Smart Lighting System

A PROJECT REPORT

Submitted by

Group Id: 84835

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In partial fulfillment for the award of the degree
Of

BACHELOR OF ENGINEERING
in

Information Technology

MADHUBEN AND BHANUBHAI PATEL INSTITUTE OF TECHNOLOGY,
NEW V. V. NAGAR

Gujarat Technological University
Ahmedabad

2019-20

MADHUBEN AND BHANUBHAI PATEL INSTITUTE OF TECHNOLOGY
NEW V. V. NAGAR

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This is to certify that the project entitled **"Smart Lighting System"** has been carried out by **Payal Patel (160630116032), Himani Thakar (160630116041), Mansi Patel (160630132001)** under my guidance in fulfillment of the degree of Bachelor of Engineering in Information Technology 8th Semester of Gujarat Technological University, Ahmedabad during the academic year 2019-20.

Prof. Roshani Shah — **Internal Guide**

Prof. Hetal Chudasama — **Head of Department**

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Chapter 1: Introduction 1.1 Purpose This system deals saving the energy in the smart conference room, which uses the object detection and the energy efficiency algorithm in order to save the energy. Approaches for energy saving can be grouped in two parts, i.e., LDR-based and IR-based ones. System proposes a novel two-stage IOT framework where consumption of the light can be reduced with the help of sensors and IOT model. It shows that this framework enables new portrait for the saving of electricity in the smart room. 1.2 Document Convention IR Infrared Sensor LDR Light Dependent Resistor IOT Internet of Things nodeMCU Node MicroController Unit 1.2.1 Infrared Sensor An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. The device which emits so as to sense some object in the surroundings is called infrared sensor. Infrared sensor detects the motion of the object as well as heat of an object. 1.2.2 Light Dependent Resistor An LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. Its resistance decreases by increasing the intensity of light or in different word, it is used to exhibit photo conductivity. 1.2.3 Internet of Things The Internet of things (IoT) is a system of interrelated computing devices, mechanical and digital machines provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. 1.2.4 node MicroController Unit NodeMCU is an open source IOT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The firmware uses the Lua scripting language. ESP8266 is a low-cost, Wi-Fi Module chip that can be configured to connect to the Internet for Internet of Things (IOT) and similar Technology Projects. 1.3 Product Scope Smart system of lighting is rapidly getting ready for an energy efficient candidate to replace current inflorescent lights in the apartments. These kinds of systems use LEDS for operating in sensor-rich environments to transfer lighting which is appropriate while formatting usage of energy. Longevity and high efficiency and large bandwidth makes LEDs desired components for lighting. Saving of energy from smart lighting systems are having the potential for significant economic impact while lights contribute more than 30% consumption of electric energy in developed countries, which costs them billions of dollars annually. Chapter 2: Literature Survey 2.1 Brief Description of Domain 2.1.1 Problem Summary Smart systems of lighting rapidly getting ready for an energy efficient candidate to replace current inflorescent lights in the apartments. These kinds of systems use LEDS for operating in sensor-rich environments to transfer lighting which is appropriate while formatting usage of energy. Longevity and high efficiency and large bandwidth makes LEDs desired components for lighting. Saving of energy from smart lighting systems are having the potential for significant economic impact while lights contribute more than 30% consumption of electric energy in developed countries, which costs them billions of dollars annually. Occupancy control-based smart lighting is an energy-efficient method for lighting control. 2.1.2 Objective of the Project To develop a system for intelligent lighting system using control of occupancy with the help of Arduino nodeMCU microcontroller, IR module, relay and transformer. Saving of energy from smart lighting systems is having the potential for significant economic impact while lights contribute more than 30% consumption of electric energy in developed countries, which costs them billions of dollars annually. In this approach the artificial lighting of the indoor environment depends on people in the room. The sensor is deployed to detect human existence. Given information will then be used in the smart lighting system. Occupancy sensing obtains feedback from digital sensors which are transparent into an embedded system. The important advantage of the given approach is that only energy is consumed just when it is needed, thereby reducing the cost of making available energy to others. It is effective so it requires no human intervention for its operation. 2.2 Overall description of system 2.2.1 Product Perspective This project is designed to provide an IOT based system for energy efficiency. This includes automatic controls that make adjustments based on conditions such as

occupancy and daylight availability. This ability saves energy and provides a level of comfort and convenience. The final output is based on both hardware readings and the code implemented to adjust the intensity of a LED bub. 2.2.2 Project Function Figure 2.1 Data Flow Diagram 2.2.3 Operating Environment The following are the technologies which are used in our project. 2.2.2.1 Software * Arduino IDE * ThingSpeak Platform 2.2.2.2 Hardware * IR Sensor * LDR Sensor * nodeMCU * Transformer * Relay 2.2.4 Design Implementation constraint The feature is not applicable for real time processing. It detects the occupancy over a short range. Both the sensors are to be arranged in such a way that it can detect the occupancy and external light in a feasible way. Incorrect placement of sensors can lead to failure in the output of the system. 2.2.5 Feasibility Study This is a small scale project it is not yet feasible for working in real time. Currently the IR sensor can detect the occupancy over a short range while other high range sensors can be used to specifically detect the presence of human being. In future, this feature can be enhanced more by providing accuracy in sensing and detecting. 3.1.5 LDR Sensor

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ACKNOWLEDGEMENT

We take this opportunity with much pleasure to thank all the people who have helped us through the course of our journey towards producing this report. We sincerely thank our project guide **Prof. Roshani Shah** for her guidance, help and motivation. Apart from the subject of our project, we learnt a lot from her, which we are sure, will be useful to us in different stages of our life. We would like to express our gratitude to them for much help with the project design and methodology, and for review and many helpful comments.

We would like to thank our concerned faculty members for their assistance in finalizing the project problem and useful comments. We would like to thank our other members of faculty at **MBIT** for their caring and supportive attitude. We would like to thank all the lab assistants for their assistance and help.

Payal Patel (160630116032)
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Mansi Patel (160630132001)

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ABSTRACT

For the utilization of a very few amount of energy available to us, its consumption in an efficient manner is the biggest concern of any developing country in the current time. Automation for Lighting in residential or industrial buildings is one of the energy efficient strategies for sustainable economic development. In this project, a system is developed for intelligent lighting using control of occupancy. This prototype is of an Arduino nodeMCU micro controller and IR module, relay, and a transformer. The IR sensor simply detects the existence of human inside the smart conference room and sends the corresponding data signal to Arduino nodeMCU board. The relay of switches is being connected to nodeMCU board and it acts as a whole control and coordination unit for the entire system. The static and global count has also been used for tracking the total occupancy of people in the room. This proposed project has notably achieved the reduction of energy consumption by controlling the intensity of the light accordingly whenever it is needed. Implementation of this system can happen in real time applications on a big scale in the resident area as well as the corporate offices and it encourages the reduction of energy consumption which in turn makes it available for different other areas of the country which are not yet available for the power source.

