Department of Electronic and Telecommunication Engineering

University of Moratuwa

EN1190 – Engineering Design Project

Power Saving Automatic Light Controller

Group Members

- 210141U – Dissanayaka D.M.S.P.
- 210341H – Liyanaarachchi L.A.S
- 210303U – Kulasingham P.N
- 210705E – Wickramasingha M.P.D.N

Table of Contents

Abstract

Our design, a power-saving automatic light controller, is a device that automatically turns lights on and off based on the presence or absence of people in a room or area. The controller uses sensors such as ultrasonic sensors to detect human movements and switch the lights on and off accordingly. By using this type of controller, energy consumption is reduced since lights are only activated when needed. Additionally, the controller can be programmed to adjust the brightness level of the lights, further reducing energy consumption. The power-saving automatic light controller is a practical and cost-effective solution for reducing energy consumption and improving the efficiency of lighting systems and which is more helpful for disabled people. In this report, we consider what people think about our product through the survey. Furthermore, the technical feasibility and budget of the product are also included in this report.
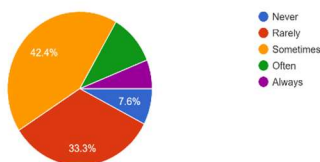
Problem & Solution

In day-to-day life, most people forget to switch off the bulb when they are leaving the place. It may cause energy waste. Therefore, electricity consumption will be increased. In these days, if electricity consumption is increased then the electricity bill will be increased. Our income got wasted because of that. By implementing an automated lighting solution that turns off lights when a room is unoccupied, we can reduce energy waste and promote a more sustainable future. Hence, we should save energy. For that at least we can switch off the bulbs when we leave the place. So, we can introduce an automatic system for switching off the bulbs. And, if we forget to turn off the light bulbs then it may cause safety risks such as fire hazards or property damage.

In our society, we meet disabled people. They are suffering because they cannot do their work individually. As an example, people who are using wheelchairs cannot switch on the lights in the room without others' help. Such as most disabled people suffer from these stuffs. So, these people face different kinds of problems such as accessing and operating light switches. So, we are thinking to introduce an automatic system for lighting the bulbs. It helps to increase disabled people's independence. Therefore, they can enter a room without others' help.

Survey Summary

We did a small survey on our project. Some of the responses are shown below.

Most responders sometimes forget to turn off the lights when they leave the room. The least number of responders turn off the lights when leaving a room.

Most people like to control lights in both manual and automatic manners. Minimum responders prefer to turn on and off lights manually. So, this will help to improve our product in both manual and automatic.
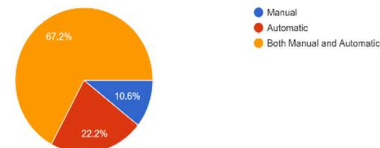

When individuals with disabilities or children use this product, we can guarantee their safety and they can increase their independence. As the responses of the responders all of them said that disabled people can improve their safety.
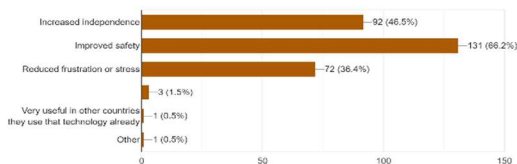
Most of the respondents prefer to buy our product by spending below Rs. 7500. And 57 responders like to spend between Rs. 7500 – Rs. 10000 to buy this product. Furthermore, some of them also prefer to spend between Rs.1000-Rs.2000 for this.
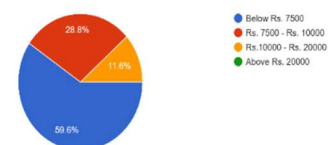
Technical Feasibility

Resource Requirements

The hardware requirements for the system include light bulbs, sensors, PCBs, power-supplying methods, and transmitters. These components are readily available in the market and can be created and designed. The software requirements include firmware for the microcontrollers and communication protocols. The software that we needed is Arduino, Solid Works, Altium, etc.

