like speed, security, power supply, and many others, IOT proves to be the most effective approach to a Smart Home.

1.1.3. Literature Review

The literature review on numerous kid safety prototypes is discussed below. A parent can send a message to the GSM module, and the GSM module will respond with specific information about the children based on the message information [2]. Google Maps allows us to view the location. Pressing the device's button will cause it to take a picture of the child and send it together with user information to the registered cellphone numbers when the youngster is in an emergency. It won't take long to save the child's life. Using GPS, GPRS, and GSM for position tracking and speed monitoring from the perspective of youngsters. The system is fixed to the automobile, or any other type of vehicle so that the GPS tracker can determine if the vehicle is traveling on a regular route or not and also

determine the bus's speed [3]. Nowadays, digital technology is quite important for connecting people online. Parents are given an android-based solution for tracking their children. The internet is the medium that joins several parts using a single device and is connected to a server. Using an ARM-7 LPC2148 microcontroller and a GSM location tracker, parents can monitor their kids in real-time [4]. Cases of missing children are steadily growing in real-world situations. Child care is a significant problem. Different approaches are presented to find effective solutions. To solve it, numerous methods and systems have been put in place. A two-node global positioning system (GPS)-based solution to the child-care dilemma was put forth in [5]. One of these two nodes is a child node that has a GPS receiver and a Bluetooth module. A Bluetooth capable mobile makes up the parent node. GPS technology can be used to track the child's location. There are two modules in the paper [6]: an audio playback module and a Wi-Fi module. Parents can receive information on the infant via a Wi-Fi module. The accelerometer sensor, cry sensor, temperature sensor, gas sensor, flame sensor, and PIR sensor are among the various sensors used by the audio playback module to produce the recorded sound. The embedded system comprises a micro-controller and an accelerometer that senses the baby's movement and angular position. Lastly, ABCs is a gadget that can follow kids who can crawl or walk, enabling parents to keep an eye on them while they are working on other things. The ABCs was created as a tool to assist a parent, following the child and automatically warning them so that the child does not stray into dangerous areas around the house [7].

1.1.4 Relevance to current and future Industry

The current generation is the target audience for this initiative. It becomes challenging for parents or family members to protect their children from electric hazards and complete other activities at the same time especially when both parents are employed. This smart, Internet of Things-based child electric exposure precaution system and home automation system described in this paper can help parents or other caregivers autonomously with the activities of infants. Numerous features have undergone testing and produced positive outcomes. A mobile app has been developed to monitor a number of different factors, including controlling electric devices and getting texts when a child is near any electric socket. Our home automation is fully connected with the flow of advanced development in the home automation sector. Today's smart home automation industries like Trionix Technology Limited, STATA IT Ltd., Canary, etc. focus more on security and living sustainably. Modern house automation trends include portable/email/content warnings, computerized lights, robotized indoor regulator alteration, booking machines, remote video observation, and remote versatile control. The home system's eyes and ears are sensors. There are sensors for a wide range of applications, including detecting motion or development and measuring temperature, moisture, light, fluid, and gas [8].

Future home automation systems will be able to provide nearly all necessary services, including communication, healthcare, energy, utilities, entertainment, and security. More

and more devices will connect to one another as we enter the next generation. The ideal scenario is a world in which data is transmitted between machines and people without the need for manual byte input. computers that can gather data automatically and then modify it. With the progress of time, engineers are working toward these objectives is the advancement in home automation technology that allows us to safeguard, monitor, and manage our home using a smartphone. Future home automation services will view the smart home as an efficient means of delivering remote services, particularly to children, the elderly, and people with disabilities who need close supervision and assistance. We may anticipate that the home of the future will be even more automated and secure than theone we live in now as technology improve.

1.2 Objectives, Requirements, Specification and constant

1.2.1. Objectives

- Control of electricity-driven appliances in a household from a distance
- Access to home devices through internet connectivity
- Improving the security system of the home
- Allowing users to monitor children's distances from electrical appliances, and turn the devices on/ off accordingly

1.2.2. Specifications

PIR Sensor : An electronic sensor that measures the infrared (IR) light emitted by objects in its field of vision is known as a passive infrared sensor (PIR sensor).
GSM (Global System for mobile communication) : We use a GSM module in Proteus called SIM800l. It uses wireless radiation monitoring to alert the user with a text message when a child goes near a power point.
Relay : The type of switch that we used for our lamps is a single pole double throw (SPDT) relay.
BUCK convertor : DC-to-DC power converter which steps down voltage.
SMPs : A switching regulator is incorporated into an electronic power supply called a switched mode power supply in order to efficiently convert electrical power. An SMPS converts voltage and current characteristics while transferring power from an AC source to DC loads, like a personal computer.
16x2 LCD (LM016L) : An LCD (liquid crystal display) that can display a total of 32 characters (16 in each line) is used to show the ongoing state of the circuit. This LCD is connected to the Arduino through a PCF8574-I2C LCD driver to reduce the number of pins required to connect the LCD and the Arduino.
Proteus: This is the software that we used for building the circuit.

Arduino IDE: This consists of a text editor and a compiler which we used to write the code and compile it respectively to program the Arduino UNO in our circuit design.
COMPIM: Used as a part of the process of setting up and connecting the Blynk app to the Proteus circuit. Its function is to model physical COM interfaces in Proteus. The Baud rate is selected according to our preference.
ESP-12 Wi-Fi Module: An invention of the AI-Thinker team, the processor of this module is ESP8266 which is a fast-high integration wireless SOC. It's mainly designed for space and power-constrained mobile platform designers. Among all the Wi-Fi chips in the hi-tech industry, ESP8266EX is the most operable and integrated chip currently. It provides an unmatchable ability to embed Wi-Fi capabilities within other systems or functions. Not only that, it's also the lowest cost chip in the market with minimal space requirement. In addition, it can serve as a Wi-Fi adapter so wireless internet access can be added to any micro-controller-based design with simple connectivity (SPI/SDIO or I2C/UART interface).
Blynk: Mobile application to implement our Smart Home Design by interacting with the Arduino UNO (microcontroller) and the rest of the circuit. It's an essential and widely used app for projects involving microcontrollers and IoT. Users will control the appliances by giving commands through this app.
Arduino: This microcontroller Arduino Mega 2560 Pro is the central processing unit of our design. It takes the programming code as input to implement it on the circuit. Several pins of the Arduino UNO are connected to several input/output devices, sensor, etc. in our circuit design to control the entire process of Smart Home.

1.2.3 Technical and Non-technical consideration in design process:

- Developing a cost-efficient home automation system
- Capable of controlling the electrical appliances at home via the internet
- Connected to the internet, allowing users to control them through a mobile app called 'Blynk'
- Ensuring minimum physical interaction between users and electrical home appliances
- More comfortable lifestyles, improve home security systems
- Enabling energy efficiency
- Will allow users to monitor children's distances from electrical appliances
- Turn the devices off through the app when children get close to a certain radius of the devices

1.2.4 Constraints:

Constraints mainly involved time and budget. The challenge was to make a cost-effective and easy-to-use Smart Home System. Consumers are not interested to spend a fortune on Smart homes, especially one that is complicated to operate. Downloading necessary software for the design, building the circuit, selecting specifications for components, and writing the code was highly time-consuming. A concerning constraint is that some software isn't available for free (e.g. Virtual Serial Port Driver Pro software) so we're using them for a certain trial period after which it'll become unusable.

1.2.5 Applicable compliances, standards, and codes:

Table 1: Applicable compliances, standards, and codes

System	Compliances	Standards and Codes
IoT-based home automation	Software for model system simulation	Proteus
	Code compiler	Arduino IDE
	Sensor	PIR sensor
	Home appliance	Lamps, Motors
	Data transmitter and receiver	Arduino, GSM (SIM800L)
	Central Processing Unit for communication	Arduino UNO
	Connect the circuit to the Blynk app	COMPIM
	Relays	
	Wi-Fi-module	ESP-12F
	LCD	16x2 LCD(LM016L), PCF8574-12C LCD Driver
	Control home appliances through app	Blynk app (Blynk 0.1 legacy)
	Read data transmitted and received	Virtual terminal

1.3 Systematic summary of the proposed project

Using the Arduino UNO as our main processing unit for communication, we construct a circuit using the Proteus program. Push button switches in our circuit can be used both manually and through the Blynk app on users' smartphones to control the lighting in our circuit that represent home appliances. Between Arduino and the household appliances, relays are employed. On their app, users may check the status of the lighting (on/off) and alter them to suit their preferences. Our circuit uses an ESP-12F Wi-Fi module to make it accessible through the Blynk app when the app is linked to an internet network. In order to rotate and detect motion within a specified radius of it, we use an ultrasonic sensor attached to a servo motor. The circuit's distance can be altered using the potentiometer. When motion is detected, the sensor will send this information to the Arduino UNO, which will then send a text message to users via GSM and turn off the device/powerline automatically.Two virtual terminals are utilized to monitor all of this data transmission and reception, and an LCD is used to constantly show the circuit's current state. The Arduino IDE has been used to compile the programming code and insert it into the Arduino UNO in our circuit. The Proteus circuit in the computer will be checked to determine if a connection has been made with the Blynk app on smartphones using another program named "VirtualSerial Port Driver Pro." The innovative aspect of our concept is the IoT-based Home Automation strategy, which enables users to keep track of children's distances from electrical appliances and turn them off via an app when they are within a predetermined range of them.

1.4 Conclusion

Due to the quick advancement of technology, home automation has recently gained popularity and made living easier. Everything has been automated and digitalized almost completely. We can manage hardware through the internet thanks to this innovative technology. There are many home automation systems that use different microcontrollers and different parameters to monitor and control home appliances. IoT and other communication tools can be used with the technology to operate home appliances effectively. We can use a mobile device or a laptop connected to the internet to operate household appliances from anywhere in the world. The system only allows users to operate a variety of tube lights, fans, home appliances, electrical motors, air conditioners, and air heating systems. All of these kinds of systems are becoming more and more common due to their progressive decrease in implementation costs and capacity to offer flexible functionality that can be readily changed by everyone in accordance with their needs. Although there are many home automation systems on the market, we have created an IoT-based home automation system that has the capability of providing kid protection whenever a connected electrical socket is within reach of a child. It will reassure parents that their children are secure from any electrical risks while they are around.

Chapter 2: Project Design Approach [CO5, CO6]

2.1 Introduction :

People always have desired greater comfort and convenience in their lives, and IOT in smart homes is well qualified for the role of simplifying and improving people's lives. In this modern era, IOT based Home automation system are very popular among the people around the world as it can make people's life easy and comfortable. After researching some papers or articles, we find three types of home automation system's design approaches which can implement in real life for the betterment of people. Though we have chosen one best design, but we have other two designs as well. The three design approaches to home automation that we have identified are - 1. Home automation using power line, 2. Home automation using PLC (programmable logic controller), and 3. IoT based Home Automation System. Now, we have discussed multiple design approaches in this chapter.

2.2 Identify multiple design approach :

1) Powerline :

In powerline home automation system, a power line communication framework is implemented using Microchip PIC micro-controllers. The design is basic master/slave: the master is the control unit, capable of sending orders and slave is the unit that connects with the window junction box, which controls the window motor. The user interface consists of a small keyboard with three buttons, each for a particular function [7]. In this home automation system, the Microchip PIC16F876 [7] is the micro-controller that controls communication: if the user sends a command, it transmits the associated packet across the network, identifying if someone else is carrying the line or if the line is free, and performing synchronization with the slave unit. On the other hand, the slave unit is detecting the power line to determine whether someone is transmitting. If this is the case, following the synchronization phase, the microcontroller receives and analyses the data to send the appropriate command to the window junction box [7].

This power line home automation system is a low budget system. It transfers data using existing power lines and it doesn't need additional wires to transfer the information. However, this system is very complicated and demands the use of extra converter circuits and devices. If we consider AC or DC power-line for smart home automation system, then the cost of installation will be the main problem for normal people.
On the other hand, AC power-line structures, are implemented over AC voltages each in closed environments and within a wide distribution of power grids, over very long distances and with large amounts of energy involved [7]. If we consider a power supply for an entire building, the major wires are scattered around the structure and handle the entire load created by equipment as devices operate on energy. [7].

AC power line systems may perform a variety of tasks, including assessing the power meter, sending records and voice through standard lines, paying the electricity bill, and storing network information [7]. As every house and building has correctly installed electricity lines, the existing power lines may be utilized to connect a high-speed internet connectivity position without any need for new connections.

2) PLC :

In PLC based home sutomation system, all the home appliances are connected to the main controller which is a programmable logic controller (PLC) through a [8] communication cable. To interact with the main controller, the equipment is connected with actuators. The computer centralizes all processes via a wire that communicates with the main controller(PLC) on a constant basis. [8].
In this home automation system, Motion detector floodlights will be utilized, which transforms light in the wavelengths into electrical current, activating an alert in the detector's minicomputer [8] housed and activating the switch. The radar becomes sensitive when there is a moving object in the absence of light, and enters a complete negative condition. When no moving object is detected, the light goes dark. [8]. In this system, Control signals are sent by the PLC to the actuators and the local power unit. The system's hardware is affected by the local power unit. [8]. So, this is a power consuming system. The installation cost of this system is high as users need to buy wires, switches, and hubs for installing this system.
On the other hand, this system won't have problems like interference or range as it has [8] reliability. PLC based home automation system comes with low security risks because wired networks are less vulnerable to attacks by hackers. This system can reduce the cost of energy uses [8]. Electrical wiring, power wiring, computer and a main controller will also be used in this PLC based home automation system.

3) IoT :

IoT is used in home automation to control, monitor, and transmit data to other devices without the need for human-to-human or human-to-computer interact through the internet. It enables certain actions to be carried out automatically, whenever specific circumstances occur, For example, when a person enters the bedroom, the light turns on automatically, and when the person leaves the room, the light turns off automatically, or the person can control the switching from his smart phone's mobile application. It is possible to program the lights in a specific area of the home to turn on and off automatically [9]. The internet connection is provided via IOT and Sensors can be connected to home related appliances. It incorporates computer intelligence into home devices to allow for the monitoring of home conditions and the control of household appliances [9]. The smart home is more secure and safe due to several sensor devices [9]. In Fig.3, A smart motion detector sensor

will be used for IOT Home automation system. This sensor will let users know when there's movement in their home. Using infrared technology, [9] it monitors the surroundings and sends a notification to user's smartphone when motion is detected [9]. Smart motion sensors have a variety of security applications for detecting motion and alert homeowners [9] when they are away. By using smart motion Sensor, the lights can be turned on/off automatically when someone walks into, or out of a room.
Again if we connect motion sensor with the smart phone, then users don't need to be worry because If any incident happens, the user will be notified via their smart phone using the Android application. If an invader tries to sneak [9] into a user's residence, then Users do not need to be concerned because they can monitor using their phone that is connected to the smart motion detector sensor, and if the smart motion detector sensor detects any movement, it will quickly send alerts to the user's phone, allowing them to receive the essential information and take necessary action.

Now, voice recognition system can recognize voice and control home appliances through speech and also control it through internet. Here, we wanted to use voice recognition system to stop all the electrical home appliances, when not used or before going out, in order to save more energy and reduce the electricity bill cost. Also, this voice recognition system will be adjusted or connected with the smart-phones and Internet. We wanted to connect voice recognition system with our home automation but unfortunately, it wasn't work properly so, we removed voice recognition system from our project.

In this home automation system, The energy efficiency may be increased since more energy is conserved and the cost of electricity is reduced when electrical appliances are switched off automatically or simply when they are not in use.

For our project, Wi-Fi has been selected because of its appropriate functionality. WIFI has more than enough capability to be implemented into the design. Furthermore, the majority of today's laptops, notebooks, and smartphones include a built-in Wi-Fi adaptor. This system's cost will be reduced indirectly. Because of its user-friendly interface, An appropriate Android application based on Wi-Fi is used. [14].

2.3 Describe Multiple Design Approach :

1) Powerline:

We build a circuit on Proteus software, using Atmel AT89C51 micro-controller. In Transmitting end, we use user interface LCD and keypad. FSK modulator is used for adjusting the carrier signal's frequency in response to the information stream, one frequency for logic level 1 and another for logic level 0. If we use FSK, we can simply retrieve the original filter because the amplitude is no longer significant, so the influence

of noise is reduced. Bandpass filter is also used in transmitting end for limiting the bandwidth of the output signal to the band allocated for the transmission so that we can avoid extra noises that comes from powerline and get the original and a clear message signal.

In Receiving end, we used FSK demodulator to demodulate the signal and to get rid of the little floats in the waveform output. Relays are used for controlling high current circuits with the help of low current signals. We used transistor in receiving end. The transistor turns ON and OFF in response to the microcontroller. Our information signal is a high frequency signal so, a coupling transformer used here as a high frequency transformer to lower the voltage of existing power circuits to run low-voltage devices and raise the voltage of electric generators to carry electric power across long distances.

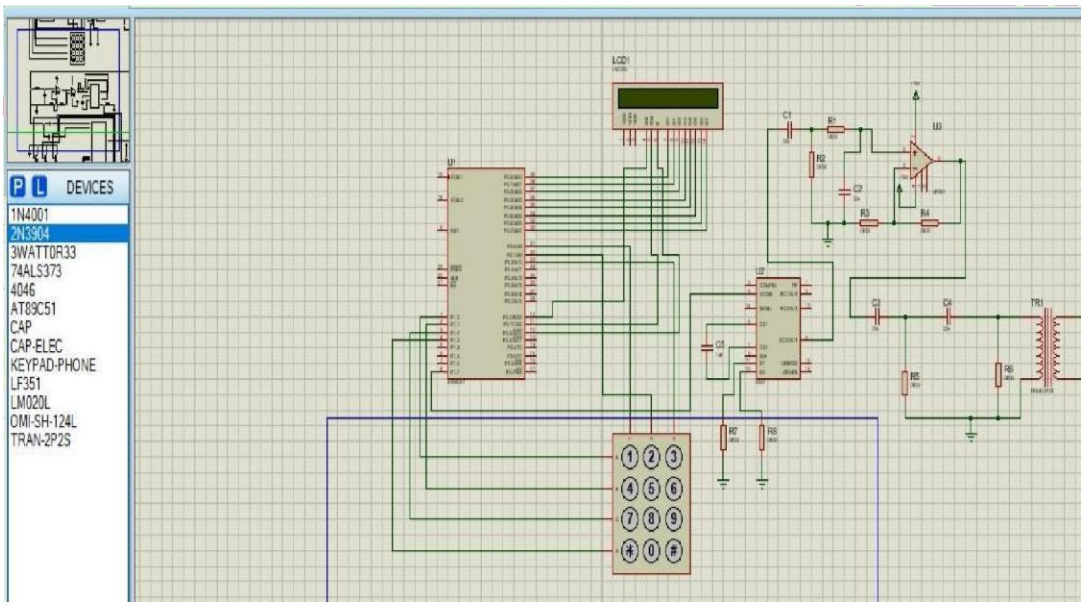


Figure 1: Transmitting End

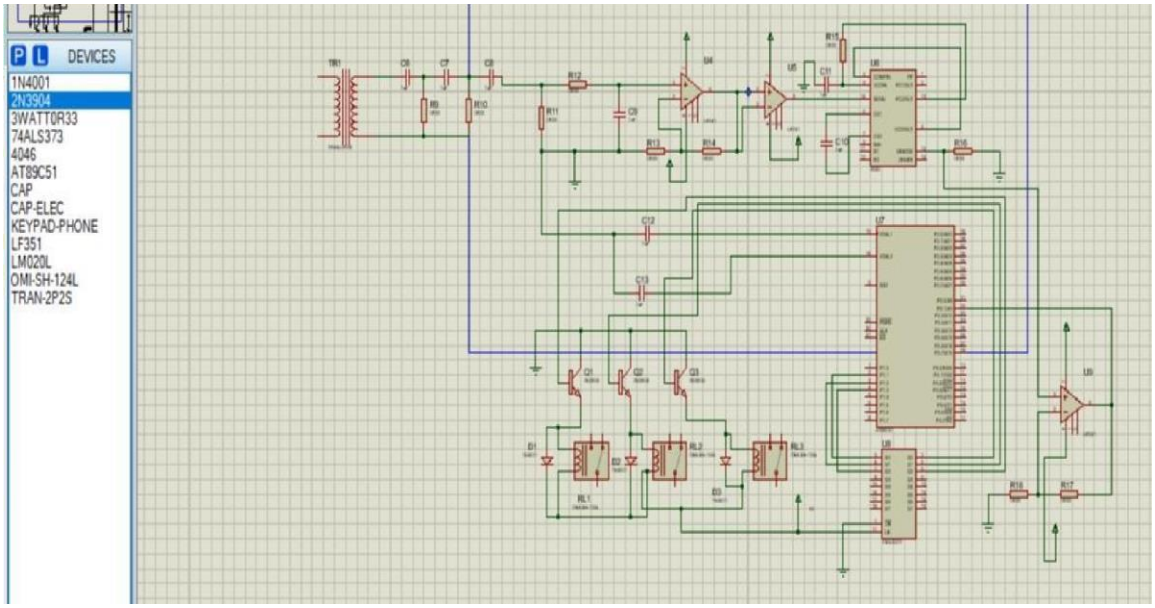


Figure 2: Receiving End

2) PLC:

For multiple design approaches PLC is an option to automate home. PLC can help to achieve home automation, for example, air conditioning system or light and other appliances can be switched on or off according to the demand of home ambience. A PLC based security system will detect smoke and send alarm text to the user mobile, automate by balancing the cooling system of the room by turning AC, heater or fan on or off, automate water supply pump according to the demand of the water and excessive electrical power usage.