Chapter 1: Introduction

1.1 Purpose

This system deals saving the energy in the smart conference room, which uses the object detection and the energy efficiency algorithm in order to save the energy. Approaches for energy saving can be grouped in two parts, i.e., LDR-based and IR-based ones. System proposes a novel two-stage IOT framework where consumption of the light can be reduced with the help of sensors and IOT model. It shows that this framework enables new portrait for the saving of electricity in the smart room.

1.2 Document Convention

IR	Infrared Sensor
LDR	Light Dependent Resistor
IOT	Internet of Things
nodeMCU	Node MicroController Unit

1.2.1 Infrared Sensor

An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. The device which emits so as to sense some object in the surroundings is called infrared sensor. Infrared sensor detects the motion of the object as well as heat of an object.

1.2.2 Light Dependent Resistor

An LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. Its resistance decreases by increasing the intensity of light or in different word, it is used to exhibit photo conductivity.

1.2.3 Internet of Things

The Internet of things (IoT) is a system of interrelated computing devices, mechanical and digital machines provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

1.2.4 node MicroController Unit

NodeMCU is an open source IOT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The firmware uses the Lua scripting language. ESP8266 is a low-cost, Wi-Fi Module chip that can be configured to connect to the Internet for Internet of Things (IOT) and similar Technology Projects.

1.3 Product Scope

Smart system of lighting is rapidly getting ready for an energy efficient candidate to replace current inflorescent lights in the apartments. These kinds of systems use LEDS for operating in sensor-rich environments to transfer lighting which is appropriate while formatting usage of energy. Longevity and high efficiency and large bandwidth makes LEDs desired components for lighting. Saving of energy from smart lighting systems are having the potential for significant economic impact while lights contribute more than 30% consumption of electric energy in developed countries, which costs them billions of dollars annually.

Chapter 2: Literature Survey

2.1 Brief Description of Domain

2.1.1 Problem Summary

Smart systems of lighting rapidly getting ready for an energy efficient candidate to replace current inflorescent lights in the apartments. These kinds of systems use LEDS for operating in sensor-rich environments to transfer lighting which is appropriate while formatting usage of energy. Longevity and high efficiency and large bandwidth makes LEDs desired components for lighting. Saving of energy from smart lighting systems are having the potential for significant economic impact while lights contribute more than 30% consumption of electric energy in developed countries, which costs them billions of dollars annually. Occupancy control-based smart lighting is an energy-efficient method for lighting control.

2.1.2 Objective of the Project

To develop a system for intelligent lighting system using control of occupancy with the help of Arduino nodeMCU microcontroller, IR module, relay and transformer. Saving of energy from smart lighting systems is having the potential for significant economic impact while lights contribute more than 30% consumption of electric energy in developed countries, which costs them billions of dollars annually. In this approach the artificial lighting of the indoor environment depends on people in the room. The sensor is deployed to detect human existence. Given information will then be used in the smart lighting system. Occupancy sensing obtains feedback from digital sensors which are transparent into an embedded system. The important advantage of the given approach is that only energy is consumed just when it is needed, thereby reducing the cost of making available energy to others. It is effective so it requires no human intervention for its operation.

2.2 Overall description of system

2.2.1 Product Perspective

This project is designed to provide an IOT based system for energy efficiency. This includes automatic controls that make adjustments based on conditions such as occupancy and daylight availability. This ability saves energy and provides a level of comfort and convenience. The final output is based on both hardware readings and the code implemented to adjust the intensity of a LED bub.

2.2.2 Project Function

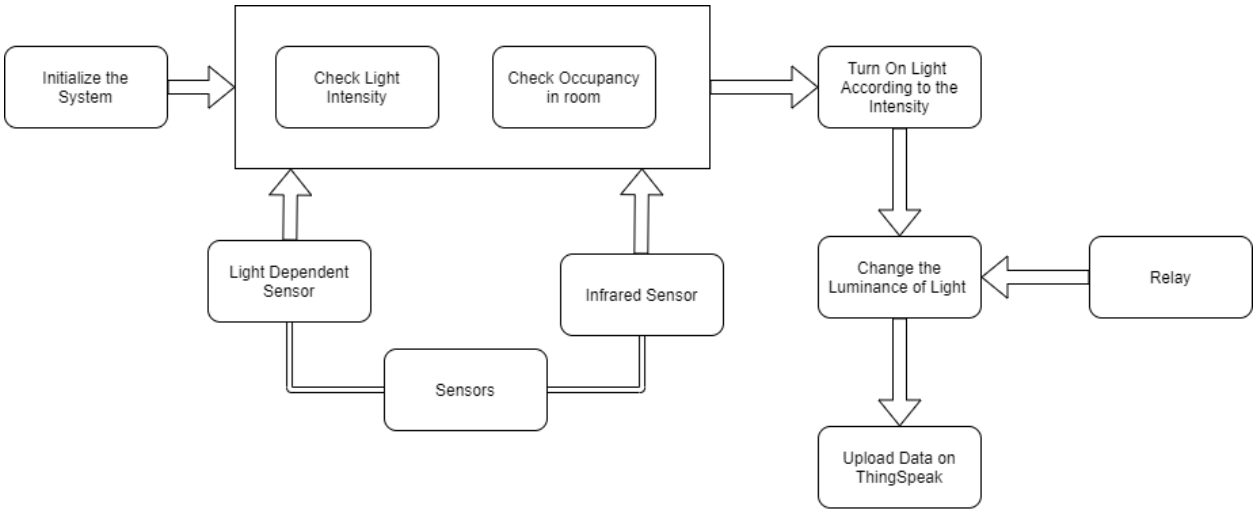

Figure 2.1 Data Flow Diagram

2.2.3 Operating Environment

The following are the technologies which are used in our project.

2.2.2.1 Software

- Arduino IDE
- ThingSpeak Platform

2.2.2.2 Hardware

- IR Sensor
- LDR Sensor
- nodeMCU
- Transformer
- Relay

2.2.4 Design Implementation constraint

The feature is not applicable for real time processing. It detects the occupancy over a short range. Both the sensors are to be arranged in such a way that it can detect the occupancy and external light in a feasible way. Incorrect placement of sensors can lead to failure in the output of the system.

2.2.5 Feasibility Study

This is a small scale project it is not yet feasible for working in real time. Currently the IR sensor can detect the occupancy over a short range while other high range sensors can be used to specifically detect the presence of human being. In future, this feature can be enhanced more by providing accuracy in sensing and detecting.