Performance Targets

The system's performance targets are based on industry standards and there are no mistakes. The system will be designed to turn on the lights automatically when someone enters the room and turn them off when they leave, thereby conserving energy. The most important thing is when people enter the room more than one, the light will only be off if all of them are left from the room. The system will also have a user-friendly control system because of the manual and automatic systems.
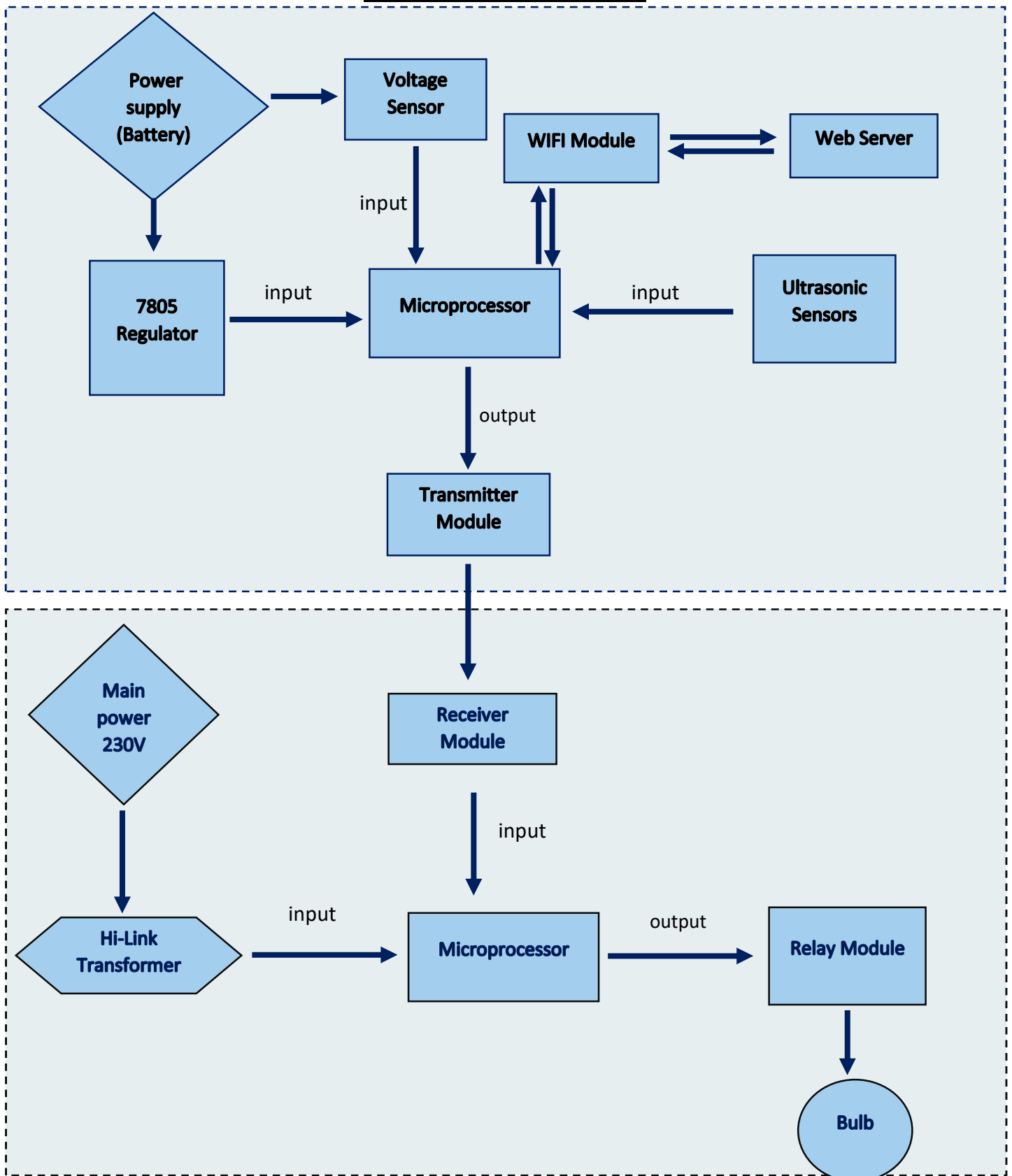
Technical Risks