A preliminary A Design of Multiple Alternative Solution: (Hardware):

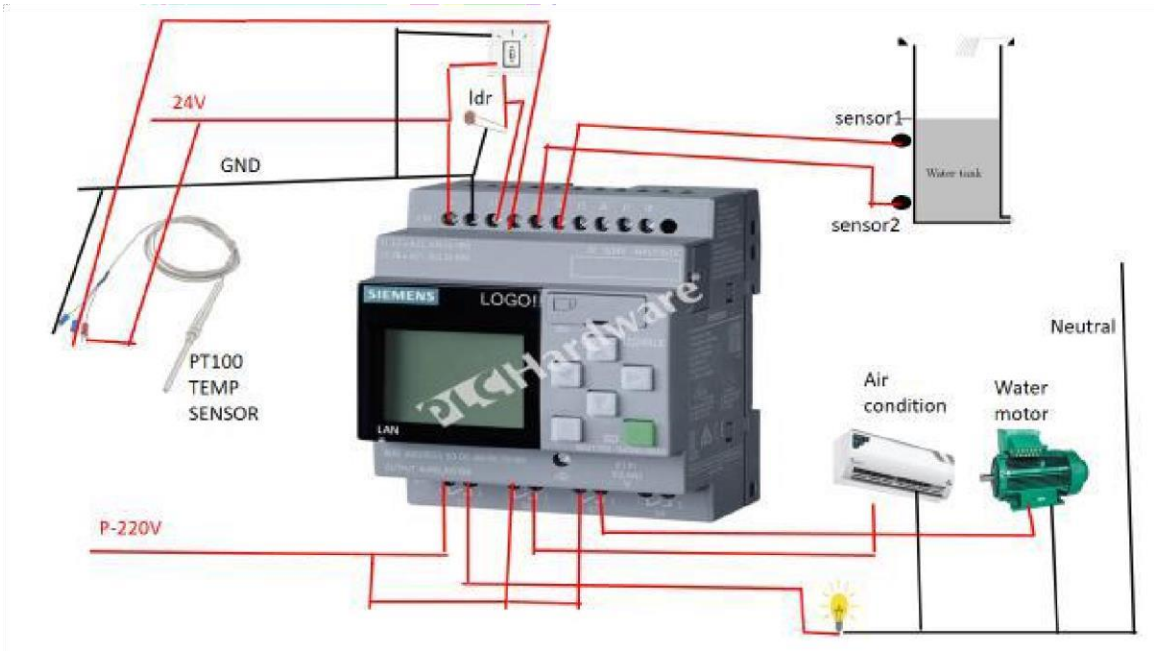


Figure 3: A PLC based home appliances connection

3) IOT:

We build a circuit on Proteus software, using Arduino UNO as our central processing unit for communication. The lamps in our circuit which represent home appliances can be controlled by push button switches in our circuit manually and also through the Blynk app on users' smartphones. Relays are used between Arduino and the home appliances. Users' can see the status (on/off) of the lamps on their app and also change them according to their preference. A Wi-Fi module (ESP-12F) is used in our circuit to make it accessible via the Blynk app when the app is connected to an internet network. We use an ultrasonic sensor connected to a servo motor to rotate and detect motion within a certain radius of it. The potentiometer is used to change that distance in the circuit. On sensing motion, the sensor will transmit this information to the Arduino UNO which will then send a text message to alert users through the GSM and also automatically turn off the device/powerline. Two virtual terminals are used to see all this data transmission and receiving while LCD is used to display the ongoing status of the circuit at any time. The programming code for this circuit's functioning has been compiled in Arduino IDE and inserted into the Arduino UNO in our circuit. Another software called "Virtual Serial Port Driver Pro' will be used to see if the proteus circuit in the computer has connected to the Blynk app on smartphones.

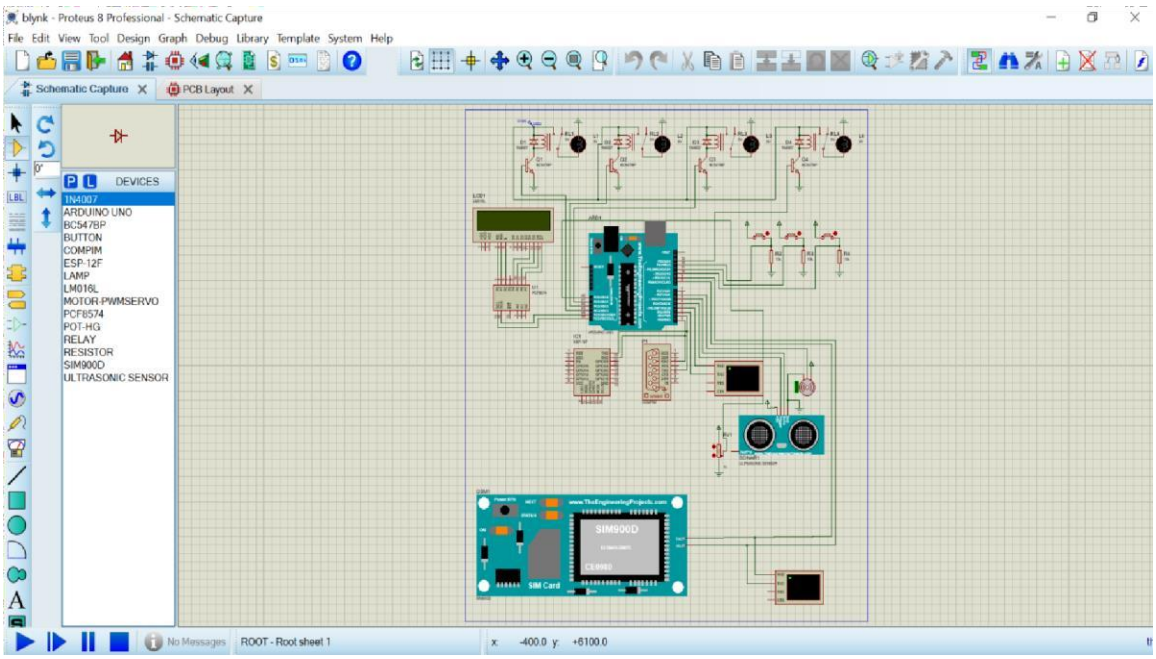


Figure 4: IOT Proteus Circuit Diagram

Design Comparison:

We think among three home-automation systems design approaches, IOT based Home Automation System will be the best approach. Those are given below:

Table 2 : Design Comparison

Types of Home Automation System .	**Power Line Home Automation System.**	**PLC based Home Automation System.**	**IOT based Home Automation System.**
1)Complexity	1) Power Line home automation systems are quite complicated and demand the use of extra converter circuits and devices. [7].	1) In this home automation system, everything will be connected by a wire. The equipment is attached with wires to communicate [8] with the programmable logic controller (PLC) [8]. So, there is a lot of complexity in wire connection.This system is extremely inflexible [8].	1) IOT based home automation system is a wireless home automation system that has a much more flexibility than wired systems [9].

2) Installation Process	2) Installation process is troublesome. Because of the uses of existing power lines, this system became less expensive. There is no need for extra wiring or cabling. consumers do not have to pay taxes for this system as they are using the existing power lines.	2) Installation process is hard and expensive. When installing a PLC, input/output installation is the most critical job. [8] This system is difficult to ignore the complication of passing via wires or unsecured electricity connections in this system. The programming language of PLC is also a bit difficult.	2) This system has several advantages, including Easy of use, flexibility in installation, avoidance of the complications of flowing across wires or poor electricity connection, rapid problem identification, and, most importantly, easy mobility. It makes the system easily accessible to the end user. [9].
3) Risks	3) In power line home automation system, if a noise gets mixed with communication signal while a household appliance is connected to a power line, it can disrupt the home appliances and causes difficulties with the power line communication system. [7].	3) In this home automation system, wires can be easily damaged. Exposed wires are sensitive to routine mistreatment. Exposed and improperly installed wires may also provide a tripping hazard, not only damage the cable but also perhaps [8] sending someone to the emergenc hospital. [8] Wires that have been damaged must need to be entirely replaced. Otherwise, there will be a greater risk for damaging home appliances.	3) IOT home automation system is free from mixing up noise power with signal and has no complexity. So, there is no chance to disturb the home appliances and create problems. It is completely easy to use and comfortable. It reduces manual efforts.
4) Security	4) Although power line systems seem to be more resistant tothreats, they are not entirely secured and require some software [7] protection to achieve acceptable levels of security against potential attacks.	4) PLC based home automation system is secured because wired networks are less vulnerable to attacks by hackers. But, it has also risks because of damaged wires.	4) IOT home automation system also gives a better security as this system can be connected with advanced sensors and smart-phones which can give an emergency alert to users if anything bad happened.

5) Saving energy and Electricity bill cost	5) As this is a power line home automation system, It transfers data across existing power lines, which consumes a lot of energy. [7]. So, although this system is a low budget system but it cannot save energy rather it will use energy in every home appliance that will be controlled by using power line.	5)The extensibility [8] of this system may be both costly and time-consuming. As PLC based home automation system has a lot of cords and cables connections like Electrical wiring, power wiring, Connections of wires with computer and a main controller, buying hubs and switches, so ofcourse it will increase electrical bill cost at high rate. At the end, this home automation system controls the energy systems and increases energy efficiency [8]	5) IOT based home automation system will conserve more energy and lower the cost of electricity. Saving energy benefits the environment by reducing pollution. .

People always have desired greater comfort and convenience in their lives, and IOT in smart homes is well qualified for the role of simplifying and improving people's lives. In this modern era, IOT based Home automations are very popular among the people around the world as it can make people’s life easy and comfortable.

2.4 Analysis of Multiple Design Approach :

By simulating the circuits of our designs on their respective software, we observed their various aspects such as speed, connectivity, etc. Here, we analysed the multiple design approach.

PLC :

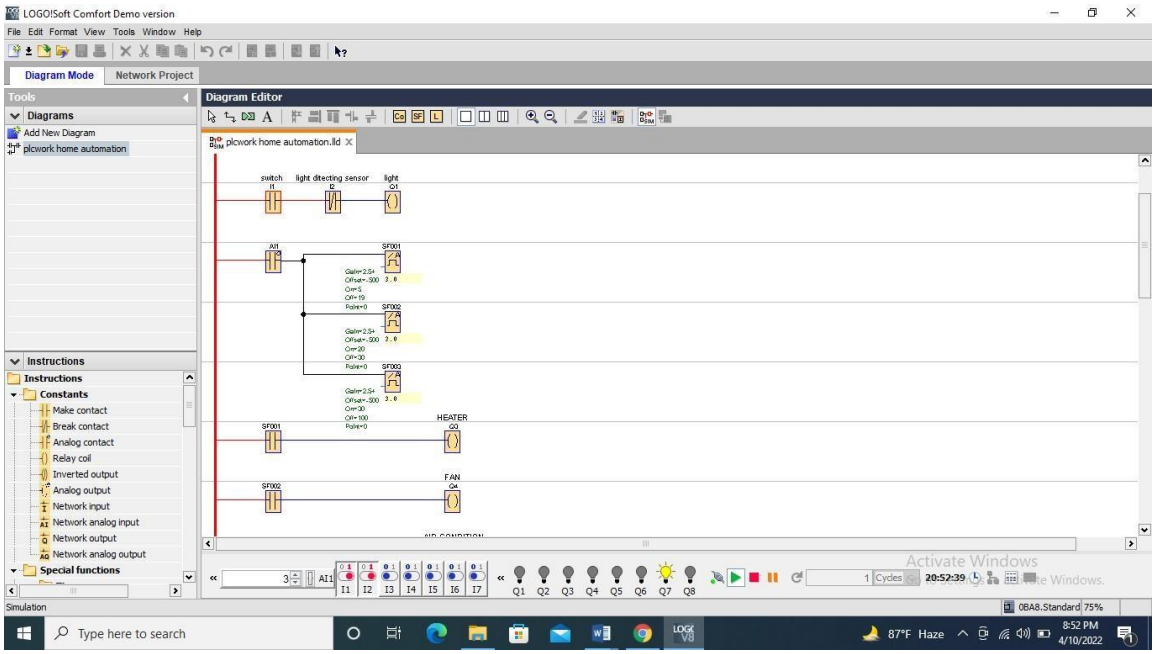


Figure 5 : PLC Circuit Diagram in Software

Test case: In Fig 2 and Fig 3, switch 1 is on and when LDR can sense light that contact gets opened and light will automatically be turned off otherwise light will be kept o