2.3 Canvas

2.3.1 AEIOU Canvas

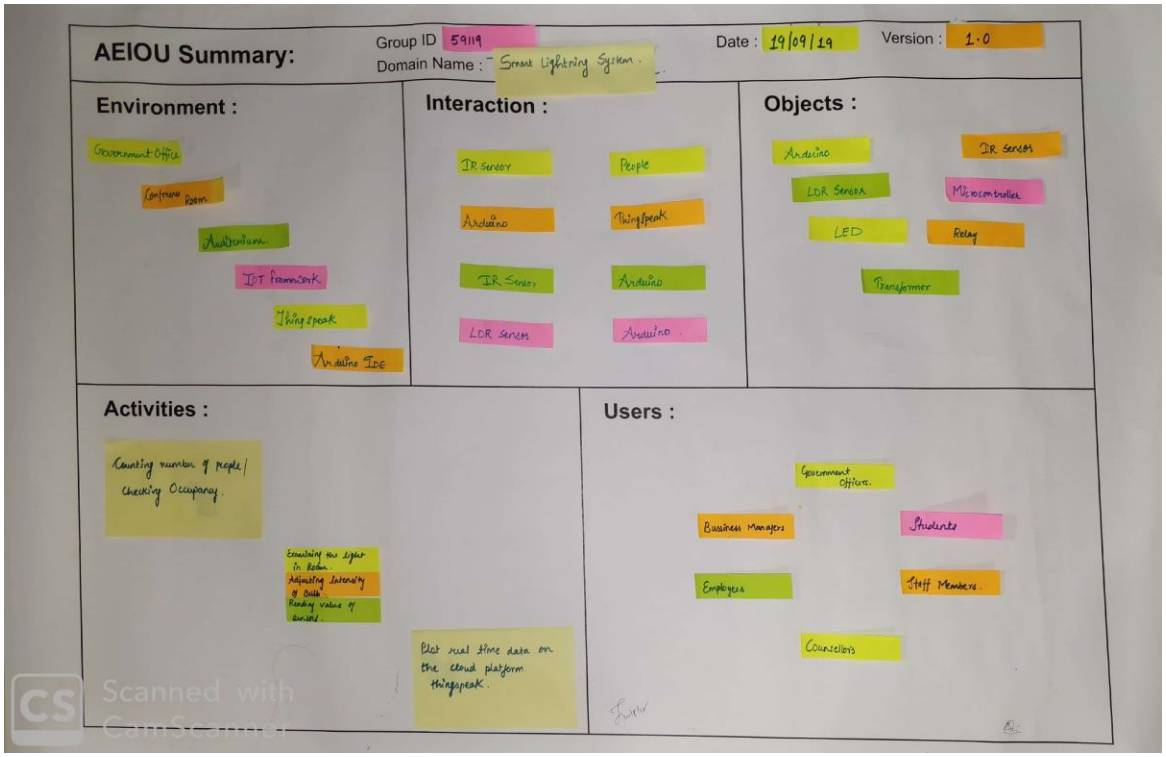

Figure 2.2 AEIOU Canvas

AEIOU stands for 5 elements to be coded: Activity, Environment, Interaction, Object, and User. Activities are goal directed sets of action paths towards things people want to accomplish. The modes people work in, and the specific activities and processes they go through. Objects are building blocks of the environment, key elements sometimes put to complex or unintended uses, the objects and devices people have in their environments and how do they relate to their activities.

2.3.2 Empathy Canvas

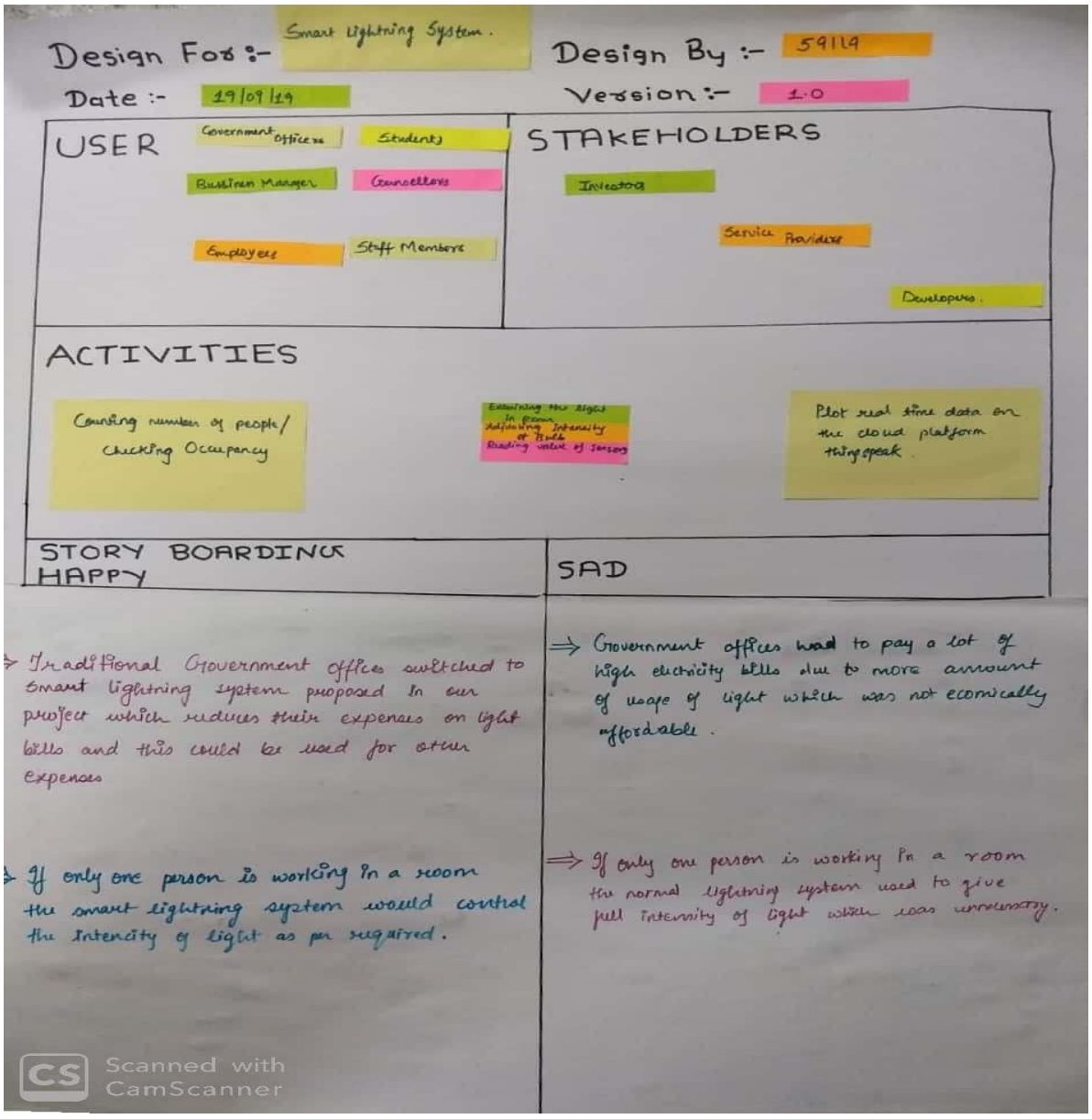

Figure 2.3 Empathy Canvas

1. To define any centric problem we need to know the user properly.
2. Stakeholder: the people that directly or indirectly make an impact on the system. The main supporters of our project i.e. the ISP, Developer an Investor.
3. Story boards: It helped us understand that when we build anything for anyone, the purpose and emotion behind that are equally important.