The technical risks associated with the project are mainly related to hardware and software compatibility. We have addressed these risks by carefully selecting the components and developing software components that are compatible with each other. We have also tested the system thoroughly in a controlled environment and have identified and resolved any issues that arose during testing.
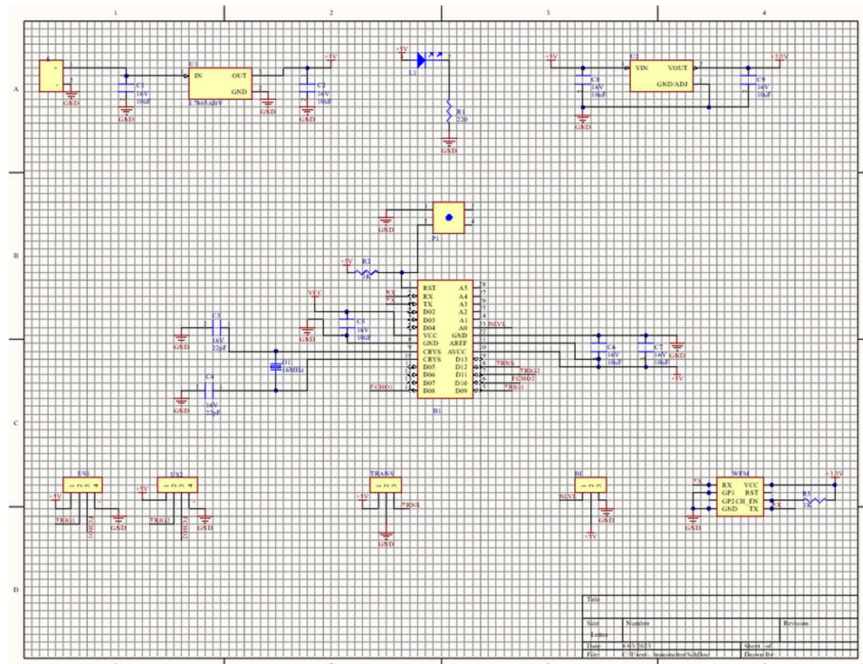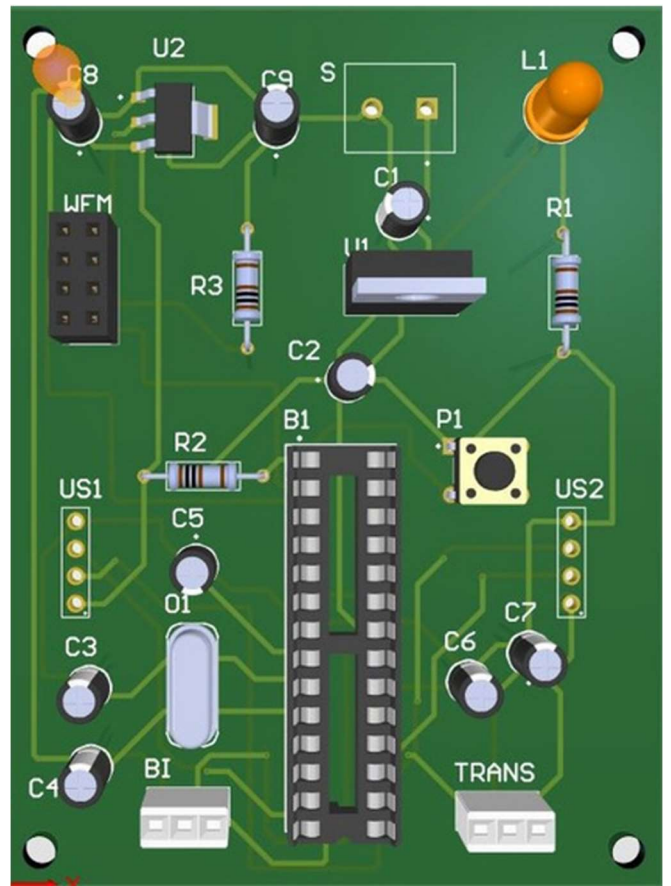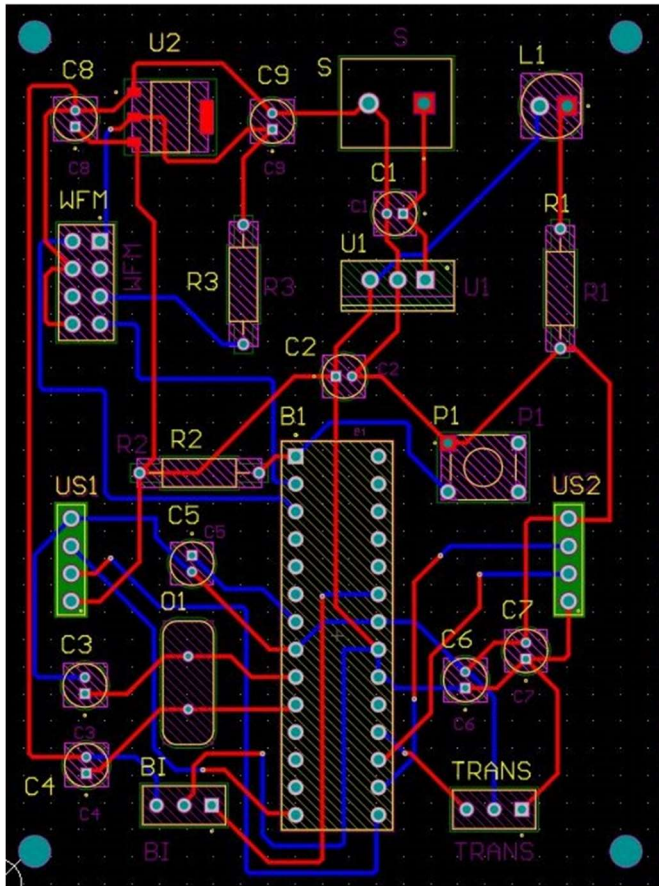
Testing and Evaluation