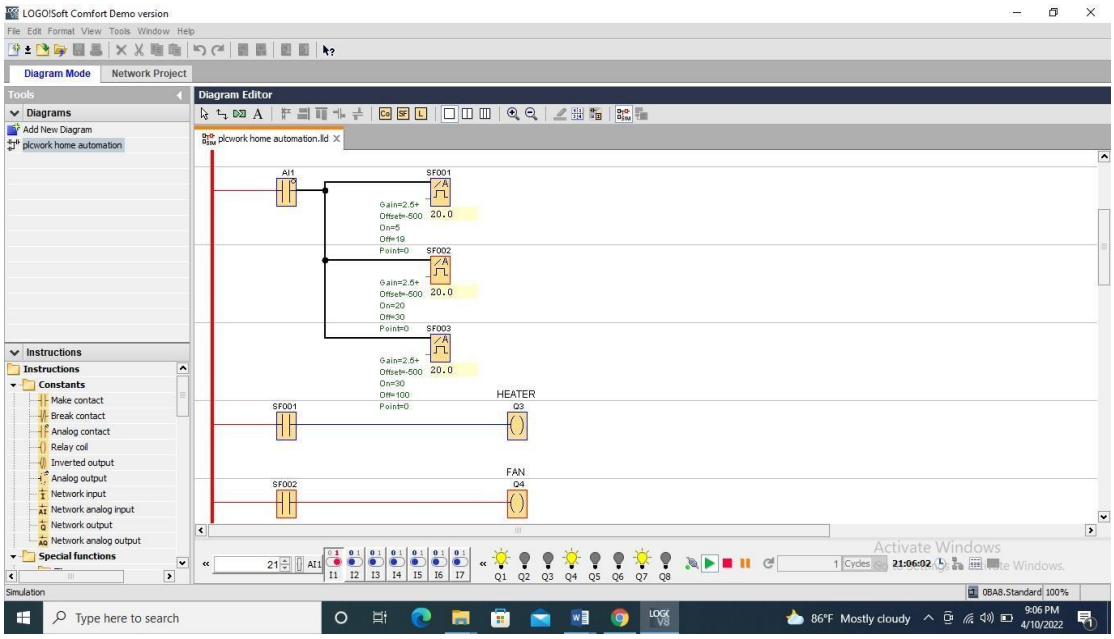


Figure 6: PLC Test case 1: when temp is 5-19*C fan (Q4) is on

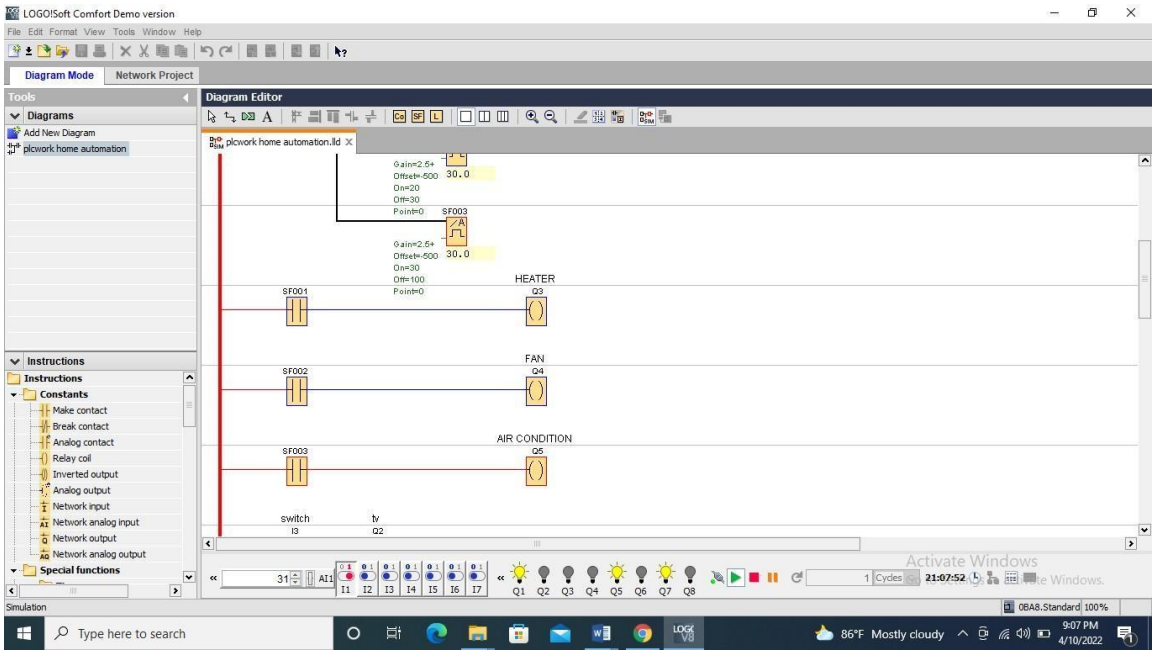


Figure 7: PLC Test case 2: when temp is 19-30*C fan (Q4) is on

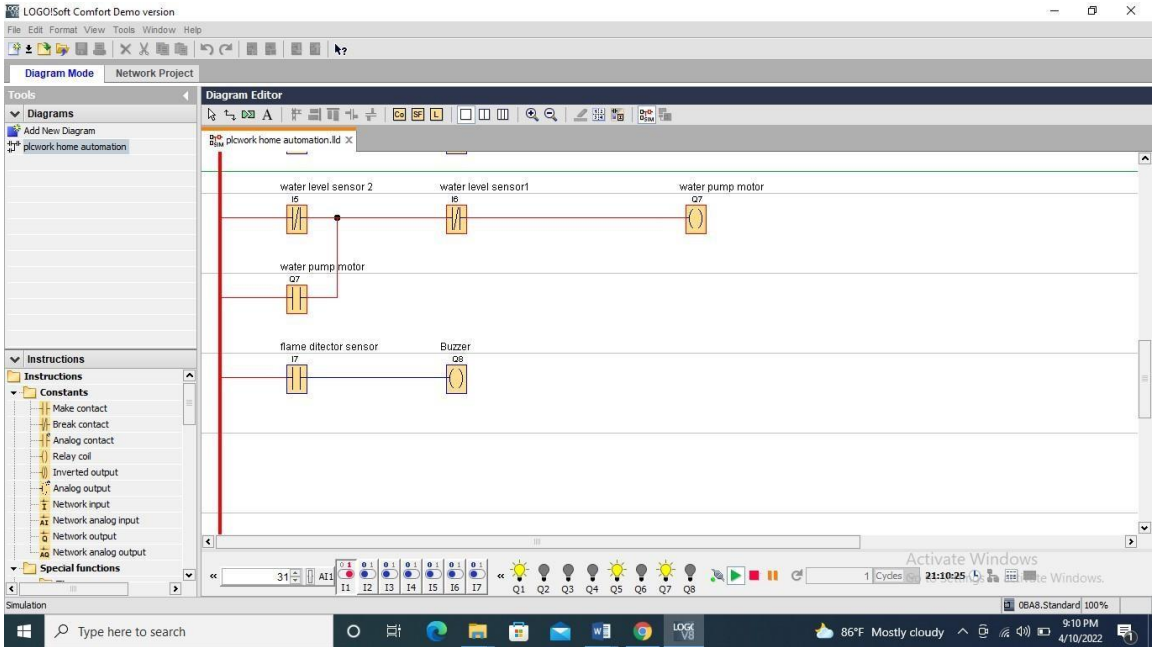


Figure 8: Test case 3: when temp is 31-100*c air condition (Q5) is on

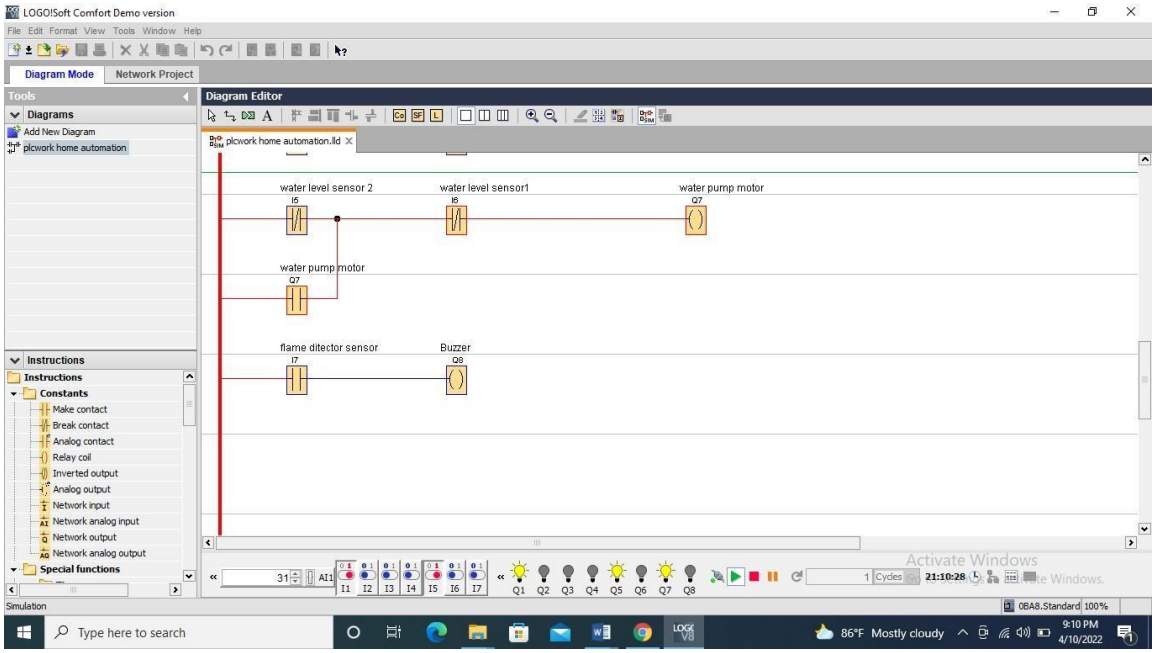


Figure 9: Test case 4: when 2 water level sensors (I5 and I6) didn't get the touch of water contacts are closed water pump motor (Q7) is on.

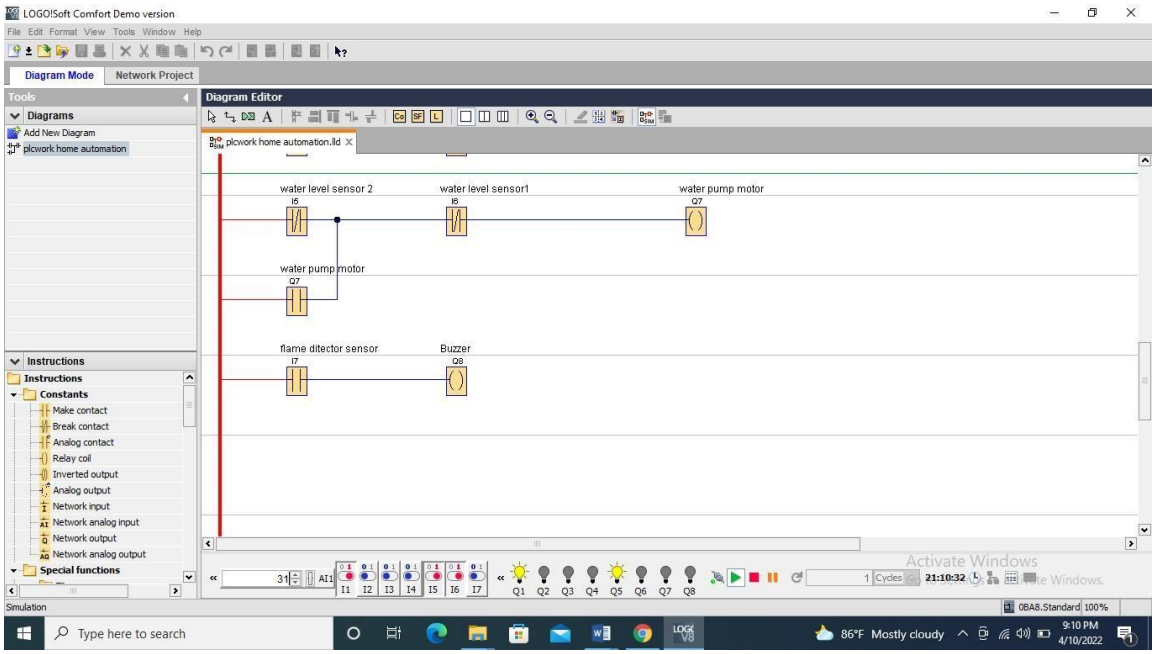


Figure 10: Test case 5: when sensor 1 and sensor 2 (I5 and I6) is filled with water then water pump motor (Q7) is off

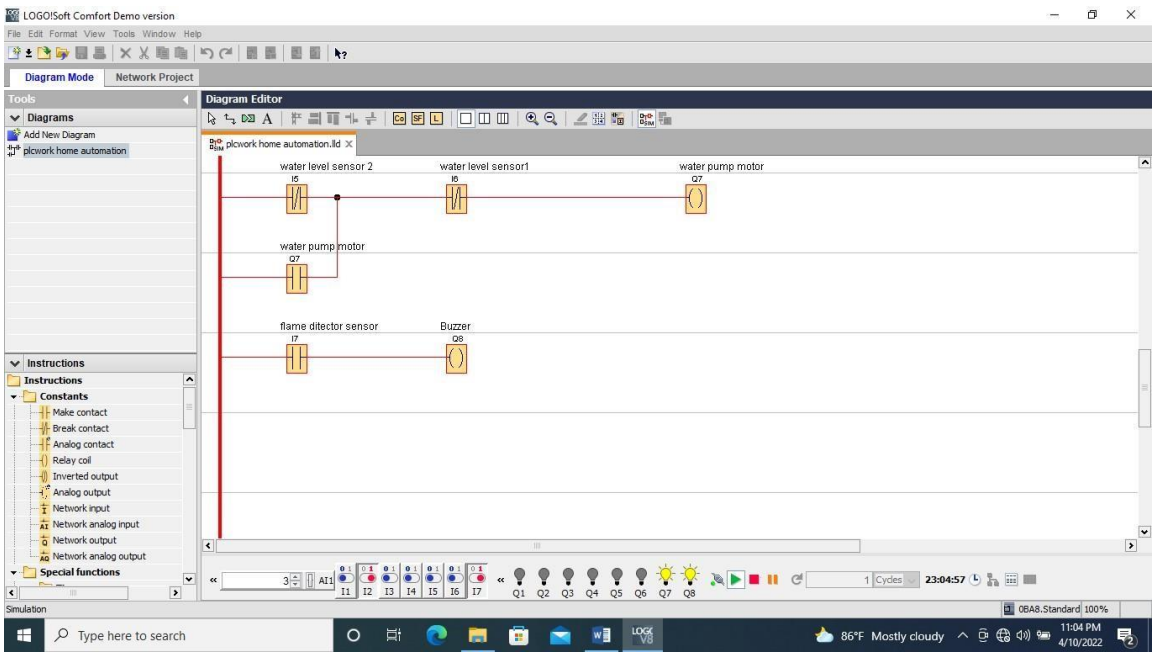
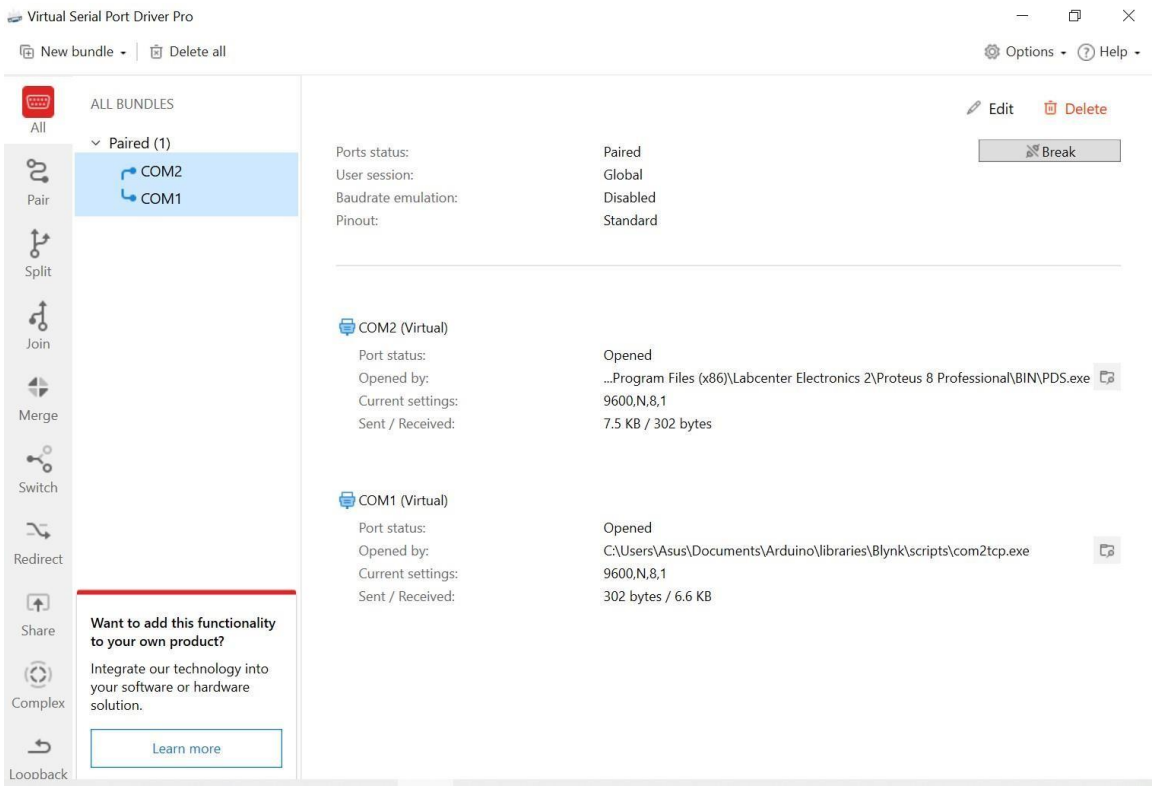


Figure 11: Test case 6: as soon as I7 flame detects Q8 buzzer is on

IOT:

1. Ensuring a connection between Proteus software and Blynk app using ‘Virtual Serial Port Driver Pro’ software:



2)Controlling lamps using Blynk app:

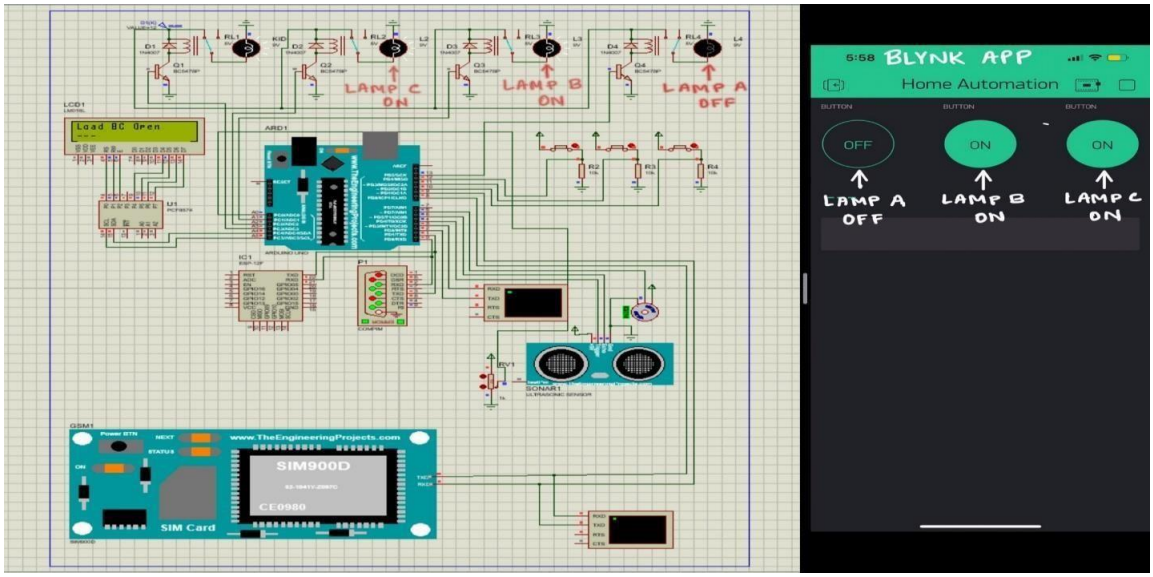


Figure 12 : IOT test case 1

2. Lamp remains on when the distance (potentiometer readings is more than 50, according to our code). The fluctuations in distance readings (i.e. 61,111,61,111….) is due to the constant rotation of the sensor as it's mounted on a servo motor):

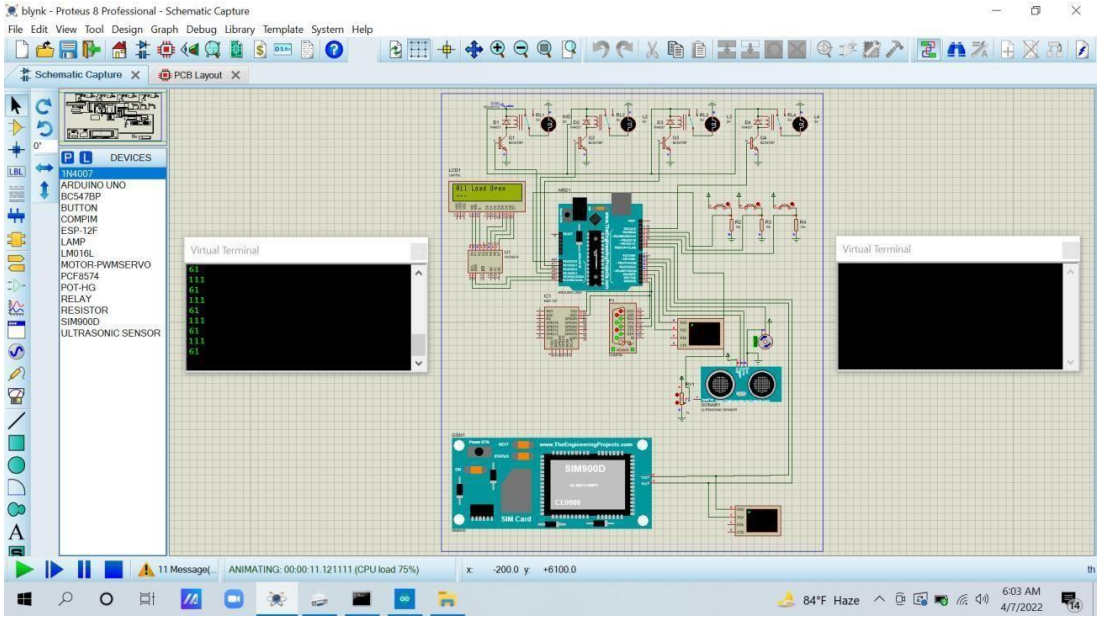


Figure 13 : IOT test case 2

3.Lamp automatically turned off when distance is 50 or less and text message 'Kid Near Socket' alert send to the user, according to our code.

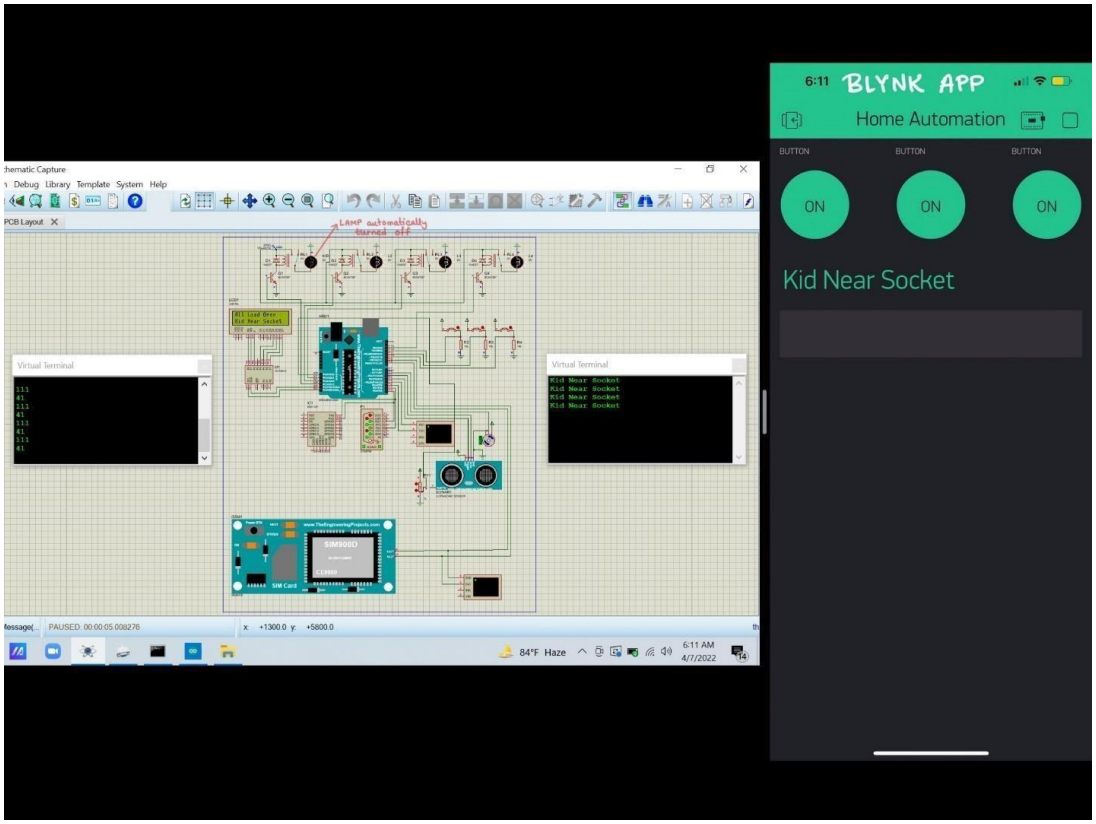


Figure 14: IOT test case 3 kid near socket test

PowerLine :

We analysed powerline home automation by code. In this automation, FSK modulator is used for adjusting the carrier signal's frequency in response to the information stream, one frequency for logic level 1 and another for logic level 0. If we use FSK, we can simply retrieve the original filter because the amplitude is no longer significant, so the influence of noise is reduced. Bandpass filter is also used in transmitting end for limiting the bandwidth of the output signal to the band allocated for the transmission so that we can avoid extra noises that comes from powerline and get the original and a clear message signal.