2.3.3 Ideation Canvas

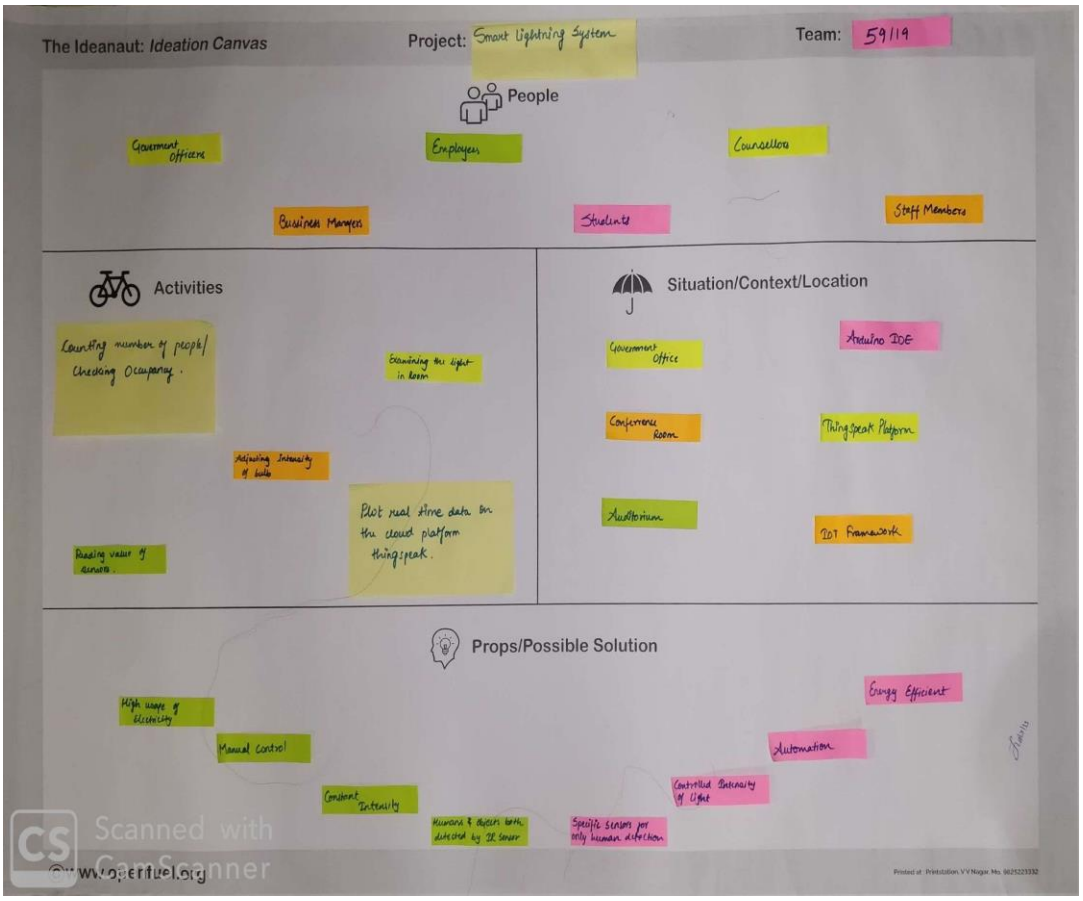

Figure 2.4 Ideation Canvas

Ideation is the creative process of generating, developing, and communicating new ideas, where an idea is understood as a basic element of thought that can be visual, concrete, or abstract. Ideation comprises all stages of a thought cycle, from innovation, to development, to actualization. As such, it is an essential part of the design process, both in education and practice. We explained how things can be connected to get a better idea.
An ideation canvas is a rough whiteboard/sheet where ideas can be stretched into any limits or dimensions. Ideation session is not aimed at finding solutions to the defined problem. But its aim is to define the best possible problem and stretch out its possible scope.