The system will be tested and evaluated using a combination of manual testing and automated testing tools using simulations and hardware components. The tests will be conducted in a controlled environment simulating different scenarios and conditions, such as varying ambient light levels and occupancy patterns. The evaluation criteria will be based on the system's energy efficiency, response time, reliability, and accuracy. The test results will refine the system design and improve its performance.
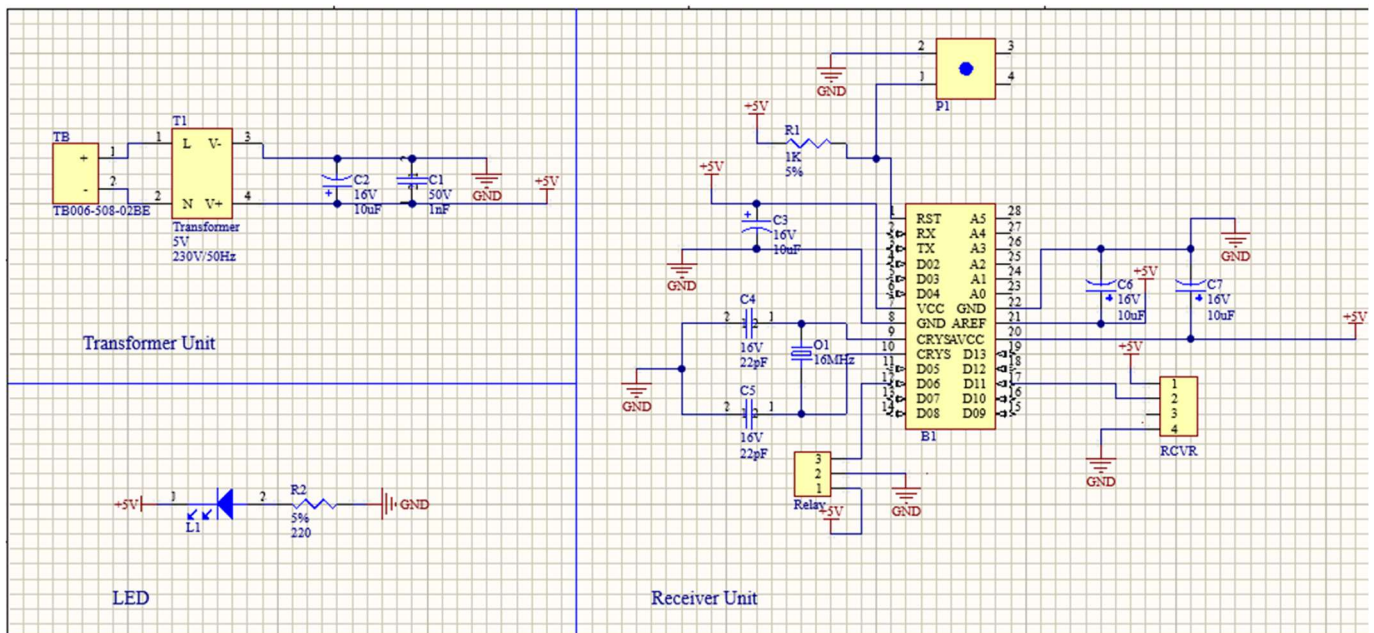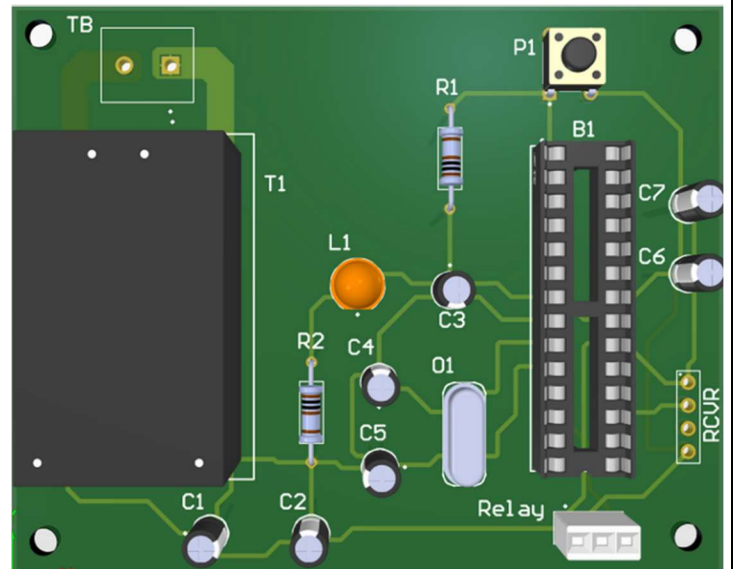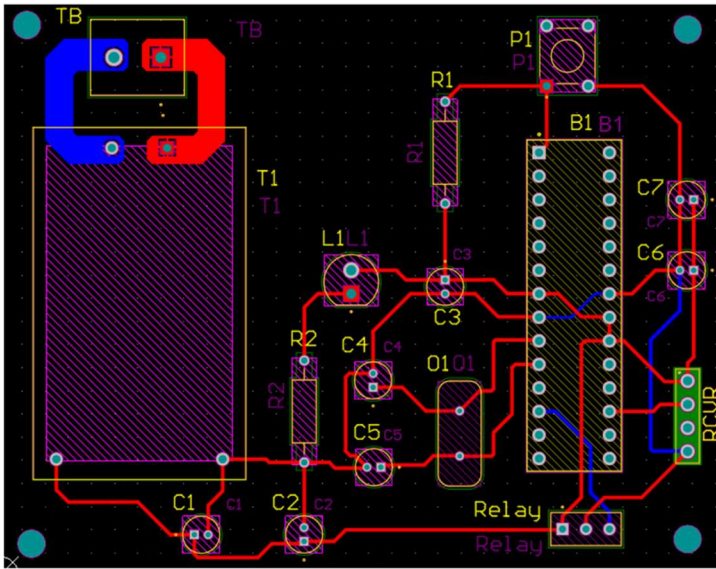
Product Architecture