In Receiving end, we used FSK demodulator to demodulate the signal and to get rid of the little floats in the waveform output. Relays are used for controlling high current circuits with the help of low current signals. We used transistor in receiving end. The transistor turns ON and OFF in response to the microcontroller. Our information signal is a high frequency signal so, a coupling transformer used here as a high frequency transformer to lower the voltage of existing power circuits to run low-voltage devices and raise the voltage of electric generators to carry electric power across long distances.

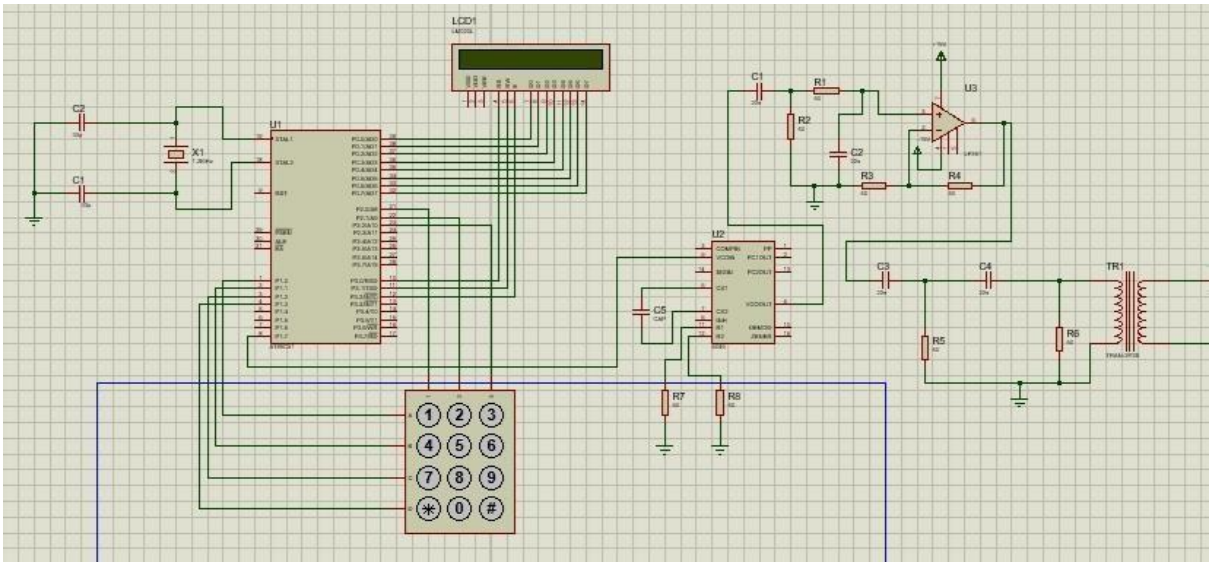


Figure 15: Transmitting End

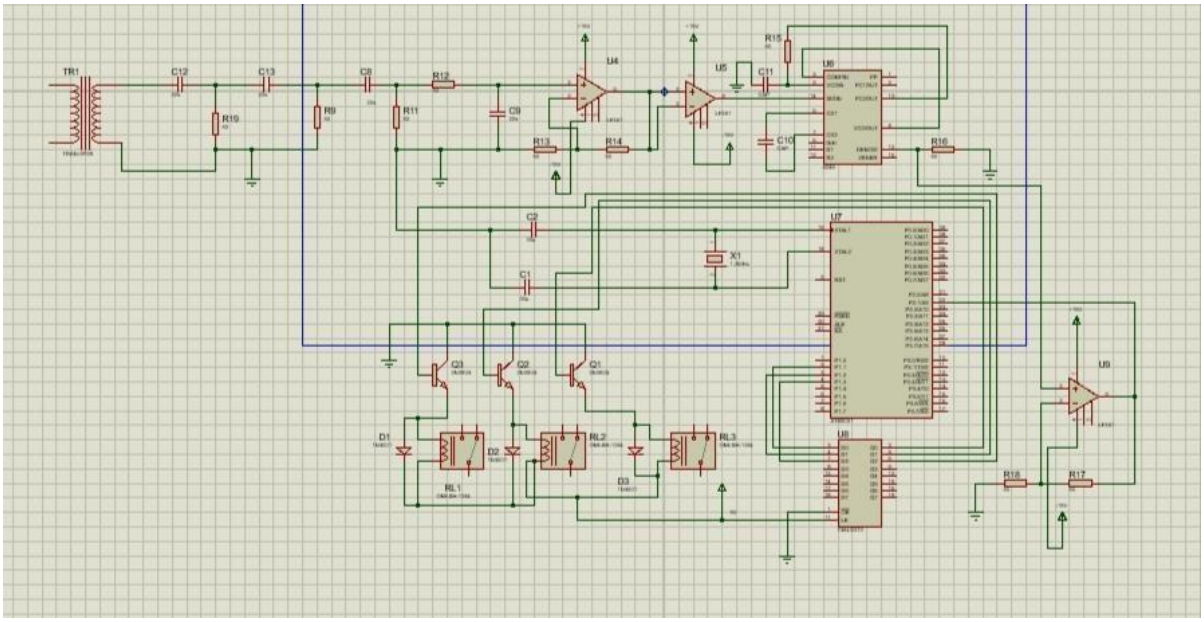


Figure 16: Receiving End

2.5 Conclusion :

Although there are many home automation systems on the market, we have created an IoT based home automation system that has the capability of providing kid protection whenever a connected electrical socket is within reach of a child. It will reassure parents that their children are secure from any electrical risks while they are around. IoT based home automation system reduce progressive in implementation costs and capacity to offer flexible functionality that can be readily changed by everyone in accordance with their needs.

Chapter 3: Use of Modern Engineering and IT Tool [CO9]

3.1 Introduction:

The methods, abilities, and modern engineering tools necessary for engineering practice must be usable by an engineer. Engineering is a dynamic field. Massive data books, manual drawings, and hand calculations are rapidly being replaced by online data storage sites, simulation programs, and software. Since modern engineering technologies provide more effective solutions, it is imperative for an engineer to complete duties using these technologies. Engineering in the modern era focuses on the development and comprehension of technological systems and products, as well as their applications and impacts. It is also intrigued by conventional methods.

3.2 Selecting appropriate engineering and IT tools:

We will discuss the cutting-edge modern engineering approach used in the project "Home Automation System" in this chapter. The embedded system on which this project is built is reliable. There are two components to this project: 1. Software and 2. Hardware. We shall discuss the tools that are suitable for this project here. It splits in two main categories. First category is discussed about C++ coding. In the second category, we have discussed about Internet of Things (IOT) based home automation system.

C++ coding: High-performance apps can be made using the cross-platform language C++. Bjarne Stroustrup created C++ as an addition to the C language. Programmers have extensive control over memory and system resources thanks to C++. In 2011, 2014, 2017, and 2020, the language underwent four significant updates, becoming C++11, C++14, C++17, and C++20 [9]. We choose C++ for coding our home automation system because it is one of the most widely used programming languages worldwide is C++.Operating systems, graphical user interfaces, and embedded systems all use C++ today. Programming in C++, an object-oriented language, offers applications a distinct structure and encourages code reuse, which reduces development costs. Applications that can be converted to different platforms can be created using C++ because it is portable, fun and simple to learn.

Because C++ and Java are close to each other, programmers can easily move from one to the other.

Internet of Things (IOT) based home automation system: Home automation is a concept that attempts to give users access to affordable lighting options, improved energy conservation, and energy efficiency in our daily use of electrical appliances in our homes. In addition to lighting solutions, the concept also includes building a central home entertainment system, having overall control over our home security, and much more. The Internet of Things (also known as IoT) based House Automation system intends to use internet protocols or cloud computing to control all the appliances in our smart home, as the name suggests. The reasons behind choosing IoT based home automation system is that, the system offers much more flexibility as it has a number of benefits, including ease of installation and use, the avoidance of complicated wiring and loose electrical connections, simple fault detection and triggering, and, above all, simple mobility [10].

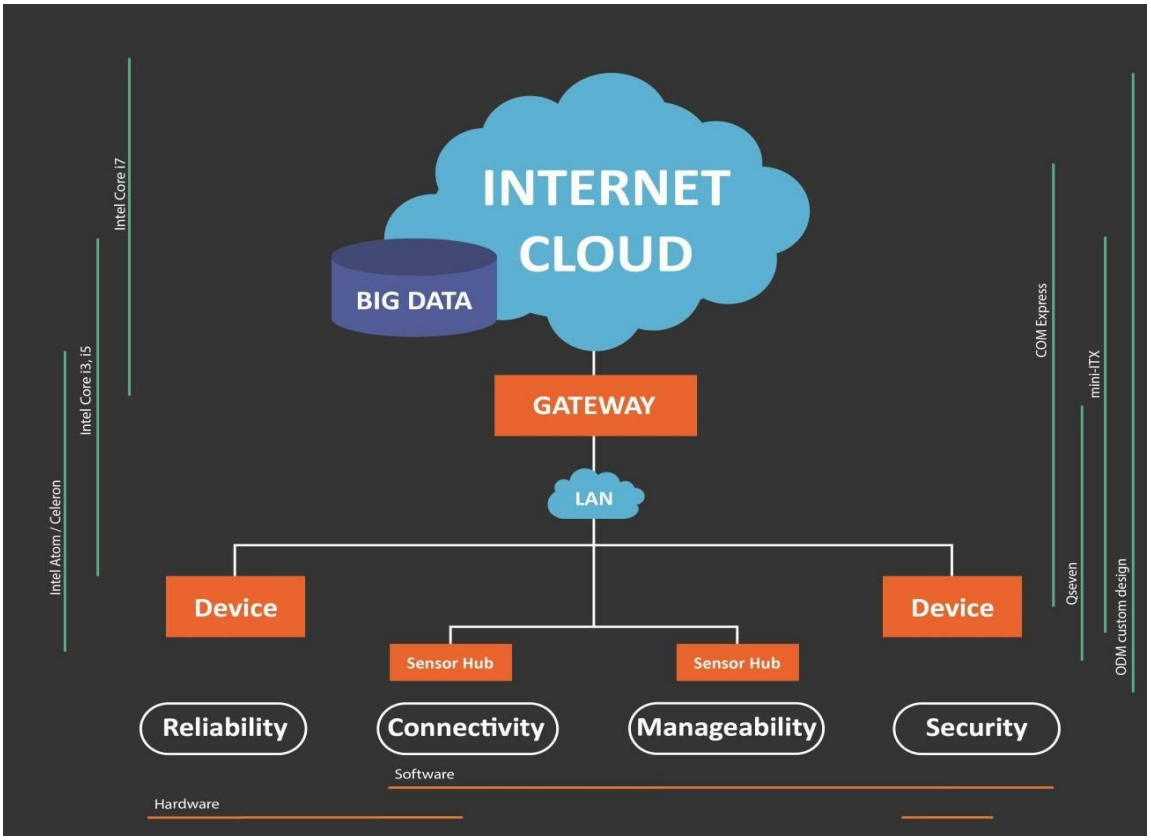


Figure 17 : IoT Based Home Automation System concept

3.3 Use of modern engineering and IT tools:

Software Tools

In this section we are going to talk about the exact tools that we have used for the project.

Proteus: An exclusive tool set for automating electronic design is called the Proteus Design Suite. The program is primarily used by technicians and electronic design engineers to develop schematics and electronic prints for printed circuit board production. Labcenter Electronics Ltd. created it. A Windows program for schematic capture, simulation, and PCB (Printed Circuit Board) layout design is called the Proteus Design Suite. Depending on the amount of designs being created and the specifications for microcontroller simulation, it can be found in a variety of forms. An auto-router and fundamental mixed mode SPICE simulation capabilities are included in all PCB Design solutions [11].

Blynk App : With the help of Blynk, we can design mobile applications that make it simple to communicate with microcontrollers or even complete computers like the Raspberry Pi. The smartphone app is the pioneer of Blynk. Actually, the Blynk app is an app editor. We can make one or many projects thanks to it. Each project is capable of containing graphical widgets that can communicate with one or more devices, such as buttons, virtual LEDs, value displays, and even text terminals. Without writing any code at all, we can use the Blynk library to control the Arduino or ESP32 pins right from our phone. To provide them access to the linked devices, you can also share this app with friends and relatives. Imagine that we create a smartphone application that allows us to regulate the temperature of the room, window coverings, and lights from our phone.
Other family members can access the capability if we share the project with them [12].

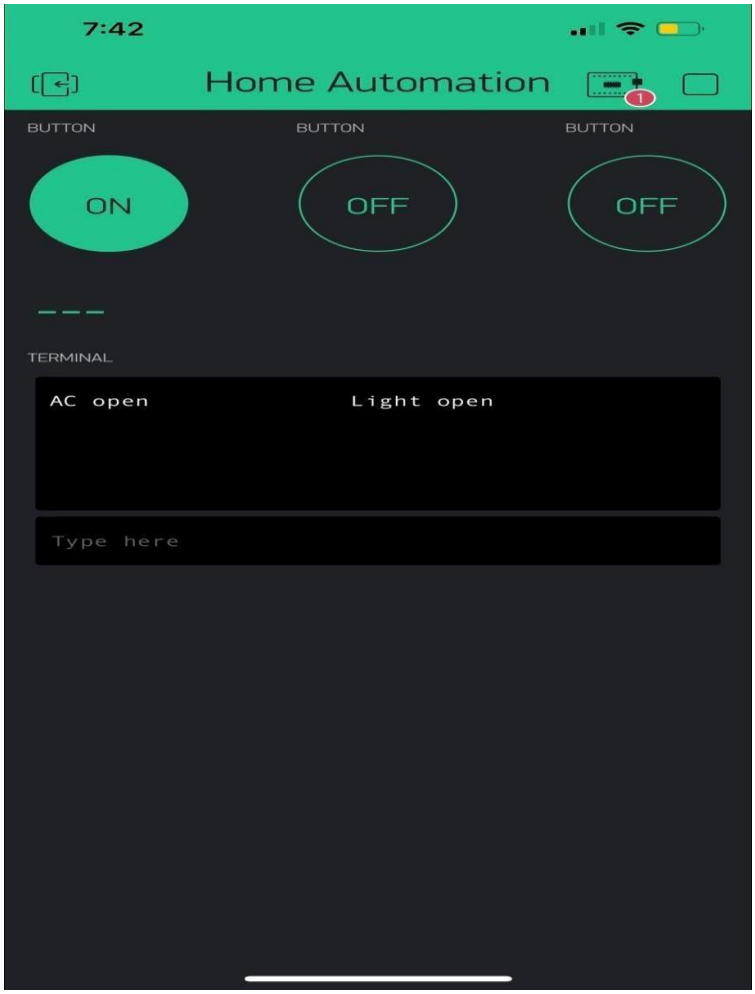


Figure 18: Blynk Smartphone App

Arduino IDE : A text editor for writing code, a message area, a text console, a toolbar with buttons for common functions, and a number of menus are all included in the Arduino Integrated Development Environment, also known as the Arduino Software (IDE). To upload programs and communicate with them, it establishes a connection with the Arduino hardware [13].

Hardware Tools

PIR sensor: An electronic sensor that measures the infrared (IR) light emitted by objects in its field of vision is known as a passive infrared sensor (PIR sensor). PIR sensors allow us to detect motion, and they are nearly always used to determine if a person has entered or exited the sensor's field of view. They are lightweight, affordable, low-power, simple to operate, and durable. They are frequently found in devices and appliances used in homes and businesses because of this. They are frequently referred to as PIR, pyroelectric, passive infrared, or IR motion sensors [14].

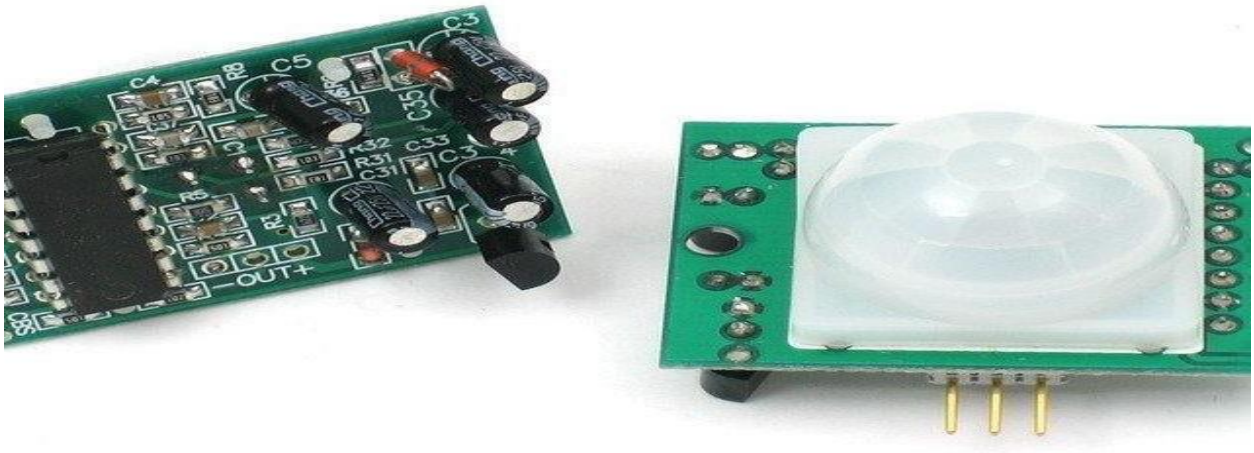


Figure 19 : PIR Sensor

GSM (Global System for mobile communication): We use a GSM module called SIM800L. It uses wireless radiation monitoring to alert the user with a text message when a child goes near a power point. A GSM modem called SIM800L GSM can be included into many different Internet of Things (IoT) projects. We can use this shield to do practically everything a typical cell phone can do, including sending and receiving SMS text messages, making and receiving phone calls, and connecting to the internet via GPRS, TCP/IP, and more! The shield also supports a quad-band GSM/GPRS network, making it virtually universally functional. The SIM800L GSM shield is made to surround the SIM900 chip with all the components required to connect to Arduino as well as a few more goodies to make the most of the chip's special characteristics [14].

Figure 20 : GSM

Relay: The type of switch that we used for our lamps is a single pole double throw (SPDT) relay. Relay is a switch that is activated by electricity. It is made up of a set of operating contact terminals and a set of input terminals for one or more control signals. Any number of connections in different contact configurations, such as make contacts, break contacts, or combinations of both, may be included on the switch [14].

Figure 21 : Relay

BUCK convertor: DC-to-DC power converter which steps down voltage. A chopper circuit known as a "buck converter" is made to step-down the applied dc input signal. In the case of buck converters, the fixed dc input signal is converted into a different, lower value, dc signal at the output. This indicates that it is built to have an output dc signal with a smaller magnitude than the applied input. It is also known as a Buck Regulator, Step-down DC to DC Converter, and Step-down Chopper [14].