2.3.4 Product Development Canvas

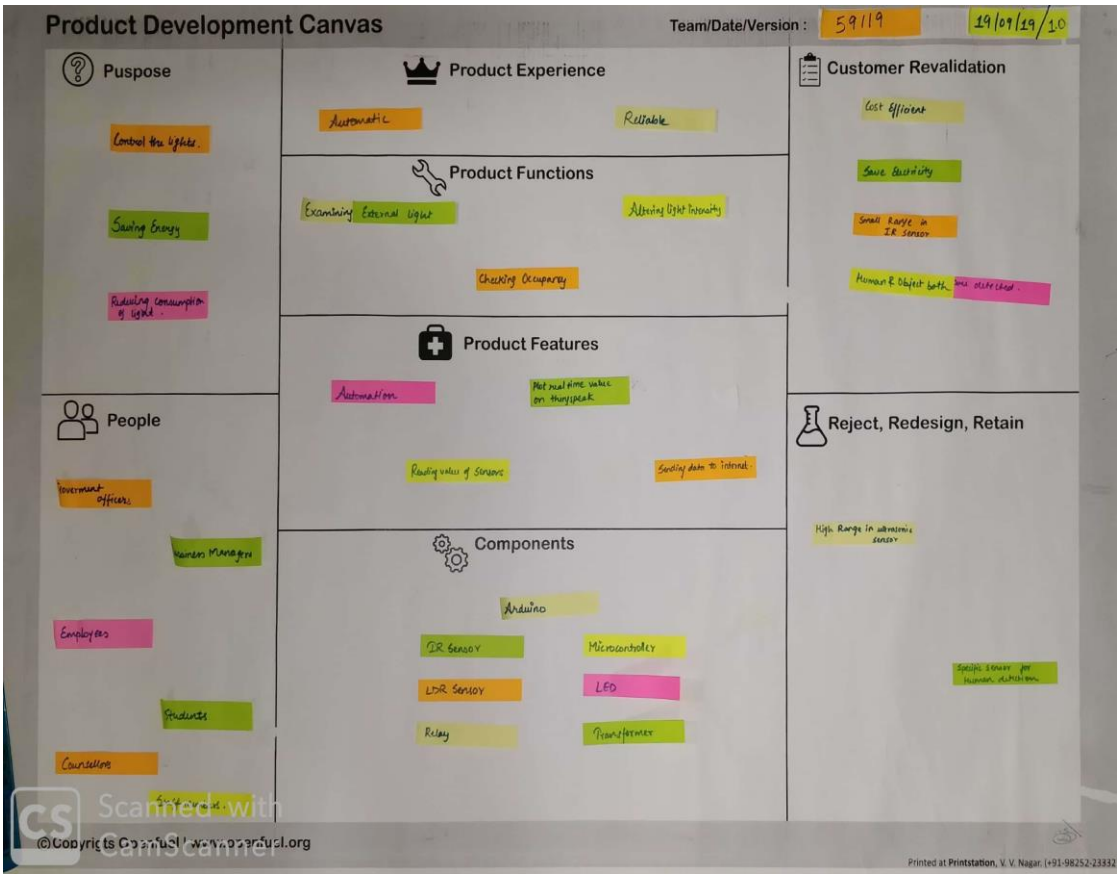

Figure 2.5 Product Development Canvas

We had to design a product based on a key solution. A key solution according to our understanding was a solution which solved a key problem. Out of the many possible solutions for multiple problems that we listed down in the "Ideation" phase, we recognized some problems that if solved would be very emotionally rewarding to the users and functionally rewarding to the supply chain management.

Chapter 3: Software Requirement Specification

3.1 Tools and Technologies

3.1.1 Arduino IDE

Figure 3.1 Arduino IDE

The Arduino integrated development environment (IDE) is a cross platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.

The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures.

3.1.2 ThingSpeak Platform

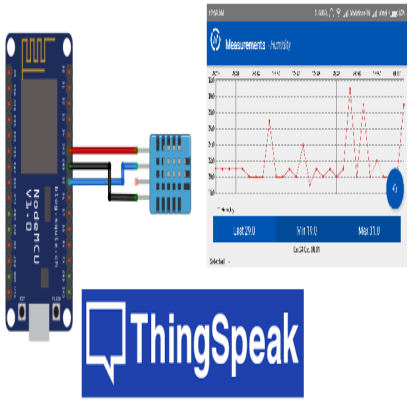

Figure 3.2 ThingSpeak Platform

According to its developers, "ThingSpeak is an open-source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP and MQTT protocol over the Internet or via a Local Area Network. ThingSpeak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates".

ThingSpeak has integrated support from the numerical computing software MATLAB from MathWorks, allowing ThingSpeak users to analyze and visualize uploaded data using Matlab without requiring the purchase of a Matlab license from Mathworks.

3.1.3 nodeMCU microcontroller

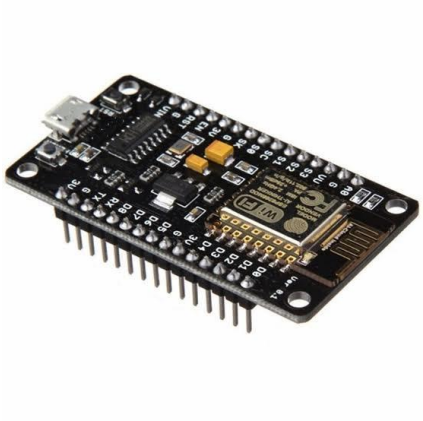

Figure 3.3 nodeMCU micro controller

NodeMCU is an open source IOT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. ESP8266 is a low-cost, Wi-Fi Module chip that can be configured to connect to the Internet for Internet of Things (IOT) and similar Technology Projects.

3.1.4 IR Sensor

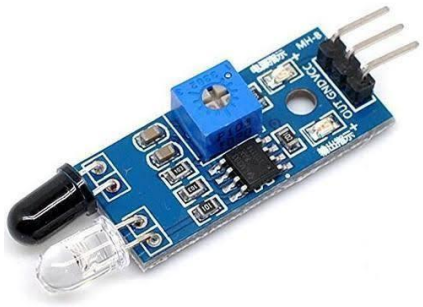

Figure 3.4 IR Sensor

An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. The device which emits so as to sense some object in the surroundings is called infrared sensor. Infrared sensor detects the motion of the object as well as heat of an object. An IR sensor measures infrared radiation of object instead of emitting so that they are also called as passive IR sensors. Usually all objects radiate some thermal radiations mostly in infrared spectrum. These radiations are not visible by our eyes which can be detected by infrared sensor.

3.1.5 LDR Sensor

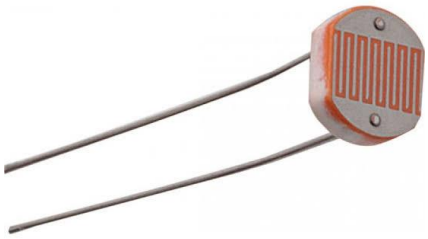

Figure 3.5 LDR Sensor

An LDR sensor aka light dependent resistor is a resistor controlled by light. Its resistance decreases by increasing the intensity of light or in different word, it is used to exhibit photo conductivity. An LDR sensor can be installed in circuits which are light sensitive; also, dark and light activated circuits. LDR sensor consists of the semiconductor with high resistance. In the dark it can have a very high resistance in range of mega ohms while in the presence light a LDR sensor can have a resistance of very low in hundreds ohms. If the light incident on the LDR sensor exceeds certain ohms, then there will be absorption of the photons which in turn will give electron energy as much to jump into conduction band. This results in free electrons to conduct the electricity so as to reduce the resistance. The range of resistance and sensitivity is fully dependent on the device being used. Also different LDR sensors can react differently within certain wavelength to the photons.

3.1.6 Transformer

Figure 3.6 Transformer

A transformer is a passive electrical device that transfers electrical energy between two or more circuits. A varying current in one coil of the transformer produces a varying magnetic flux, which, in turn, induces a varying electromotive force across a second coil wound around the same core. Electrical energy can be transferred between the two coils, without a metallic connection between the two circuits.

Transformers are used for increasing or decreasing the alternating voltages in electric power applications, and for coupling the stages of signal processing circuits.

3.1.7 Relay

Figure 3.7 Relay Circuit

A **relay** is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.

Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal.

The traditional form of a relay uses an electromagnet to close or open the contacts, but other operating principles have been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called protective relays.

3.2 System Features

3.2.1 System Features

Occupancy Sensing

Occupancy sensing is a technique used to detect the amount of people present in a room. In this project, we are using this technique in order to control the intensity of light depending upon the occupancy present in the room. It allows for dimming or turning off lights automatically after a given space has been vacant for a certain user-specified period of time. Once movement is detected, lights turn back on or dim up as desired. It also alters the intensity of light depending upon the range of occupancy, as high occupancy rate requires more amount of light intensity, whereas low occupancy requires less amount of light intensity. The movement detection part is handled by motion sensors employing infrared, PIR, ultrasonic or microwave sensing technology. The number of sensors that should be deployed in a given space in order to provide the lighting system with a sufficient input depends both on the size and the type of that space, as well as on the desired performance of lights there. A method which enables more efficient performance, is one where the space is divided into a number of separate lighting zones, each assigned to one or more sensors. Whenever movement is detected in one of the zones, only this particular zone lit up.