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Power supply (Battery)  →  Voltage Sensor

Power supply (Battery)  →  7805 Regulator

WIFI Module  ⇄  Web Server

Voltage Sensor  → input →  Microprocessor

7805 Regulator  → input →  Microprocessor

WIFI Module  ⇅  Microprocessor

Ultrasonic Sensors  → input →  Microprocessor

Microprocessor  → output →  Transmitter Module

Transmitter Module  →  Receiver Module

Main power 230V  →  Hi-Link Transformer

Receiver Module  → input →  Microprocessor

Hi-Link Transformer  → input →  Microprocessor

Microprocessor  → output →  Relay Module

Relay Module  →  Bulb
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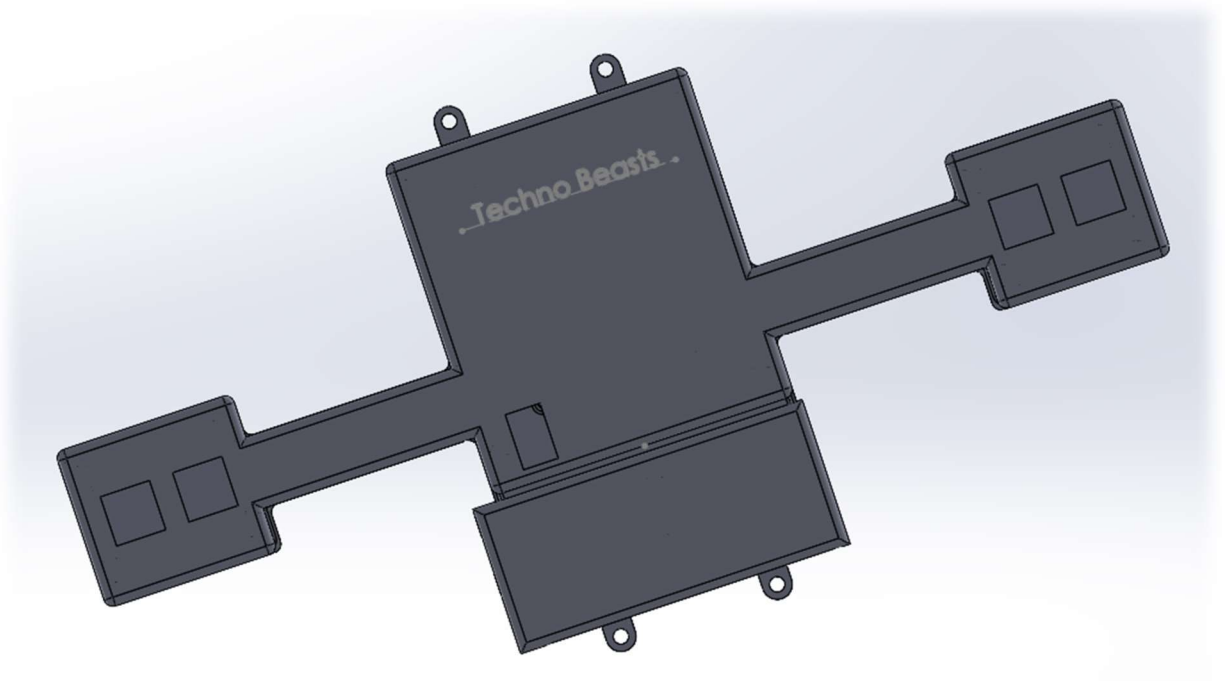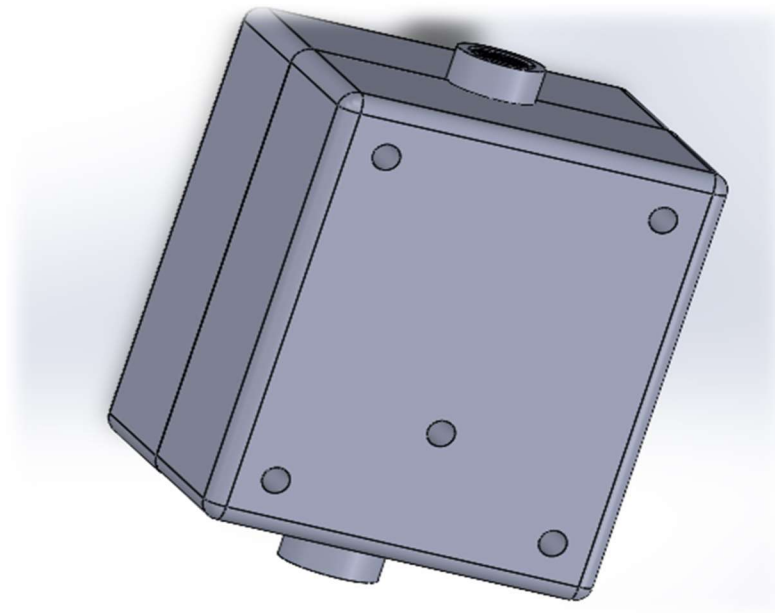
PCB Designs