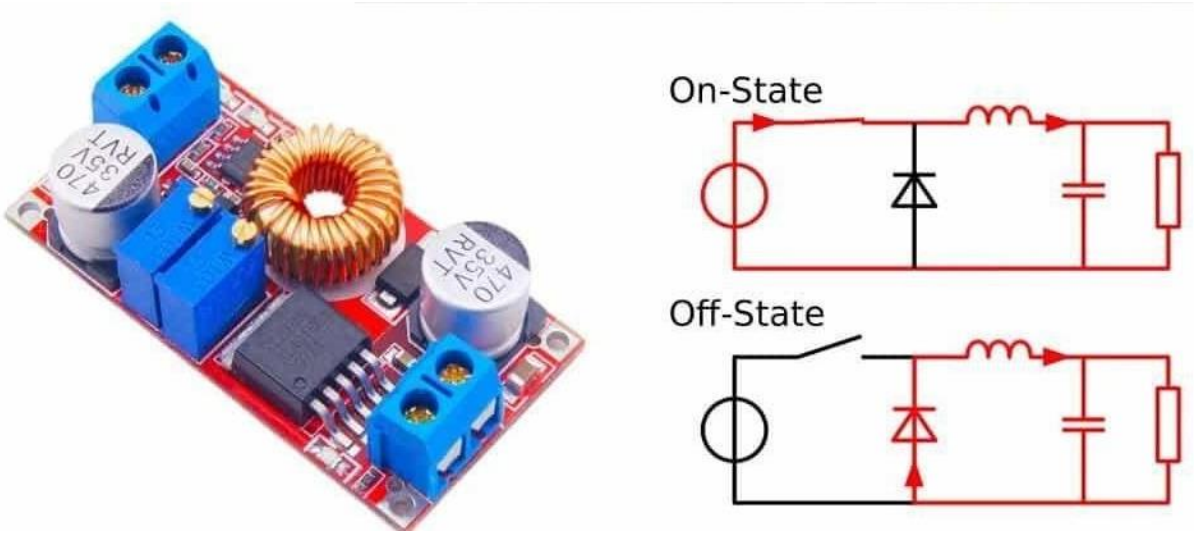


Figure 22 : Buck Converter

SMPs: A switching regulator is incorporated into an electronic power supply called a switched mode power supply in order to efficiently convert electrical power. An SMPS converts voltage and current characteristics while transferring power from an AC source to DC loads, like a personal computer [14].

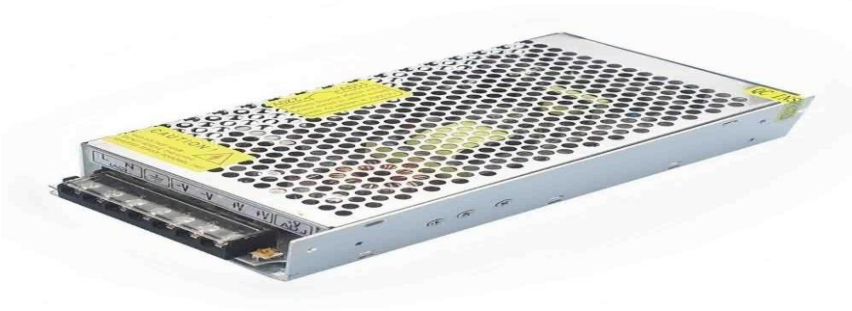


Figure 23: SMPs

16x2 LCD (LM016L): An LCD (liquid crystal display) that can display a total of 32 characters (16 in each line) is used to show the ongoing state of the circuit. This LCD is connected to the Arduino through a PCF8574-I2C LCD driver to reduce the number of pins required to connect the LCD and the Arduino [14].

Figure 24 : LCD

ESP-12 Wi-Fi Module: An invention of the AI-Thinker team, the processor of this module is ESP8266 which is a fast-high integration wireless SOC. It's mainly designed for space and power-constrained mobile platform designers. Among all the Wi-Fi chips in the hi-tech industry, ESP8266EX is the most operable and integrated chip currently. It provides an unmatchable ability to embed Wi-Fi capabilities within other systems or functions. Not only that, it's also the lowest cost chip in the market with minimal space requirement. In addition, it can serve as a Wi-Fi adapter so wireless internet access can be added to any micro-controller-based design with simple connectivity (SPI/SDIO or I2C/UART interface) [14].

Figure 25: Wi-Fi Module

Arduino: This microcontroller Arduino Mega 2560 Pro is the central processing unit of our design. It takes the programming code as input to implement it on the circuit. Several pins of the Arduino UNO are connected to several input/output devices, sensor, etc. in our circuit design to control the entire process of Smart Home. A smaller version of the Arduino Mega is the Arduino Mega2560 Pro. Its smaller size than the Arduino Mega avoids the issue, yet it has greater input output and memory than the Arduino Uno. For practically all of our initiatives, it is useful. The product uses atmega 2560 microcontrollers operating at 16 MHz. The CH340G included on the board allows for direct connection to the PC. Through the COM port on the PC, we can use the Arduino IDE to program it [14].

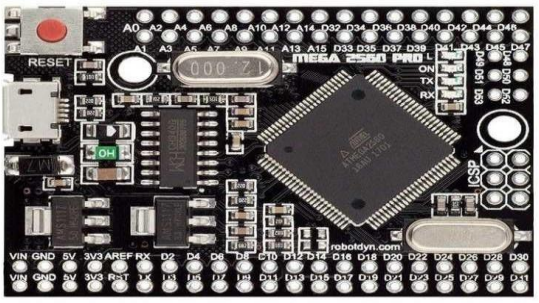


Figure 26 : Arduino

3.4 Conclusion:

We might draw the conclusion that the tools of modern engineering and information technology fundamentally assist us in every aspect of our digital lives. With the use of contemporary equipment, we have moved closer to completing our intended project. An engineer must be able to use the techniques, skills, and contemporary technical tools required for engineering practice. The field of engineering is dynamic. Online data storage sites, simulation tools, and software are quickly replacing massive data books, hand drawings, and calculations. It is essential for an engineer to carry out tasks using new engineering technologies since they offer more practical solutions. Modern engineering focuses on the creation and understanding of technological systems and products, as well as their uses and effects. It is also fascinated by traditional techniques.

Chapter 4: Optimization of Multiple Design and Finding the Optimal Solution [CO7]

4.1 Introduction:

We have developed three design strategies for home automation: 1. Using a PLC (programmable logic controller) for home automation 2. Using electrical lines for home automation, and 3. Home automation system powered by IOT .

4.2 Optimization of multiple design approach:

Powerline:

We build a circuit on Proteus software, using Atmel AT89C51 micro-controller. In Transmitting end, we use user interface LCD and keypad. FSK modulator is used for adjusting the carrier signal's frequency in response to the information stream, one frequency for logic level 1 and another for logic level 0. If we use FSK, we can simply retrieve the original filter because the amplitude is no longer significant, so the influence of noise is reduced. Bandpass filter is also used in transmitting end for limiting the bandwidth of the output signal to the band allocated for the transmission so that we can avoid extra noises that comes from powerline and get the original and a clear message signal.
In Receiving end, we used FSK demodulator to demodulate the signal and to get rid of the little floats in the waveform output. Relays are used for controlling high current circuits with the help of low current signals. We used transistor in receiving end. The transistor turns ON and OFF in response to the microcontroller. Our information signal is a high frequency signal so, a coupling transformer used here as a high frequency transformer to lower the voltage of existing power circuits to run low-voltage devices and raise the voltage of electric generators to carry electric power across long distances.

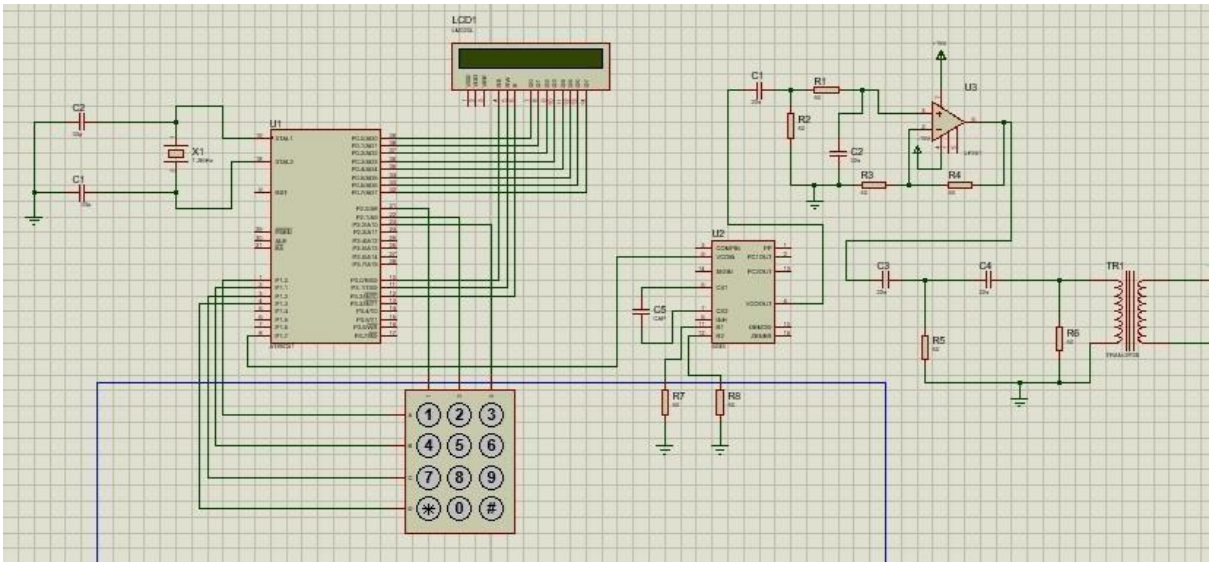


Figure 27: Transmitting End

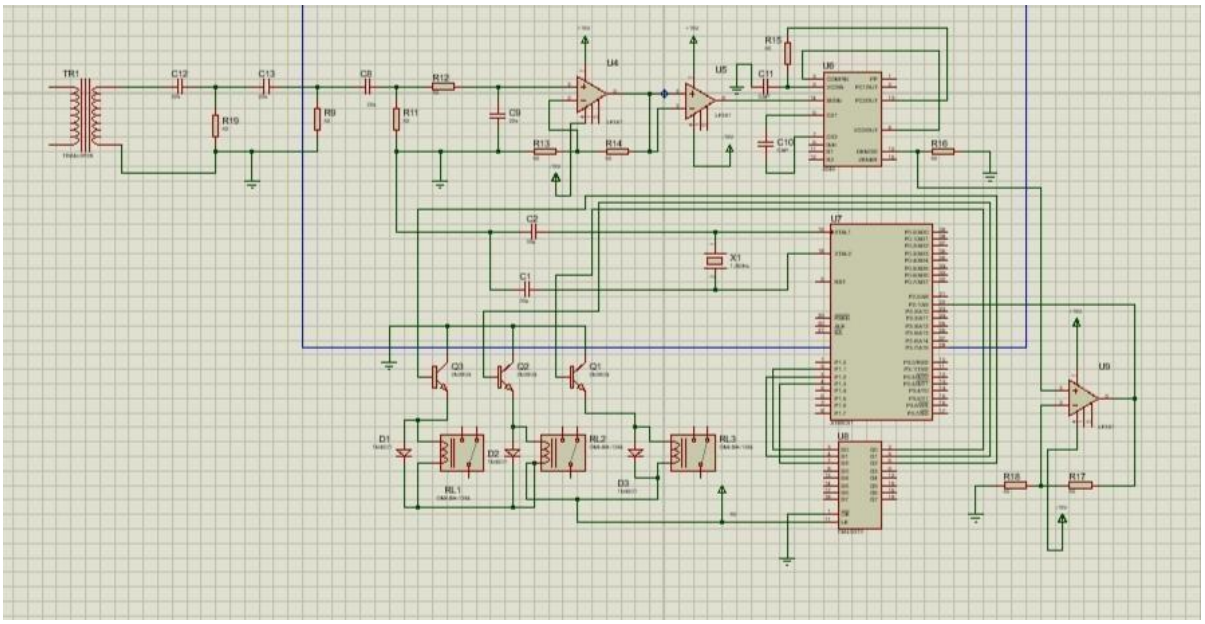


Figure 28 : Receiving End

PLC:

For multiple design approaches PLC is an option to automate home. PLC can help to achieve home automation, for example, air conditioning system or light and other appliances can be switched on or off according to the demand of home ambience. A PLC based security system will detect smoke and send alarm text to the user mobile, automate by balancing the cooling system of the room by turning AC, heater or fan on or off, automate water supply pump according to the demand of the water and excessive electrical power usage.

Table 3: Specifications and requirements of PLC Design (Software)

System	Specifications	Requirements	Components
Smart Home	• Control home appliances • Connection Secured • High speed communication • Energy saving system	Sensors	RTD(PT100 temperature sensor), LDR light sensor, Flame detector sensor
		Central Processing Unit for communication and 2G/3G/4G/GSM/LTE	GSM/GPRS communication module Siemens LOGO! 8 CMR2020 - 6GK7142-7BX00-0AX0
		Software	LOGOSoft Comfort for PLC

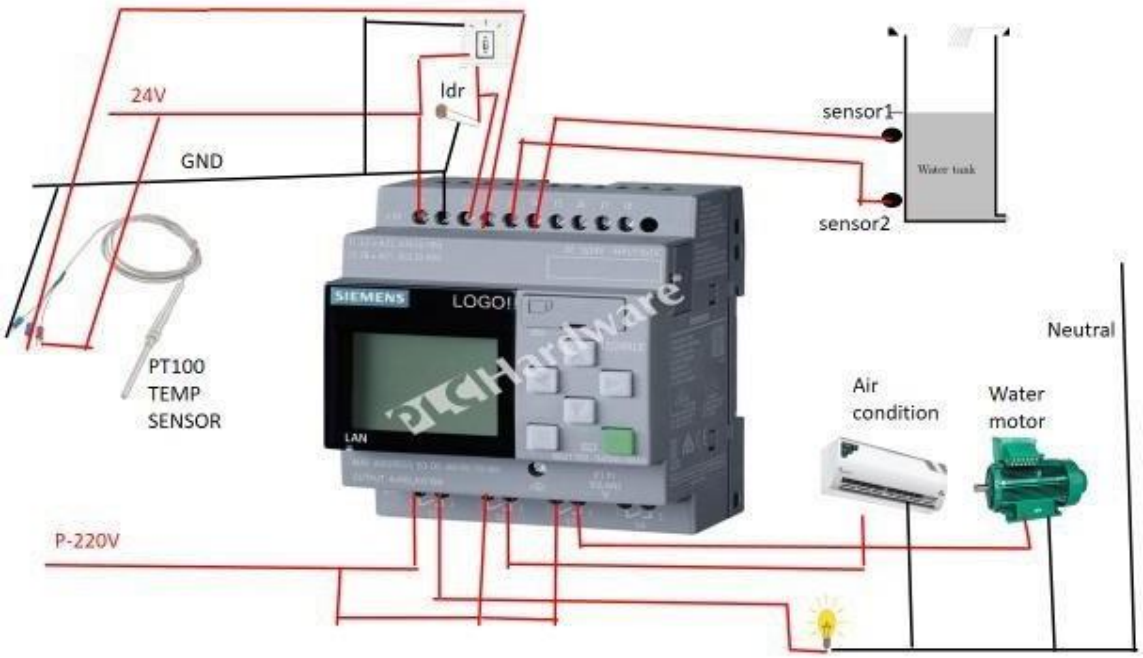


Figure 29 :. A PLC based home appliances connection (A preliminary Design- hardware)

4.3 Identify Optimal Design Approach:

IOT:

We have built a circuit on Proteus software, using Arduino UNO as our central processing unit for communication. The lamps in our circuit which represent home appliances can be controlled by push button switches in our circuit manually and also through the Blynk app on users' smartphones. Relays are used between Arduino and the home appliances. Users' can see the status (on/off) of the lamps on their app and also change them according to their preference. A Wi-Fi module (ESP-12F) is used in our circuit to make it accessible via the Blynk app when the app is connected to an internet network. We use a PIR sensor detect motion within a certain radius of it. On sensing motion, the sensor will transmit this information to the Arduino UNO which will then send a text message to alert users through the GSM and also automatically turn off the device/powerline. Two virtual terminals are used to see all this data transmission and receiving while LCD is used to display the ongoing status of the circuit at any time. The programming code for this circuit's functioning has been compiled in Arduino IDE and inserted into the Arduino UNO in our circuit. Another software called "Virtual Serial Port Driver Pro' will be used to see if the proteus circuit in the computer has connected to the Blynk app on smartphones.

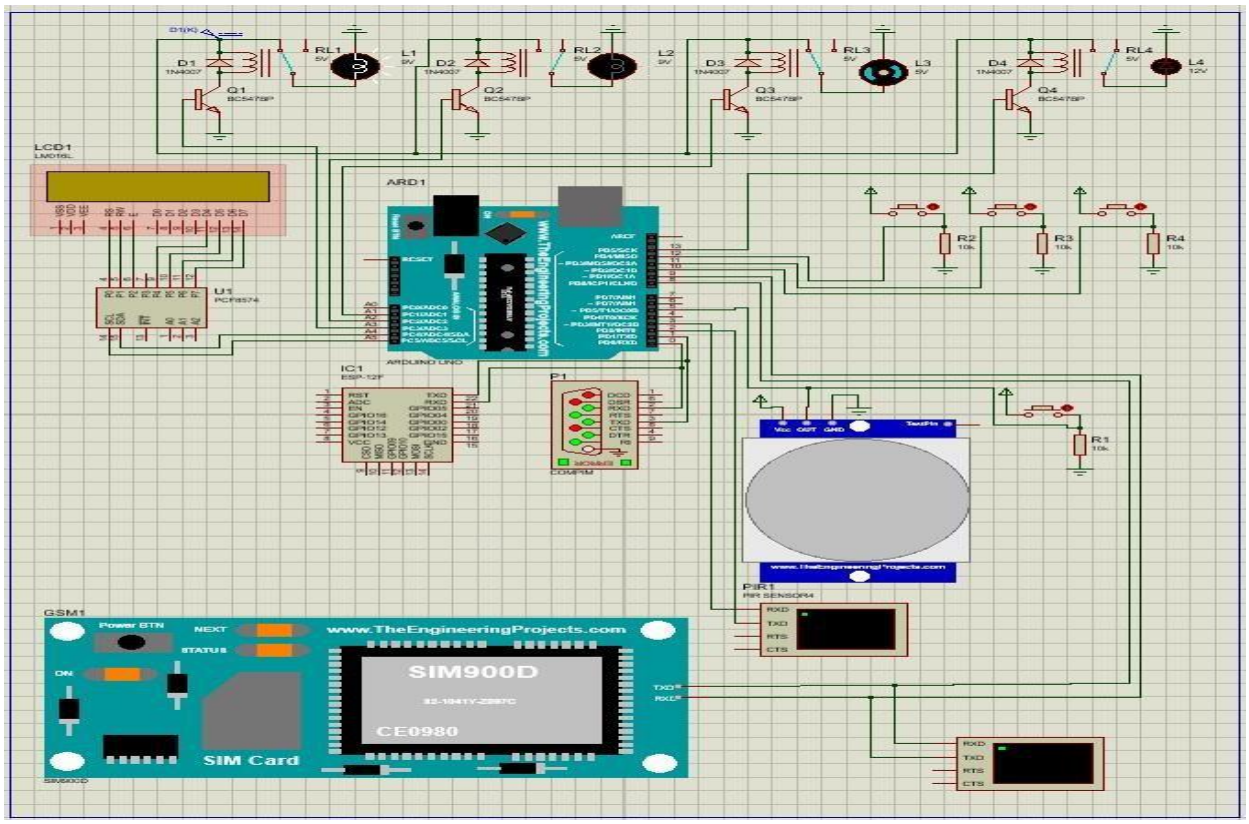


Figure 30 : IOT Optimal Design Approach (Software)