The picture below shows how this works

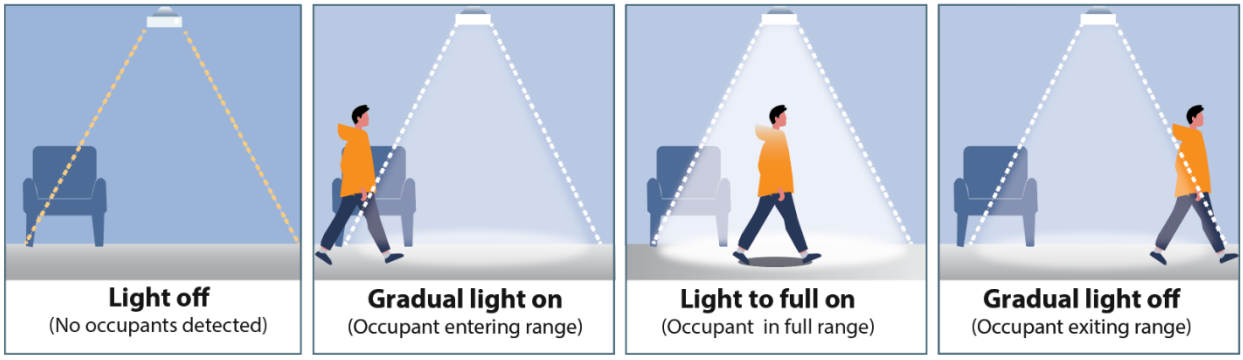

Figure 3.8 Occupancy Sensing

Detecting of a human depends on the range of a sensor. For ex, IR sensor has a range of 2-30cm to detect an obstacle.

Detecting External Light

This technique is used to adjust the intensity of bulb according to the external sunlight present in the room. With less sunlight the requirement of bulb intensity is more, whereas less intensity is required depending upon the presence of sunlight.

In order to detect the intensity of light or darkness, we use a sensor called an LDR (light dependent resistor). The LDR is a special type of resistor that allows higher voltages to pass through it (low resistance) whenever there is a high intensity of light, and passes a low voltage (high resistance) whenever it is dark.

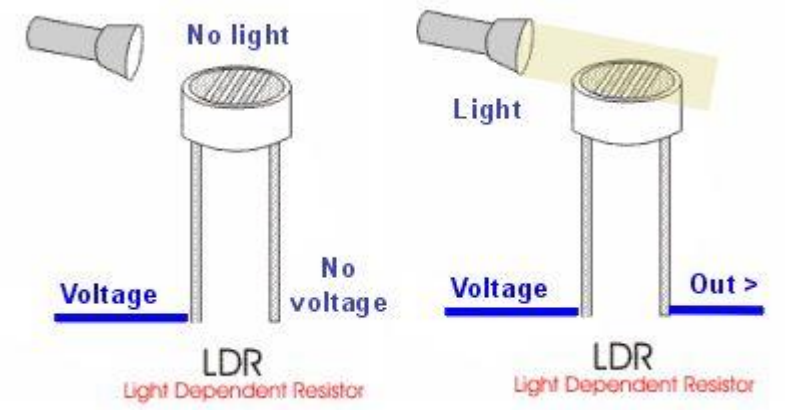

Figure 3.9 Working of LDR Sensor

Automation in Altering Light Intensity

The project provides automatic alteration in intensity of LED bulb depending upon the two factors i.e. occupancy of the room and external sunlight present in the room. Intensity of the bulb is adjusted using the transformer and relay circuit.

The sensors depict the data on occupancy and daylight, depending upon which the relay in either turned ON/OFF. The transformer is used to control the voltage of the bulb.

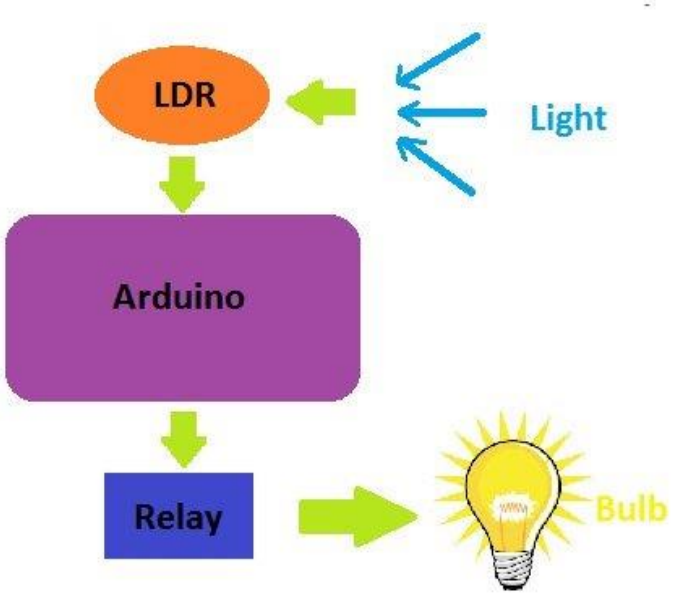

Figure 3.10 Altering Intensity of Bulb

3.3.1 Project Description and Goals

The aim of the project is to build a smart lighting system using occupancy sensing and detecting external sunlight. Based on these two factors the intensity of a bulb can be adjusted. This system deals saving the energy in the room, which uses the object detection and the energy efficiency algorithm in order to save the energy.

The project has proposed the idea of smart lighting system which can help in automation. The system has a connection among wired sensors, micro-controller, transformers and relays for the purpose of voltage regulation. This system includes various systems and their applications which performs specified functions and provides the automation and control. This project discusses the modules like Counting number of people, sending data to internet, and altering the intensity of light with respect to the given condition. In this project, an efficient approach for smart lighting system is proposed. C Arduino programming and nodeMCU micro-controller has been used to collect data for the wi-fi. It shows how to use the various sensors, which detects occupancy and availability of external light source in the room. In addition, that this project shows the way to sense and analyze the real time data over the internet and store it in a cloud platform, and a way to send data to the user for visualization. Also, this project shows the idea of how to save the electricity in general in any of the room and make use of sensors effectively. Main control for the entire system has been assigned to nodeMCU micro-controller which is Arduino based WIFI embedded controller. This system design is to detect the occupancy of the humans entering and leaving the room and detect any external light which enters the room and based on that parameter, changing brightness of light in the room.