Transmitter Side PCB

Receiver Side PCB

Enclosure Designs

Transmitter Side Enclosure
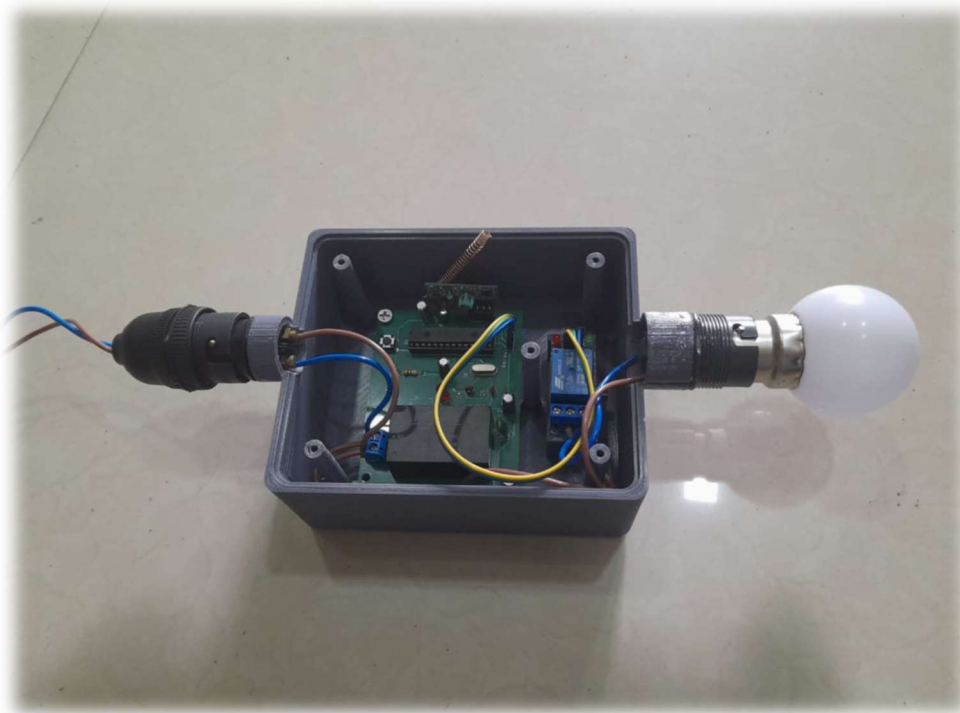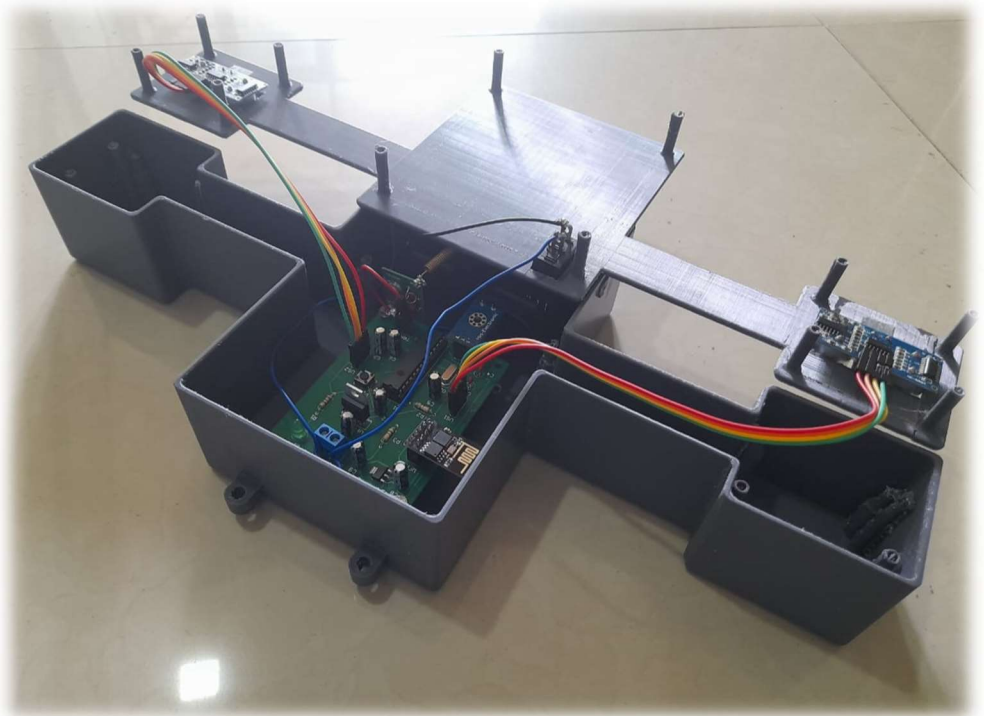

Receiver Side Enclosure

Web Site

https://technobeasts.42web.io

Finalized Product

Transmitter

Receiver

Marketing, Sales, and After-Sale Service Considerations

Marketing:

Developing a comprehensive marketing plan to promote the automatic light bulb system:
   a. Identify the target audience for the product and tailor marketing efforts accordingly.Mostly middle-aged people will be targeted because they are interested in technology and easy ways to do something.
   b. Using social media platforms and digital marketing strategies to reach a wider audience and it's better to advertise on TV is useful because most people can be caught by it as wellas social media.
   c. Partner with home automation companies and energy-efficient solution providers to increase exposure and reach new customers. Energy efficiency is another opportunity for succeed our product. Most people will be attracted to it because of the energy crisis.
   d. Attending trade shows and exhibitions to showcase the product and generate interest.