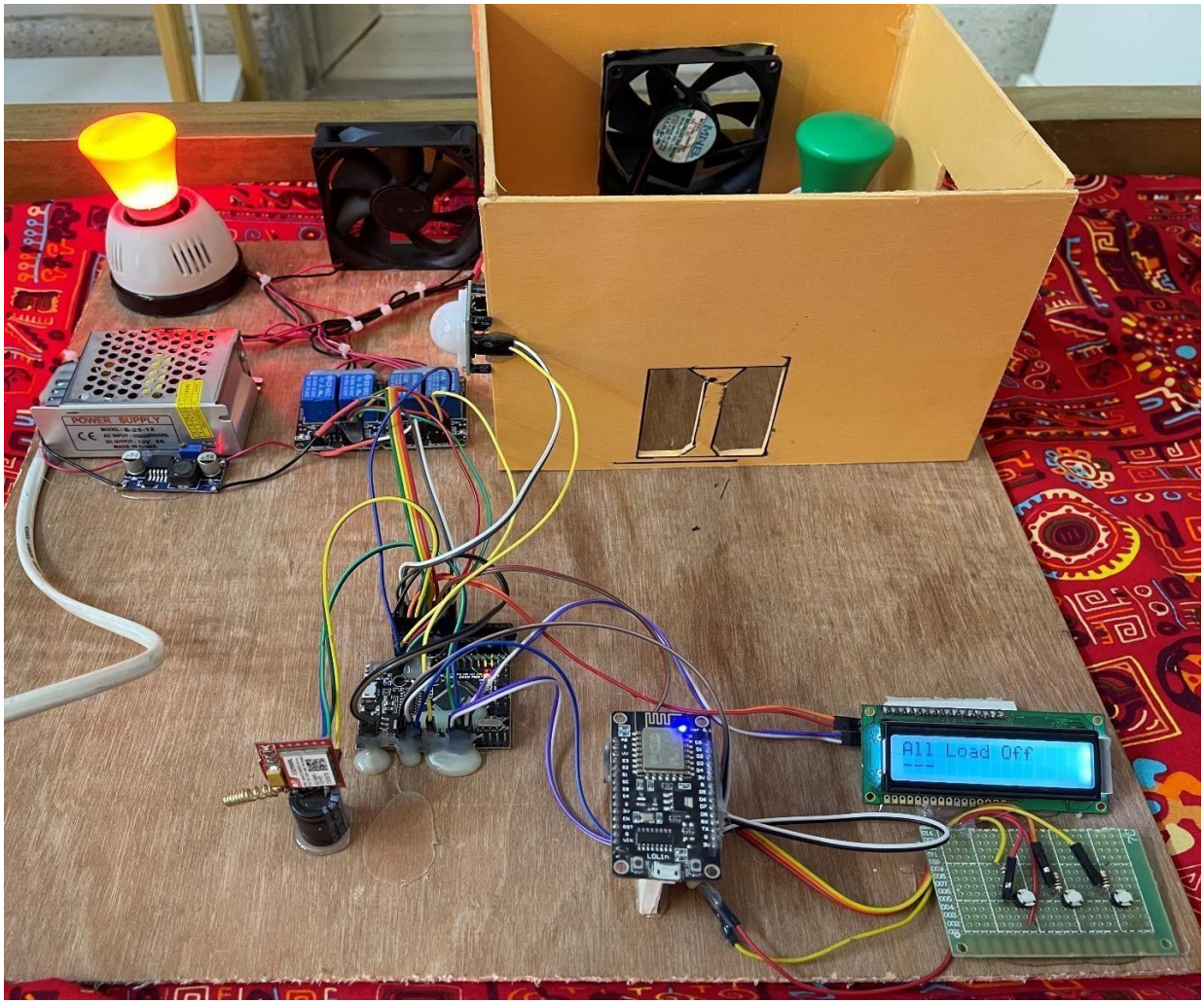


Figure 31: IOT Optimal Design Approach (Hardware)

4.4 Performance Evaluation of Developed Solution:

After conducting our three multiple designs approaches, we have pointed some significant functional differences such as connectivity, safety, speed, power consumption.

Connectivity: After observing all three we got that connecting PLC is quite expensive and also not easy at all. Then we can connect power line with Bluetooth that also doesn't cover maximum range. If we consider IOT we can connect to any Wi-Fi network to operate [3].

Safety: if we consider safety measures between these three designs, we can notice that anyone can connect with the Bluetooth module HC-05 from a far distance and

we measure that within a range of 25 meter anyone connect with the system easily [1]. Then if we consider PLC it is quite hard to connect so expert only can connect this so safety measures can't be ensured properly. So if we considered IOT we can connect through Wi-Fi. Wi-Fi can be accessed from a long distance [3]. It's safe because we can use Blynk app login ID and password is required for all users so no one else can control home appliances other than home owner. The child precautions system also makes the IOT based smart home the safest option among all other design.

Speed: IOT based system takes very less time to respond after users give command from Blynk app. Bluetooth and powerline doesn't respond instantly these systems take time to respond [3].

Table 4 : Power Consumption

PLC	Powerline	IoT
PLC=140.33 watt (per day)	•Bluetooth Module HC05= 18 watt (per day) • Line connect = 80.5	• Netgear Router AX12=46 watt (per day) • ESP32=12 watt(per day)[1]
Total Consumption=140.33watt	**Total Consumption= 98.5 watt**	**Total Consumption= 58 watt**

From the observations, we can say that IOT consumes less power.

Optimal design solution: Observing all other things, we can say that IOT based home automation system is the optimal solution for our project.

Chapter 5: Completion of Final Design and Validation [CO8]

5.1 Introduction:

We created a hardware and software prototype of a circuit using Proteus, and our communication processors were the Arduino UNO and Arduino Mega 2560 Pro, respectively. Push button switches in our circuit can be used both manually and through the Blynk app on users' smartphones to operate the lighting and fans (motors) that represent household appliances. Between Arduino and the household appliances, relays are employed. On their app, users can check the state (on/off) of the lamps and fans and also adjust them to their preferences. Our circuit uses an ESP-12F Wi-Fi module to make it accessible through the Blynk app when the app is linked to an internet network. A PIR sensor was used to find motion within a predetermined range. When motion is detected, the sensor will send this information to the Arduino, which will then send a text message to users via GSM and turn off the device/powerline automatically. Two virtual terminals are utilized to monitor all of this data transmission and reception, and an LCD is used to constantly show the circuit's current state. The Arduino in our circuit has been programmed with the programming code needed to make it work using the Arduino IDE.

5.2 Completion of final design:

Software:

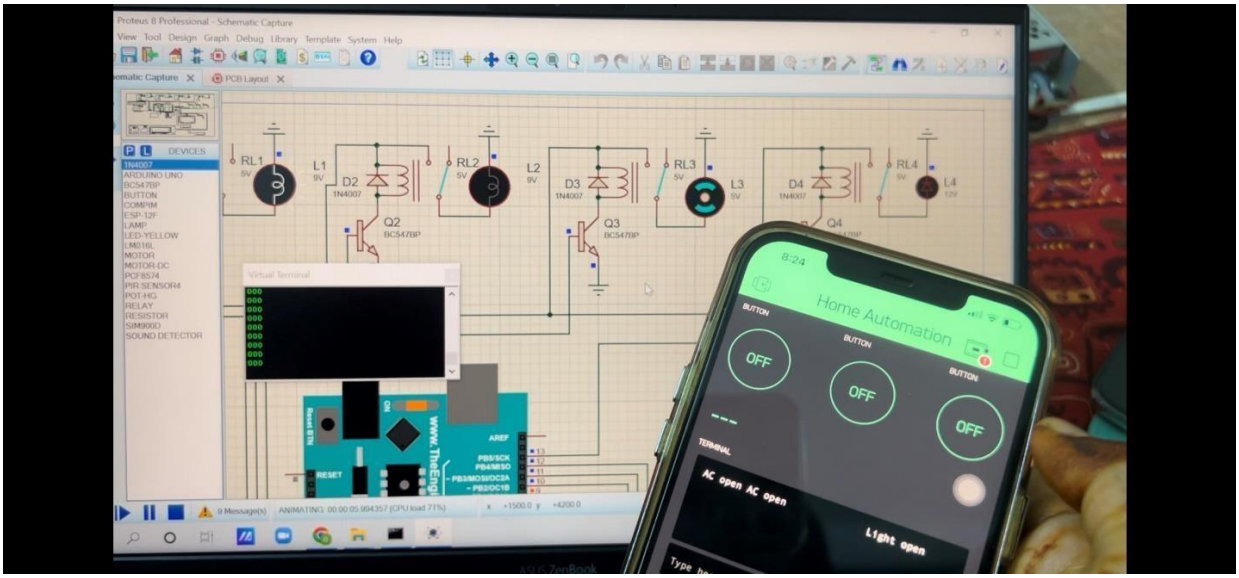


Figure 32: IOT Software test 1

In the figure above, we see that all loads in the circuit are off. The loads are also connected with the Blynk app and we can turn them on or off using the app.

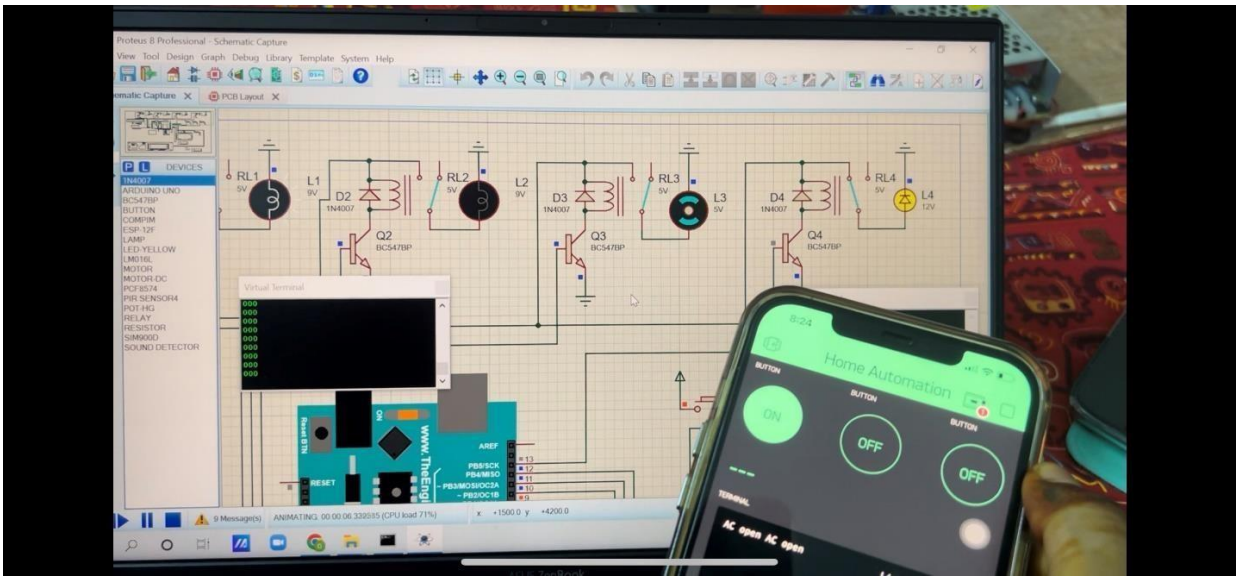


Figure 33: IOT Software test 2

Using the Blynk app, we have we have turned on the LED

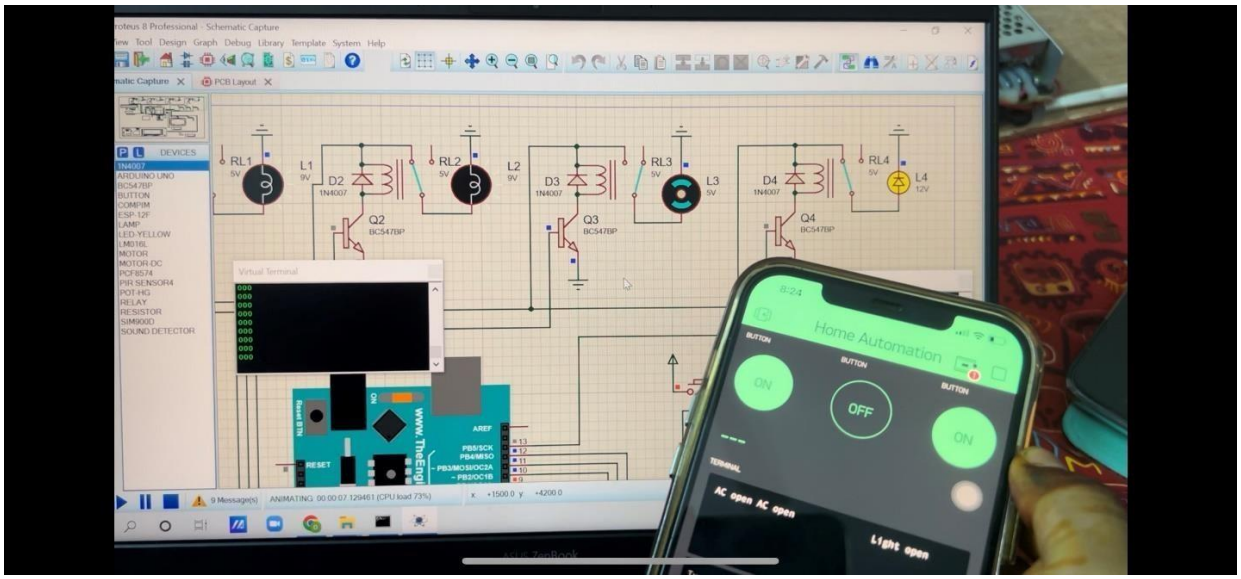


Figure 34: IOT Software test 3

Now, we have we have also turned on the Lamp in the circuit.

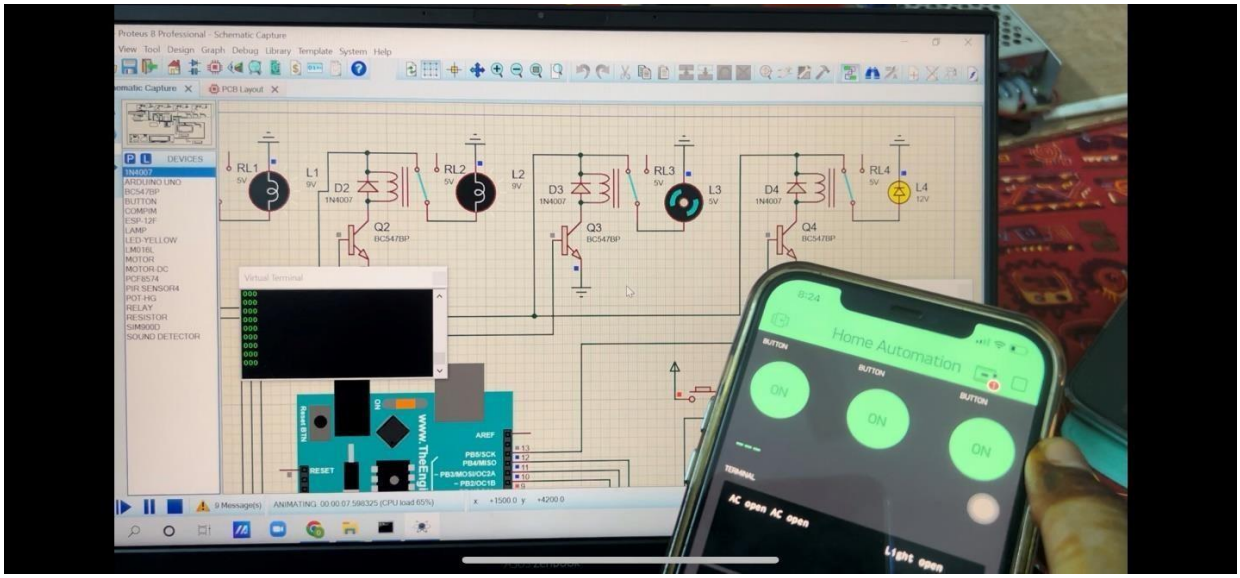


Figure 35: IOT Software test 4

Finally, we have we have turned on the motor which is the third load our circuit. All the loads are functioning perfectly.

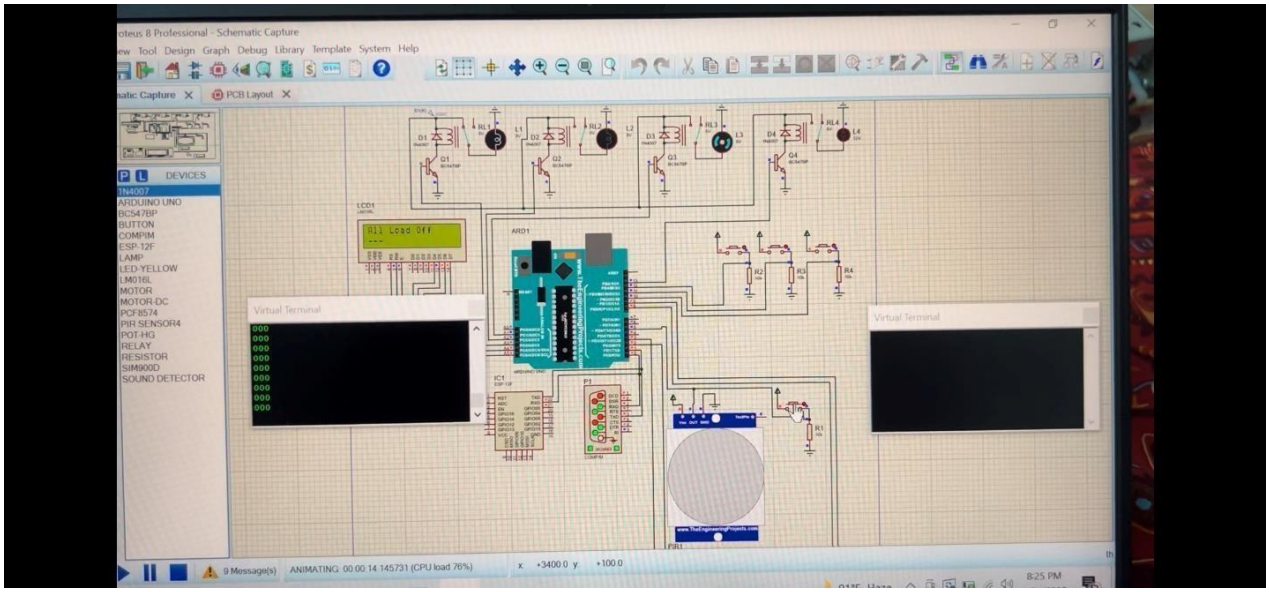


Figure 36: IOT Software test 5

We are going to test the PIR sensor movement detection. All the loads in our circuit are off and we haven't press the push button switch connected to the sensor. The push button here represents an infant or baby crawling near any electrical contact.