3.3 System Design

3.3.1 System Architecture

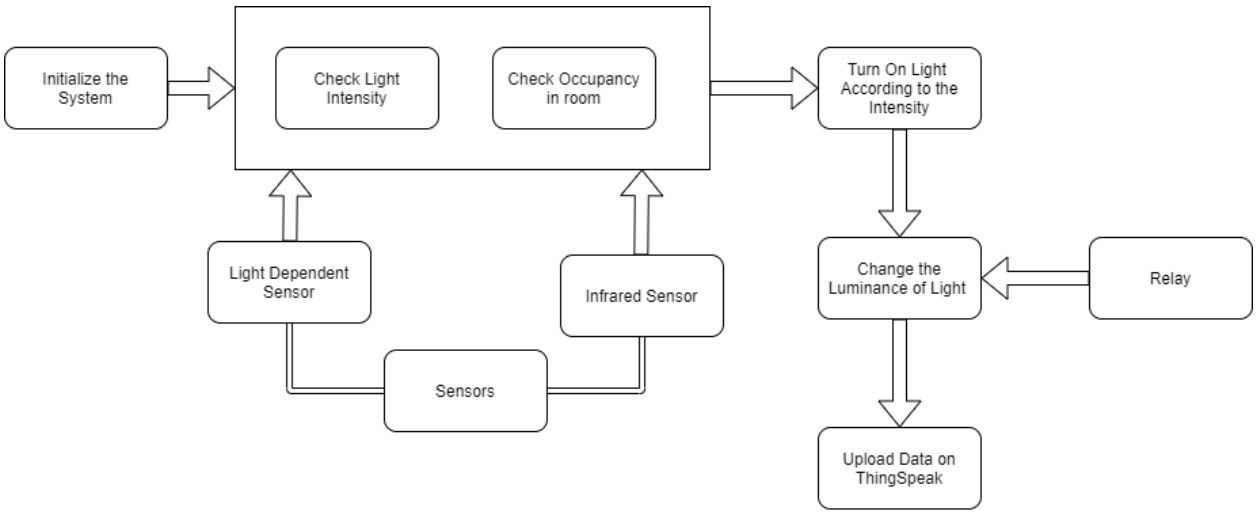

Figure 3.11: System Architecture

This system architecture has used IOT for the purpose of smart Lighting. Internet Of Things is a mainly concerned with hardware which is inspired from the structures and functions of the devices called IOT nodes .With addition to the scalability, another benefit of the proposed IOT models is their ability to extract and plot the real time data on the cloud platform called thingspeak Project excels on problem domains where the inputs or even output can be analog or digital which gives more flexibility to overall operation of the model. Meaning, the input to sensors can be analog or digital. i.e. the IR sensor takes digital input whereas LDR sensor collects the digital input ranging from 0 to 1024.