Sales:

1. Develop a sales strategy to ensure the automatic light bulb system is priced competitively. Withour survey, we found it is okay to price range above Rs.5000.00 because practically the product cost is already above Rs.5000.00.
2. Create a sales team to promote and sell the product to potential customers.
3. Offer discounts or prices to make the product more attractive.
4. Provide incentives to retailers and distributors to promote the product.
5. Develop a sales forecast to project revenue and sales targets. It is a back-office task but moreimportant to succeed in the purpose.

After-Sale Service:

1. Offer a warranty and maintenance plan for the automatic light bulb system. But pay attention to the period and conditions.
2. Provide customer support via email, phone, or online chat to answer questions andtroubleshoot issues.
3. Develop a customer feedback mechanism to monitor satisfaction levels and improve theproduct. It will be important to the market also.
4. Provide training and educational resources for customers to ensure they get the most out of theproduct.
5. Develop a repair and replacement plan to address any issues that may arise.

By considering Marketing, Sales, and After-Sale Service considerations, we can ensure the success of theautomatic light bulb system project by reaching a wide audience, generating sales, and providing excellent customer support.

Bill of quantities

Product	Quantity	Price of one quantity	Price
Atmel ATMEGA328-PU microcontroller	2	Rs. 1400.00	Rs. 2800.00
HC-SR04 4Pin Ultrasonic Sensor Module	2	Rs. 320.00	Rs. 640.00
433MHz Wireless RF Transmitter Receiver Module	1	Rs. 340.00	Rs. 340.00
5VDC 1 way 1 Channel Relay Module	1	Rs. 180.00	Rs. 180.00
L7805CV 5V Voltage Regulator	1	Rs. 50.00	Rs. 50.00
Tactile Push bottom $6 \times 6 \times 4\ mm$	2	Rs. 10.00	Rs. 20.00
16MHz Crystal Oscillator	2	Rs. 40.00	Rs. 80.00
220-ohm 2W resistor pack Carbon Film THT 5% (approx.5pcs)	1	Rs. 60.00	Rs. 60.00
10k ½ W Resistor Pack Carbon Film THT 5% (Approx.20pcs)	1	Rs. 60.00	Rs. 60.00
22pF Ceramic Capacitor THT	4	Rs. 5.00	Rs. 20.00
10uF 16V Electrolytic Capacitor THT	3	Rs. 10.00	Rs. 30.00
1nF 16V Electrolytic Capacitor THT	2	Rs. 5.00	Rs. 10.00
2-way Mini JST 2.0 PH Connector Wire Micro bit	2	Rs. 20.00	Rs. 40.00
Hi-Link HLK-5M05 220VAC to 5VDC 5W Step-Down Power Supply Module	1	Rs. 1350.00	Rs. 1350.00
28-pin Normal IC Base 2.5 mm (HE0021)	2	Rs. 20.00	Rs. 40.00
433MHz Helical Antenna	2	Rs. 115.00	Rs. 230.00
ESP8266 WIFI Module	1	Rs. 450.00	Rs. 450.00
Voltage Senser	1	Rs.130.00	Rs.130.00
PCB (Transmitter Side)	1	Rs. 230.00	Rs. 230.00
PCB (Receiver Side)	1	Rs. 230.00	Rs. 230.00
Enclosure (Transmitter Side)	1	Rs. 15000.00	Rs. 15000.00
Enclosure (Receiver Side)	1	Rs. 5000.00	Rs. 5000.00
Total			Rs. 26990.00

Task Allocation

The workload of the project is equally distributed among all the group members.

210141U – Dissanayaka D.M.S.P.

- *Transmitter Part PCB*
- *Coding*
- *Web site developing*

 210303U – Kulasingham P.N.

- *Receiver Part PCB*
- *Coding*

210341H – Liyanaarachchi L.A.S.

- *Transmitter Part Enclosure*
- *Soldering*

210705E – Wickramasingha M.P.D.N.

- *Receiver Part Enclosure*
- *Soldering*