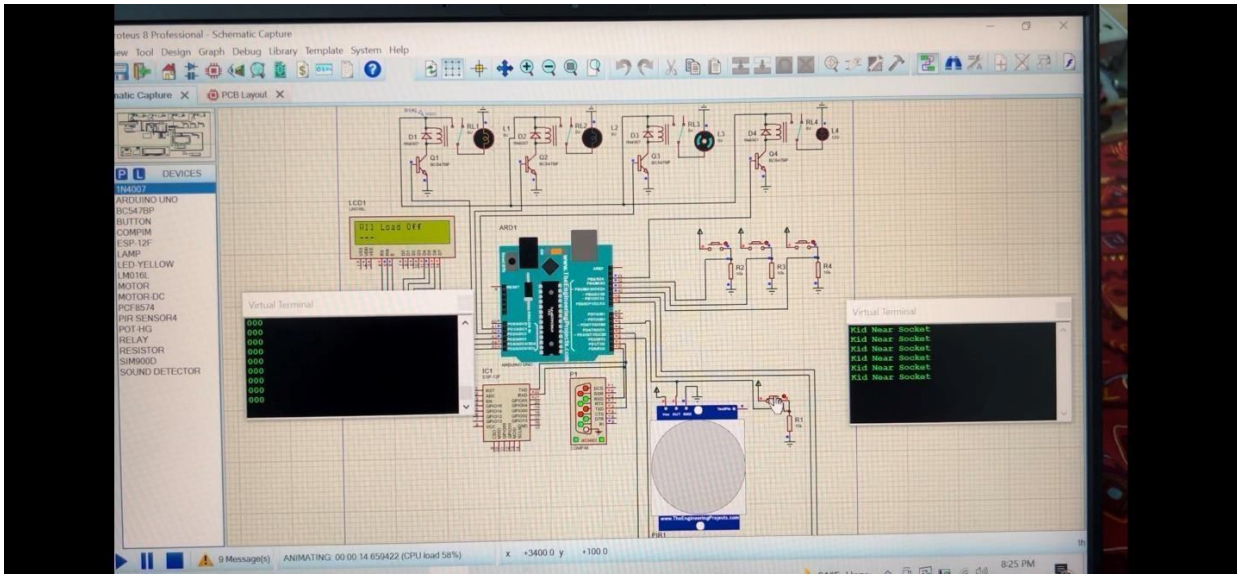


Figure 37: IOT Software test 6

As we push the switch, we can see that the virtual terminal is showing the notification ‘kid near socket’ and the lamp representing electric socket has turned off automatically.

Figure 38: IOT Software test 7

And we will also get notification in our Blynk app too.

Hardware

Figure 39: IOT Hardware test 8

We see that all loads in the circuit are off except the red light which represents a electrical contact or socket. The loads are also connected with the Blynk app and we can turn them on or off using the app.

Figure 40: IOT Hardware test 9

Using the Blynk app, we have turned on the green light

Figure 41: IOT Hardware test 10

Using the Blynk app, we have we have turned on the load B which is a motor. We can see in the display and in the app that both light and second motor is on.

Figure 42: IOT Hardware test 11

Finally, Using the Blynk app, we have we have turned on the load C which is another motor. We can see in the display and in the app that all the loads are turned on now.

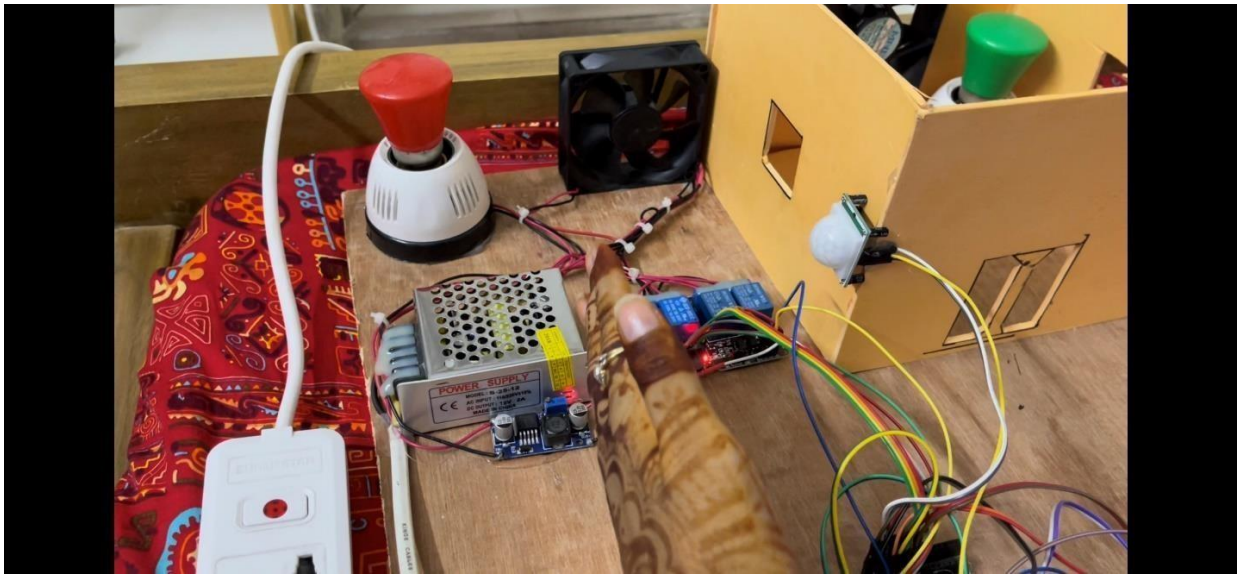


Figure 43: IOT Hardware test 12

We are going to test the PIR sensor movement detection. All the loads in our circuit are off. When we take our hand near the PIR sensor, we can see that the red light representing electrical socket has turned off automatically.

Figure 44: IOT Hardware test 13

And we will also get notification or text in our Blynk app and mobile phone too.

5.3 Conclusion

In our home automation system, we have implement our codes and built a prototype with the special feature child protection. So we can say that our analysis, training and testing is giving us a valid outcome and all our objectives have been fulfilled.

Chapter 6: Impact Analysis and Project Sustainability [CO3, CO4]

6.1 Introduction

The automated control of your room's electronic devices is known as home automation. Due to their Internet connectivity, these gadgets may be controlled from a distance. Using automation, devices may be controlled automatically without the need for an app or vocal assistance. For instance, you may program your lights to turn out when you regularly go to bed, or you can set your thermostat to turn on the air conditioning an hour or so before you return from work to avoid coming home to a steamy house. Home automation makes living more convenient and might even save your energy and heating costs. With Internet of Things technology, home automation may also increase safety. On the other hand to make our life safe and secured, safety protocol is introduced using a sensor where if a kid is around a socket or power line user will be notified.

6.2 Assess the Impact of Solution

The power savings and economic enhancements promised by the smart home technology sector. However, there is no proof that smart house technologies would cut overall home energy usage, and a number of negative societal effects are developing that need additional consideration from academics, policymakers, and practitioners. Having said that, our home automation system is safe and secured. Since, this is a smart project, this will play role to develop a society to be inclined to technology which will make our future smarter.

On the other hand, this home automation system is harmless for our health and may not affect on our health. Since very low voltages are used to run appliances, there is no risk for anyone .Furthermore, when children will be near main power line (220V) , motion sensor will detect and send a text to the users phone and application.

Since home automation is making our life easier, safe and secured, this can be legitimated in our country. Small components with low voltages will not radiate and affect the environment. Besides, smart home automation does not oppose any cultural and political rule.

6.3 Evaluate the sustainability:

The sustainability of the project is very high. Maintaining a sustainable lifestyle takes a significant amount of commitment and awareness. When you adopt this perspective, it's

remarkable how small lifestyle adjustments may have a big impact. Examining your existing lifestyle and devising strategies to minimize your energy use and trash generation is a good place to start. Once you've identified critical areas for improvement, it's time to implement the necessary changes.

You may discover unexpected ways that these items may assist ease this procedure by utilizing existing resources and technology, notably smart home technologies. Let's look at a few ways smart home technology might help you lead a more environmentally friendly lifestyle.

6.4 Conclusion

In a word, one of the project's key aims, through browser, has been realized. As suggested this project allows users to access information about their home and to operate their home appliances via their electronic devices. It makes monitoring and regulating using this approach. This feature enables the user to communicate using an application. This home automation system once seemed like a unusual and peculiar idea. But after developing the idea of home automation, this has become very popular and accepted to everyone as the process is very friendly and the access is very easy. Smart home automation is connecting the world. It is assumed that once the world will come under

AI. Then we won’t be able to think of anything without being depended on smart technology.

Chapter 7: Engineering Project Management

7.1 Introduction

A management strategy and good logbook are main components of every successful and proper project. Additionally, it will help us grasp our obligations and success.So in light of this, our project likewise proceeded as planned.

7.2 Define Plan and manage Engineering project

Table 5 : Define Plan and manage Engineering project

Plan	Obstacle	Overcome
1.Not a new but a complex engineering project with inter integrated circuit	Difficulties to understand the inter integrated circuit.	Research and studied a lot from microprocessor learning resources
2.Full fill the course outcome	It was difficult to fulfill the	Proper time management and
	course outcome	allocation of work made us overcome.
3.Had a look at the importance of this project	Many work has been done ,so it was difficult to be unique	Introduced some new ideas and implemented this on board
4.Components availability	Some components were hard to find	After some look up we found those online
5. Analytical learning	Inadequate resources	Sci-Hub was helpful for it
6.looked for an ideal solution	Finding multiple solution of the project	Compiled the ideas and came out with a new solution
7. Find out the libraries for proteus	Could not understand where the libraries might be found.	Googled the components' name and library.
8. Finding out proper sensors.	Some sensors didn't work	Updated version of the chip and sensors helped us.
9.Install it to computer	Some glitches and error was found to install it in 64-bit computer	Troubleshoot the problem .

10.Software Implementation	Initially in software there were difficulties to install.	Some videos on youtube helped us to recover this .
11.Simulation	Initially, Code was not simulated properly we couldn't define Serial communication pins and blynk app properly.	Learned it from many videos on youtube.
12.Appropriate pin diagram	Pins for Serial communication (I^2C) were not known.	Learned it from EEE365 (a microprocessor) course.
13.Shouldering	As we are not used to make doing electrical works , shouldering was tough for us as this is risky for its heat	Cautiousness and practices for sometimes has made our shouldering easier.

7.3 Conclusion:

First, we must follow the course of three successive semesters in order to finish this assignment. We have to inform our ATC on every development and deliver official briefings in front of the entire ATC panel. In order to improve management, we must keep a log book and project plan.

Chapter 8: Economical Analysis. [CO12]

8.1 Introduction:

Whenever we think of a device the first thing that come in our mind is how much economical it is in terms of the availability. Therefore, we keep our project budget friendly as much as possible.

8.2 Economic analysis :

we have tried to keep our project as budget friendly as possible. The budget of our project is given below :

Name	**Quantities**	**Tentative Cost Per Product (in Taka)**	**Total**
Arduino UNO	1	1010	1010
GSM module	1	1850	1850
5V 4 Channel Relay Module	1	250	250
Breadboard	2	60	120
Male to Female Jumper wire	10	3	30
Female to female jumper	10	3	30
Male to male jumper	10	3	30
Glue Gun	1	240	240
Glue Gun stick	5	16	80
Soldering Iron 60W	1	350	350
0.3 mm Tin Lead soldering wire Reel	1	75	75
Soldering paste (150g)	1	60	60
Bulbs	4	100	400
Wires	10	2	20
Bulb holders	4	20	80
PVC Board	1	200	200
Ultra-sonic Motion sensor	1	630	630

LCD 16*2 with 12C Module	1	400	400
Total Cost		5855	

8.3 Cost benefit analysis:

The project maintenance can be high as it can be purchase many times if any device is damaged. In this project the Arduino Uno will store the data in memory chip and mobile app will monitor. So, here we are not using any cloud drive. Therefore, the costing of our cloud drive will be zero. As a result we have tried our best to keep the device budget friendly and low maintenance so that people can use it easily. However, if we think about the electricity charge it will be high as there will be the uses of electronic devices. This automation will be low power and this will also save energy.

8.4 Evaluate economic and financial aspects :

Equipment	**Price**
• Arduino Uno R3 original	3500/-
• ESP8266(WIFI module)	300/-
• EASYVR SHEILD 3.0	4500/-
• DC RELY(6PCS)	500/-
• DHT22(TEMP & HUMIDITY SENSOR)	500/-

In this project, we just use mobile app and a motion detector sensor and some electronic devices and components, which is at low cost and so we try to keep our project budget friendly.

8.5 Conclusion:

To conclude, we can see that our device is very budget friendly as we can get our components and devices at low cost. However, if any fault comes in our device the maintenance cost also will be very low as all the components are budget friendly.

Chapter 9: Ethics and Professional Responsibilities. [CO13, CO2]

9.1 Introduction

We follow all the process step by step to make our project ethically best for our users. We are determined enough that we conduct all the processes ethically, beginning with the research and concluding with the implementation. It is very important to maintain ethical and professional responsibilities strictly. If we can't maintain ethics properly it will not be possible to run our work properly As electrical engineering professionals , we must consider the ethics of the study and work because our current and future work may have an impact on communities, societies, or even all human beings.

9.2 Identify ethical issues and professional responsibility

In every aspects we have to gain public trust to run any of our product. It is very important to gain their faith regarding our project what we are building for. Human safety is must. There is widespread consensus in the codes of ethics of engineering professional societies nationwide that engineering has a important duty to protect public safety, health, and welfare. We have conducted our project while ensuring public safety and health. We tried our best to avoid engineering-related failures and problems that may result in an injury, by using good quality components and materials.

9.3 Apply ethical issues and professional responsibility

Safety and security is one of the main concern for users. Safety and security has to be ensured strictly otherwise people will not use so for this we will give better security services. So we have to maintain some ethics to build this project. We have to ensure all the recourses and data used for our project have been treated confidential and safe. We have to ensure human and environment benefits rather any harm.[3] Users safety and security are our main concern. We will try to keep all the data safe and confidential. we acknowledged the literature review and work of others. We must follow some ethical consideration are listed below:-

- Not doing any human or environmental harm
- Users data are safe
- No simulation attack
- No data abuse
- All sharing information are private
- No sensitive data sharing

We will try to keep user's information confidential so nobody can misuse. [2]

Professional responsibility:

- Maintaining our logbook
- Every step we taken supervised by our respected ATC
- Study technical information clearly before preparing reports
- All the things we did related to electrical and electronics engineering. Tried to full fill all stakeholders requirements

9.4 Conclusion

Ethics and professional responsibilities that we have to maintain very strictly for our users. We have to maintain proper security. Electrical wiring safety has to be ensured. We have to focus more on user safety concern. As a mentor to professional, codes serve as a benchmark that all members of a profession can use to judge whether our project work is ethically and professionally worked properly or not.

Chapter 10: Conclusion and Future Work

10.1 Conclusion

Home automation has been increasingly popular and simpler to live with as a result of the rapid growth of technology. Nearly everything has been automated and digitalized. This cutting-edge technology allows us to handle devices through the internet. There are numerous home automation systems that track and manage household appliances using various microcontrollers and settings. The technology can be combined with IoT and other communication tools to efficiently operate home appliances. We can control home appliances from anywhere in the globe using a mobile device or a laptop connected to the internet. Users can only control a limited number of tube lights, fans, household appliances, electrical motors, air conditioners, and air heating systems using the system. Due to their steadily declining implementation costs and ability to provide flexible functionality that can be easily altered by everyone in line with their demands, all of these sorts of systems are becoming more and more widespread. Despite the fact that there are numerous home automation systems available, we have developed an IoT-based system that can protect children anytime when a linked electrical socket is within reach of a child. It will comfort parents that while they are nearby, their kids are safe from any electrical threats.

10.2 Future work

The feature set of this technology is very diverse. Our lives are growing more and more reliant on the ubiquitous and well-liked smart devices. Controlling smart devices installed in homes connected via IoT can be made simple by gadgets like smart Homes (like Google Home and Amazon Echo) and smart assistants. Additionally, there are numerous smart home integrations and devices that users can use to complete daily household tasks, such as controlling switches with their voice, changing the color of lights, and checking for home and child security with the use of cameras, door speakers, and door locks that can be operated using smartphones. In our project, we would also like to work on the difficulty in changing the range of PIR motion detector and slow response in poor internet connection conditions.

Chapter 11: Identification of Complex Engineering Problems and Activities

11.1 : Identify the attribute of complex engineering problem (EP)

11.2 : Provide reasoning how the project address selected attribute (EP)

11.3 Identify the attribute of complex engineering activities (EA)

11.4 Provide reasoning how the project address selected attribute (EA)

Attributes of Complex Engineering Problems (EP)

	Attributes	**Put tick (√) as appropriate**
P1	Depth of knowledge required	√
P2	Range of conflicting requirements	√
P3	Depth of analysis required	√
P4	Familiarity of issues	√
P5	Extent of applicable codes	√
P6	Extent of stakeholder involvement and needs	
P7	Interdependence	

Attributes of Complex Engineering Activities (EA)

	Attributes	**Put tick (√) as appropriate**
A1	Range of resource	√
A2	Level of interaction	√
A3	Innovation	√
A4	Consequences for society and the environment	√
A5	Familiarity	√

References :

[1] M. Rouse, Internet of things (IoT). IoT Agenda, 2020.

[2] AkashMoodbidri, Hamid Shahnasser (Jan 2017) 'Child safety wearable device', International Journal for Research in Applied Science & Engineering Technology, Vol. 6 Issue II, IEEE, pp. 438-444.

[3] Rathore, M. M., Paul, A., Ahmad, A., & Jeon, G. (2017). IoT- based big data: from smart city towards next generation super city planning. International Journal on Semantic Web & Information Systems, 13(1), 28-47.

[4] AsmitaPawar, PratikshaSagare, TejalSasane, KiranShinde (March– 2017) 'Smart security solution for women and children safety based on GPS using IOT', International Journal of Recent Innovation in Engineering and Research, vol. 02, Issue. 03, pp.85-94.

[5] Nitishree, (May-June, 2016) 'A Review on IOT Based Smart GPS Device for Child and Women Safety', International Journal of Engineering Research and General Science, Vol.4, Issue. 3, pp. 159- 164.

[6] Kok Sun Wong, Wei Lun Ng, Jin Hui Chong, CheeKyun Ng, AduwatiSali, Nor KamariahNoordin, (15 -17)December 2009) 'GPS Based Child Care System using RSSI Technique', Proceedings of the Malaysia International Conference on Communications. pp. 899904.

[7] E. Mainardi, S. Banzi, M. Bonfè, S. Beghelli, "A low-cost Home Automation System based on Power-Line Communication Links," in Conf. Proc. 22nd International Symposium on Automation and Robotics in Construction (ISARC), Ferrara, Italy, 2005 - September 11-14, 2005, pp. 1-4.

[8] C. Yilmaz, Ed., "Implementation of Programmable Logic Controller-Based Home Automatation–Issue 14 June 2010," in Journal of Applied Sciences, Vol. 10, pp. 1449-1454, June 10, 2010.
Available: https://scialert.net/fulltext/?doi=jas.2010.1449.1454#google_vignette

[9] W. A. Jabbar*, M. H. Alsibai, Nur S. S. Amran, and S. K. Mahayadin, "Design and Implementation of IoT-Based Automation System for Smart Home," IEEE International Symposium on Networks, Computers and Communications (ISNCC), Rome, Italy, November 2018.
Design_and_Implementation_of_IoTBased_Automation_System_for_Smart_Home. [Accessed Oct. 25, 2021].

[10] Omar Tayan, A. marwan, A. Aziz Alahmadi, A. Albinsari, "Design and Implementation of a Multi-Function Home Automation System Based on Internet of Things (IoT)," IJCSIS, Vol. 17, No. 2, February 2019. [Accessed Nov.20, 2021].

[11] Develco Products, "Vibration Sensor" DevelcoProducts.com. https://www.develcoproducts.com/products/sensors-and-alarms/vibrationsensor/#VibrationSensorTechnicalSpecifications [Accessed January 10th, 2022].

[12] M. H. Mazlan, F. Mohamad, R. A. Rashid, M. A. Sarijari, M. Rozaini, A. Rahim, "Real-time Communication Routing Protocol for Home Automation via Power Line," in Conf. Proc. 2008 SCOReD 2008, Johor, Malaysia, 2008 – Nov. 26-27.

[13] S. Vats, Prof. N. Bansal, Prof. G. Gurjar, S. Kamat, R. Rai, "PLC based Home Automation System," Department of Electrical Engineering, Atharva College of Engineering, in Conf. Proc. Int. Journal of Engineering Research & Technology (IJERT), Mumbai, India, 2017, [ISSN: 2278-0181].

-systemIJERTCONV5IS01006.pdf [14] K. perrish. "Ethernet vs. Wi-Fi: Is It Really Better to Go Wireless?" HighSpeedInternet.com. https://www.highspeedinternet.com/resources/ethernet-vs-wifi [Accessed January 10th, 2022]. [15] M. Schwartz. "Arduino vs. Raspberry Pi: which platform is the best for home automation?" Makecademy.com.

https://makecademy.com/arduino-vs-raspberry-pi-which-platform-is-the-best-for-homeautomation [Accessed January 5th, 2022].

[16] R. Teymourzadeh, S. A. Ahmed, K. W. Chan, and M. V. Hoong, "Smart GSM Based Home Automation System," Faculty of Engineering, UCSI University, presented at the Conf. 2013 IEEE Conference on Systems, Process & Control (ICSPC2013), Kuala Lumpur, Malaysia, December 2013, [DOI:10.1109/SPC.2013.6735152] [Accessed January 4, 2022].

[17] Chitra, jewel jose, sandeep, shirinidhishetty, A. (2018) 'smart safety jacket for smallbaby' yenepoyainstittite of technology, moodbidr.

[18] N.S. Joshi, R.K. Kamat and P.K Gaikwad, "Development of Wireless Monitoring system for Neonatal Interference Care Unit", International Journal of Advanced Computer Research, Volume 3, Issue 11, 2011.

[20] A Review of Smart Homes – Past, Present, and Futuredz, IEEE transactions on Systems Man and Cybernetics, November 2012.

[21] W3schools.com. 2022. *C++ Introduction*. [online] Available at: <https://www.w3schools.com/cpp/cpp_intro.asp#:~:text=C%2B%2B%20is%20an%20object%2 Doriented,fun%20and%20easy%20to%20learn!> [Accessed 11 September 2022].

[22] SMARTIFY. 2022. *How Does a IoT based Home Automation System Work?*. [online] Available at: <https://smartify.in/knowledgebase/iot-based-home-automationsystem/#:~:text=The%20IoT%20based%20home%20automation%20consist%20of%20several% 20smart%20devices,connected%20in%20a%20mesh%20network.> [Accessed 11 September 2022].

[23] En.wikipedia.org. 2022. *Proteus Design Suite - Wikipedia*. [online] Available at: <https://en.wikipedia.org/wiki/Proteus_Design_Suite> [Accessed 11 September 2022].

[24] Tech Explorations. 2022. *1. What is Blynk?*. [online] Available at:

<https://techexplorations.com/guides/blynk/1-what-is-blynk/> [Accessed 11 September 2022].

[25] ocs.arduino.cc. 2022. *Arduino Integrated Development Environment (IDE) v1*. [online] Available at: <https://docs.arduino.cc/software/ide-v1/tutorials/arduino-ide-v1-basics> [Accessed 11 September 2022].

[26] Udvabony.com - Electronics, Sensors, Robotics Online Shop. 2022. *Udvabony.com - Electronics, Sensors, Robotics Online Shop - Bangladesh*. [online] Available at: <https://udvabony.com/> [Accessed 11 September 2022].

Appendix :

IOT :

Code:

```
#include <LiquidCrystal_I2C.h>
#include <SoftwareSerial.h>

VR myVR(12,13);

uint8_t records[7];
uint8_t buf[64];

LiquidCrystal_I2C lcd(0x27, 16, 2);

#define relay1 A0
#define relay2 A1
#define relay3 A2
#define relay4 A3
#define Pin1 2
#define Pin2 3
#define   Pin3   4
#define Motion 10

unsigned long glStart_Timer_LCD = 0;
unsigned short gusIsNeedDisp = 1;

int pos = 0, ppp = 0;
int ret;

int relay1State = HIGH; int
relay2State = HIGH; int
relay3State = HIGH; int
relay4State = HIGH;

int FAN = LOW; int
LIGHT = LOW;
int AC = LOW;
```

```
#define onL   (20)
#define offL (30)
#define onF   (21)
#define offF (31)
#define onAC (22)
#define offAC  (32)

void printSignature(uint8_t *buf, int len)
{
  int i;   for (i = 0; i < len; i++) {      if
(buf[i] > 0x19 && buf[i] < 0x7F) {
     Serial.write(buf[i]);
    }   else {
Serial.print("[");
     Serial.print(buf[i], HEX);
     Serial.print("]");
    }
  }
}

void printVR(uint8_t *buf)
{
  Serial.println("VR Index\tGroup\tRecordNum\tSignature");

  Serial.print(buf[2], DEC);
  Serial.print("\t\t");

  if (buf[0] == 0xFF) {
Serial.print("NONE");
  }
  else if (buf[0] & 0x80) {
    Serial.print("UG ");
    Serial.print(buf[0] & (~0x80), DEC);
  }
else {
    Serial.print("SG ");
    Serial.print(buf[0], DEC);
  }
  Serial.print("\t");
```

```
  Serial.print(buf[1], DEC);
Serial.print("\t\t"); if
(buf[3] > 0) {
   printSignature(buf + 4, buf[3]);
  }
  else {
   Serial.print("NONE");
  }
  Serial.println("\r\n");
}

void setup() {
myVR.begin(9600);
Serial.begin(9600);
  Serial1.begin(9600);
  Serial2.begin(9600);
  pinMode(relay1, OUTPUT);
pinMode(relay2, OUTPUT);
pinMode(relay3, OUTPUT);
pinMode(relay4, OUTPUT);
pinMode(7, OUTPUT);
pinMode(Pin1, INPUT);
pinMode(Pin2, INPUT);
pinMode(Pin3, INPUT);
pinMode(Motion, INPUT);
digitalWrite(relay1, relay1State);
digitalWrite(relay2, relay2State);
digitalWrite(relay3, relay3State);
digitalWrite(relay4, relay4State);
  digitalWrite(7, LOW);
  lcd.init();
  lcd.backlight();

  if (myVR.clear() == 0) {
   Serial.println("Recognizer cleared.");
  } else {
   Serial.println("Not find VoiceRecognitionModule.");
Serial.println("Please check connection and restart Arduino.");
while (1);
  }

  if (myVR.load((uint8_t)onL) >= 0) {
```

```
    Serial.println("onL loaded");
  }

  if (myVR.load((uint8_t)offL) >= 0) {
    Serial.println("offL loaded");
  }
  if (myVR.load((uint8_t)onF) >= 0) {
    Serial.println("onF loaded");
  }

  if (myVR.load((uint8_t)offF) >= 0) {
    Serial.println("offF loaded");
  }
  if (myVR.load((uint8_t)onAC) >= 0) {
    Serial.println("onAC loaded");
  }

  if (myVR.load((uint8_t)offAC) >= 0) {
    Serial.println("offAC loaded");
  }
}

void loop() {
  ret = myVR.recognize(buf, 50);
if (ret > 0) { switch (buf[1]) {
case onL:
        Serial2.println("#aON*");
Serial.println("#aON*");
        break;
case offL:
        Serial2.println("#aOFF*");
Serial.println("#aOFF*");
        break;
case onF:
        Serial2.println("#bON*");
Serial.println("#bON*");
        break;
case offF:
        Serial2.println("#bOFF*");
Serial.println("#bOFF*");
```

```
      break;      case onAC:
Serial2.println("#cON*");
Serial.println("#cON*");
      break;   case   offAC:
Serial2.println("#cOFF*");
Serial1.println("#cOFF*");
      break;
default:
      Serial.println("Record function undefined");
      break;
   }
   /** voice recognized */
   printVR(buf);
  }

  int button1Pin = digitalRead(Pin1); if (button1Pin == 1) {
relay1State = LOW;   digitalWrite(relay1, relay1State);
  }
else
  {
   relay1State = HIGH;
digitalWrite(relay1, relay1State);
  }
  int button2Pin = digitalRead(Pin2); if (button2Pin == 1) {
relay2State = LOW;   digitalWrite(relay2, relay2State);
  }
else
  {
   relay2State = HIGH;
   digitalWrite(relay2, relay2State);
  }
  int button3Pin = digitalRead(Pin3); if (button3Pin == 1) {
relay3State = LOW;   digitalWrite(relay3, relay3State);
  }
  else   {       relay3State  =  HIGH;
digitalWrite(relay3, relay3State);
  }
  //  Serial.print(button1Pin);
  //  Serial.print("\t");
  //  Serial.print(button2Pin);
  //  Serial.print("\t");
```

```
  //  Serial.println(button3Pin);

  abc_load(); if
(digitalRead(Motion) == 1) {
digitalWrite(7, HIGH);
relay4State = LOW;
    digitalWrite(relay4, relay4State);
lcd.setCursor(0, 1);
lcd.print("Kid Near Socket");
    if (ppp == 0) {
      ppp = 1;
      sendSMS("Kid Near Socket");
    }

    if (gusIsNeedDisp == 1)
    {
      gusIsNeedDisp = 0;
    }  }   else {    ppp = 0;
relay4State = HIGH;
digitalWrite(7, LOW);
digitalWrite(relay4, relay4State);
lcd.setCursor(0, 1);
    lcd.print("---            ");
    if (gusIsNeedDisp == 1)
    {
      gusIsNeedDisp = 0;
    }
  }

  vLCD_Disp_Timer_Index();
}

void abc_load() {
  if (relay1State ^ 1 == 0 && relay2State ^ 1 == 0 && relay3State ^ 1 == 0) {
if (gusIsNeedDisp == 1)
    {
      lcd.setCursor(0, 0);
lcd.print("All Load Off    ");
    }
  }
  else if (relay1State ^ 1 == 0 && relay2State ^ 1 == 0 && relay3State ^ 1 == 1) {
if (gusIsNeedDisp == 1)
```

```
  {      lcd.setCursor(0, 0);
lcd.print("Load C Open     ");
  }
 }
 else if (relay1State ^ 1 == 0 && relay2State ^ 1 == 1 && relay3State ^ 1 == 0) {
if (gusIsNeedDisp == 1)
  {
   lcd.setCursor(0, 0);
lcd.print("Load B Open     ");
  }
 }
 else if (relay1State ^ 1 == 0 && relay2State ^ 1 == 1 && relay3State ^ 1 == 1) {
if (gusIsNeedDisp == 1)
  {
   lcd.setCursor(0, 0);
   lcd.print("Load BC Open     ");
  }
 }
 else if (relay1State ^ 1 == 1 && relay2State ^ 1 == 0 && relay3State ^ 1 == 0) {
if (gusIsNeedDisp == 1)
  {
   lcd.setCursor(0, 0);
lcd.print("Load A Open     ");
  }
 }
 else if (relay1State ^ 1 == 1 && relay2State ^ 1 == 0 && relay3State ^ 1 == 1) {
if (gusIsNeedDisp == 1)
  {
   lcd.setCursor(0, 0);
   lcd.print("Load AC Open     ");
  }
 }
 else if (relay1State ^ 1 == 1 && relay2State ^ 1 == 1 && relay3State ^ 1 == 0) {
if (gusIsNeedDisp == 1)
  {
   lcd.setCursor(0, 0);
   lcd.print("Load AB Open     ");
  }
 }
 else if (relay1State ^ 1 == 1 && relay2State ^ 1 == 1 && relay3State ^ 1 == 1) {
if (gusIsNeedDisp == 1)
```

```
  {
    lcd.setCursor(0, 0);
lcd.print("All Load Open  ");
  }
 }
}

void vLCD_Disp_Timer_Index()
{
 if ((millis() - glStart_Timer_LCD) >= 500)
 {
  gusIsNeedDisp = 1;
glStart_Timer_LCD = millis();
 }
}

void sendSMS(char *msg) {
Serial1.println("AT");
updateSerial();

 Serial1.println("AT+CMGF=1");
 updateSerial();
 Serial1.println("AT+CMGS=\"+8801886454598\"");
updateSerial();
 Serial1.print(msg); //text content
 updateSerial();
Serial1.write(26);
delay(3000);
}

void updateSerial()
{
delay(500);
 while (Serial1.available())
 {
  Serial.write(Serial1.read());
 }
}
```

Power Line :

Code (Transmitting End)

```
ORG 00h
START: MOV DPTR,#COM1
HERE1: CLR A
MOVC A,@A+DPTR
JZ PRINT15
ACALL COMWRT
ACALL DELAY1
INC DPTR
SJMP HERE1
PRINT15:MOV DPTR,#DATA1
PRINT1: CLR A
MOVC A,@A+DPTR
JZ COMM2
ACALL DATAWRT
ACALL DELAY1
INC DPTR
SJMP PRINT1
COMM2: MOV DPTR,#COM2
HERE6: CLR A
MOVC A,@A+DPTR
JZ DAT2
ACALL COMWRT
ACALL DELAY1
INC DPTR
SJMP HERE6
DAT2: MOV DPTR,#DATA2
PRINT2: CLR A
MOVC A,@A+DPTR
JZ START1
ACALL DATAWRT
ACALL DELAY1
INC DPTR
SJMP PRINT2
START1: ACALL DELAY3
MOV DPTR,#COM3
HERE7: CLR A
MOVC A,@A+DPTR
JZ START2
```

```
ACALL COMWRT
ACALL DELAY1
INC DPTR
SJMP HERE7
START2: MOV DPTR,#MENUE1
PRINT3: CLR A
MOVC A,@A+DPTR
JZ CNTRL
ACALL DATAWRT
ACALL DELAY1
INC DPTR
SJMP PRINT3
START3: MOV A,#0C0H
ACALL COMWRT
ACALL DELAY1
; MOV DPTR,#MENUE2
PRINT4: CLR A
MOVC A,@A+DPTR
JZ CNTRL
ACALL DATAWRT
ACALL DELAY1
INC DPTR
SJMP PRINT4
KEYCHK: MOV P2,#0FFH
K1: MOV P1,#0
MOV A,P2
ANL A,#00000111B
CJNE A,#00000111B,K1
K2: ACALL DELAY1
MOV A,P2
ANL A,#00000111B
CJNE A,#00000111B,OVER
SJMP K2
OVER: ACALL DELAY1
MOV A,P2
ANL A,#00000111B
CJNE A,#00000111B,OVER1
SJMP K2
OVER1: MOV P1,#11111110B
MOV A,P2
ANL A,#00000111B
```

```
CJNE A,#00000111B,ROW0
MOV P1,#11111101B
MOV A,P2
ANL A,#00000111B
CJNE A,#00000111B,ROW1
MOV P1,#11111011B
MOV A,P2
ANL A,#00001111B
CJNE A,#00001111B,ROW2
LJMP K2
ROW0: MOV DPTR,#KCODE0
SJMP FIND
ROW1: MOV DPTR,#KCODE1 SJMP FIND
ROW2: MOV DPTR,#KCODE2
SJMP FIND
ROW3: MOV DPTR,#KCODE3
FIND: RRC A
JNC MATCH
INC  DPTR
SJMP FIND
MATCH: CLR A
MOVC A,@A+DPTR
RET
CNTRL: ACALL KEYCHK
MOV R6,A
XRL A,#1
JZ STATUS
MOV A,R6
XRL A,#2
JZ OF
SJMP CNTRL
OF: MOV DPTR,#COM3
HERE9: CLR A
MOVC A,@A+DPTR
JZ  OFPRINT
ACALL COMWRT
ACALL DELAY1
INC DPTR
SJMP HERE9
OFPRINT:MOV DPTR,#STAT1
PRINT6: CLR A
```

```
MOVC A,@A+DPTR
JZ ADDRESS1
ACALL DATAWRT
ACALL DELAY1
INC DPTR
SJMP PRINT6
STATUS: MOV DPTR,#COM3
HERE8: CLR A
MOVC A,@A+DPTR
JZ STPRINT
ACALL COMWRT
ACALL DELAY1
INC DPTR
SJMP HERE8
STPRINT:MOV DPTR,#STAT1
PRINT5: CLR A
MOVC A,@A+DPTR
JZ ADDRESS1
ACALL DATAWRT
ACALL DELAY1
INC DPTR
SJMP PRINT5
ADDRESS1:ACALL KEYCHK
JMP TRANS
TRANS: MOV R4,#8
SETB P2.1
ACALL DELAY3 ;STARTING BITS
ACALL DELAY3
UNT: MOV A,R5
MOV B,#2 ;CHECKING EVEN PARITY
RRC A
INC R5
MOV P2.1,C
ACALL DELAY3
DJNZ R4,UNT
MOV A,R5
DIV AB
MOV A,B
JZ PARITY
SETB P2.1
JMP FIN
```

```
PARITY: CLR P2.1
ACALL  DELAY3
FIN: ACALL DELAY1
ACALL DELAY1
ACALL DELAY1
LJMP START
COMWRT: MOV P0,A
CLR P3.0 ;RS
CLR P3.1 ;R/W
SETB P3.2 ;E=1
ACALL DELAY1
CLR P3.2 ;E=2
RET
DATAWRT:MOV P0,A
SETB P3.0 ;RS=1
CLR P3.1 ;R/W=0
SETB P3.2 ;E=1
ACALL DELAY1
CLR P3.2 ;E=0
RET
DELAY2: MOV R1,#80
HERE5: MOV R2,#255
HERE4: MOV R0,#255
HERE3: DJNZ R0,HERE3
DJNZ R2,HERE4
DJNZ R1,HERE5
RET
DELAY3: MOV R1,#08
HERE13: MOV R2,#255
HERE12: MOV R0,#255
HERE11: DJNZ R0,HERE11
DJNZ R2,HERE12
DJNZ R1,HERE13
RET
DELAY1: MOV R1,#20
X: MOV R0,#145
ST: DJNZ R0,ST
DJNZ R1,X
RET
COM1: DB 38H,0EH,01,06,81H,0 ;Commands for initializing LCD
COM3: DB 1,80H,0
```

```
COM2: DB 0C2H,0
DATA1: DB "WELCOME TO",0 ;Starting up
DATA2: DB "CONTROL PANEL",0
MENUE1: DB "1 O/F:",0 ;Press 1 for switching
STAT1: DB "ADDRESS:",0
KCODE0: DB 1,2,3
KCODE1: DB 4,5,6
KCODE2: DB 7,8,9
KCODE3: DB 10,11,12
END
```

Receiving End

```
ORG 00H
SETB P2.1
START: MOV A,#0H
JNB P2.1,START
ACALL DELAY3 ;CHECK FOR 1ST STARTING BITS
JNB P2.1,START ;CHECK FOR 2ND STARTING BITS
MOV R4,#5
JMP DAT
DAT: DJNZ R4,NEXT
JMP ACTIV ;ACTIVATE THE CORESSPONDING DEVICE
NEXT: JB P2.1,ADD1
JNB P2.1,ADD2
ADD1: RL A
ADD A,#0H
ACALL DELAY3
JMP DAT
ADD2: RL A
ADD A,#01H
ACALL DELAY3
JMP DAT
ACTIV: XRL A,#1
JZ ONE
XRL A,#2
JZ TWO
XRL A,#3
JZ THREE
XRL A,#4
JZ FOUR
```

```
XRL A,#5
JZ FIVE
XRL A,#6
JZ SIX
XRL A,#7
JZ SEVEN
XRL A,#8
JZ EIGHT
XRL A,#9
JZ NINE
ONE: CPL P1.0
LJMP START
TWO: CPL P1.1
LJMP START
THREE: CPL P1.2
LJMP START
FOUR: CPL P1.3
LJMP START
FIVE: CPL P1.4
LJMP START
SIX: CPL P1.5
LJMP START
SEVEN: CPL P1.6
LJMP START
EIGHT: CPL P1.7
LJMP START
NINE: CPL P2.1
LJMP START
DELAY3: MOV R1,#08
HERE13: MOV R2,#255
HERE12: MOV R0,#255
HERE11: DJNZ R0,HERE11
DJNZ R2,HERE12
DJNZ R1,HERE13
RET
END
```