3.3.2 Flow Chart

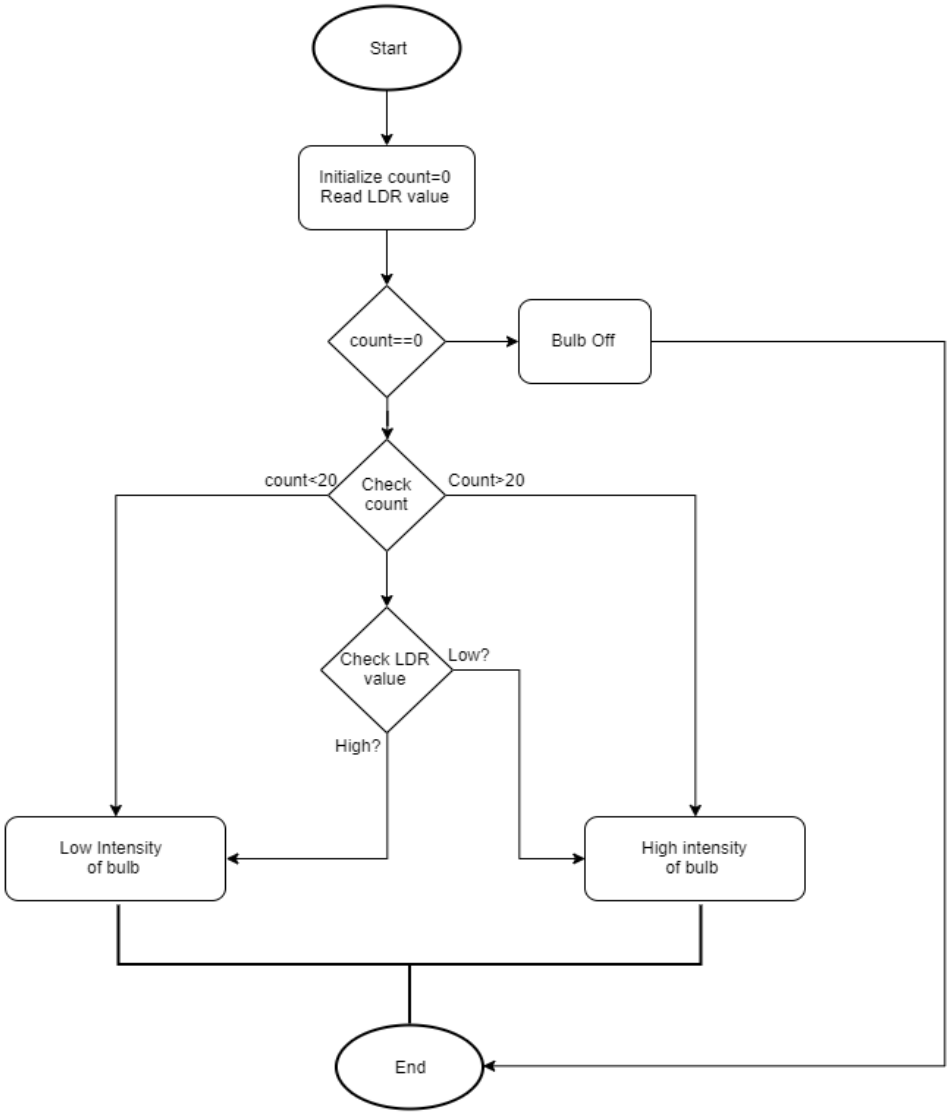

Figure 3.12 Flow Chart

3.3.2 Use-Case Diagram

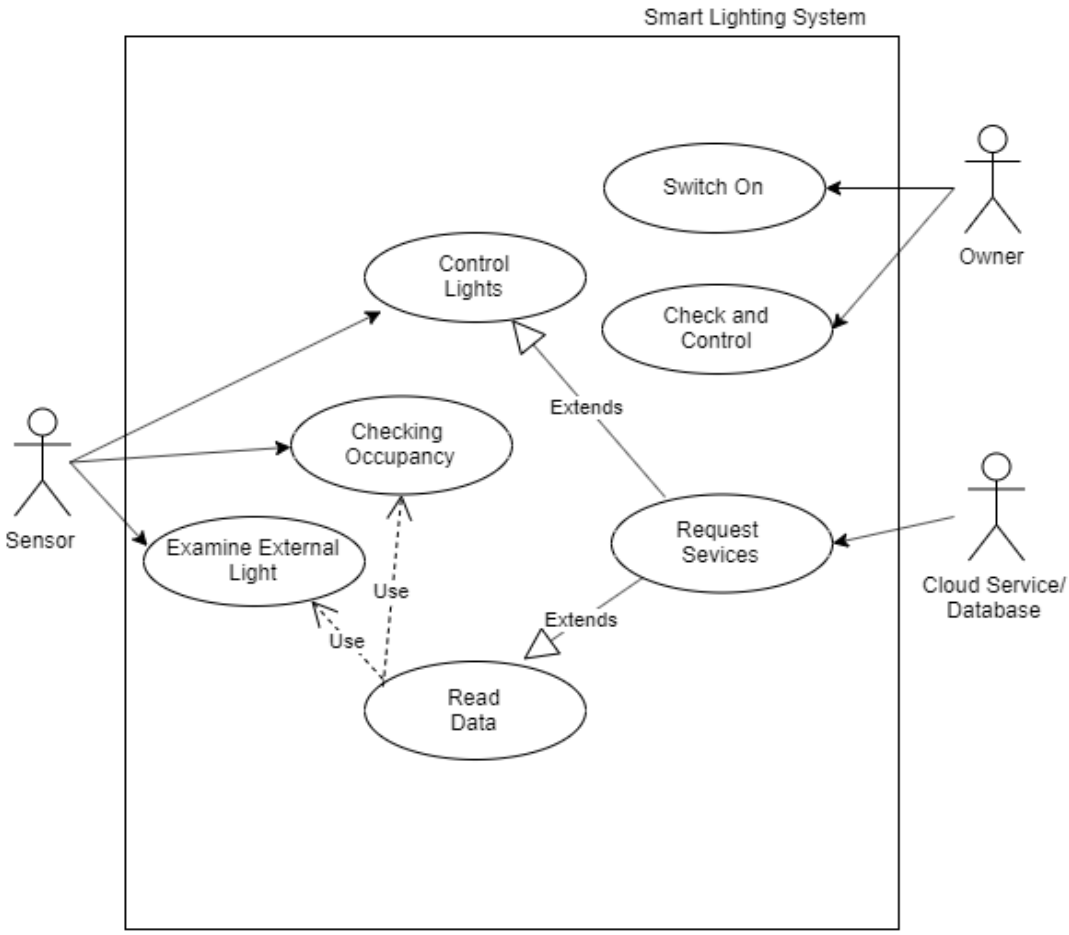

Figure 3.13 Use Case Diagram

Chapter 4: Modules

4.1 Counting Number of People in a Room

This project demonstrates the count of non-transparent object which are being traversing through two IR sensors: the first sensor increments the value of IR sensor, while the second sensor decrements the value of count. This project uses simple demo in which count for both the sensors is considered in one variable only. Depending upon the number of people in the room LED light glows as per the range of occupancy. If the count is less than 20 then green light; If the count is between 20 and 40 then yellow light else red light glows for high occupancy range.

4.2 Examining the Light in a Room

To examine the amount of external light present in the room, LDR sensor is used.

An LDR sensor aka light dependent resistor also photoresistor is a resistor controlled by light. Its resistance decreases by increasing the intensity of light or in different word, it is used to exhibit photo conductivity.

As per the circuit, we have made a voltage divider circuit using LDR and 100k resistor. The voltage divider output is feed to the analog pin of the microcontroller. The analog Pin senses the voltage and gives some analog value to microcontroller. The analog value changes according to the resistance of LDR. So, as the light falls on the LDR the resistance of it gets decreased and hence the voltage value increase.

As per the Arduino code, if the analog value falls below 500, we consider it as dark and the light turns ON. If the value comes above 500, we consider it as bright and the light turns OFF.

4.3 Plotting the Real-Time Value on Internet

For plotting the real time value on internet, we are gathering the data from the sensors and uploading them on the thingspeak where we get the real time graph of different entities w.r.t time. For example: LDR value and time graph as on internet.

Figure 4.1: An Example Plot

4.4 Adjusting the Intensity of Bulb

Intensity of the bulb is adjusted using the transformer and relay circuit. -The light intensity is adjusted in accordance with the number of people present in the room and the intensity of the external light in the room.

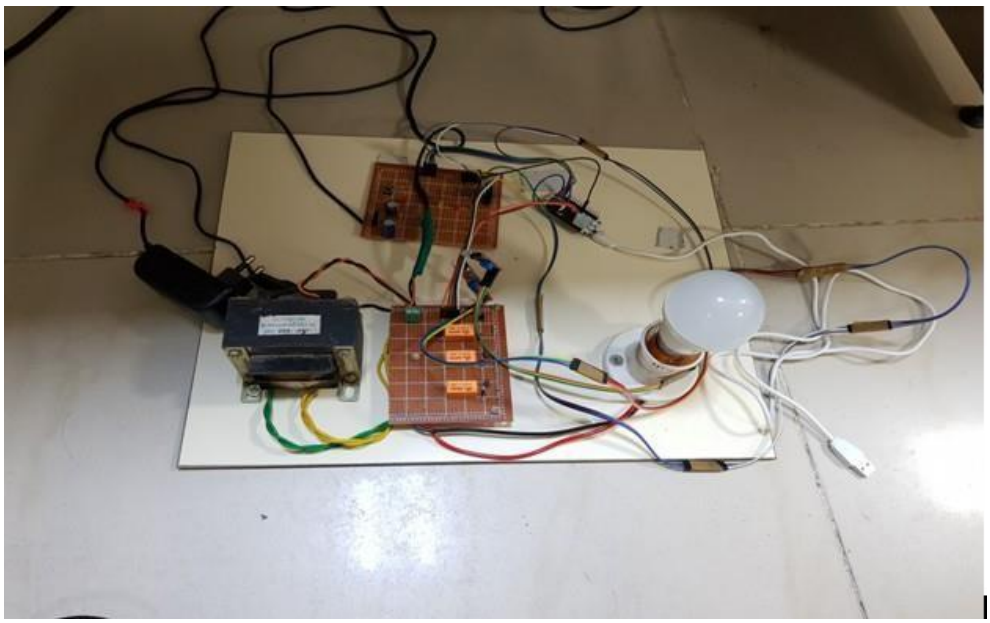

Figure 4.2 Whole System

Chapter 5: Implementation and Result

5.1 Installation and Procedure to Run Modules

The basic modules in this project are

1. setup()
2. connectWifi()
3. loop()
4. sendDataTS()
5. isrcount1()

setup()

This function is used to setup the initial variables, pin modes and start using libraries. Wi-Fi is connected which will further help in sending the data to the online platform called ThingSpeak. Different task is assigned to various pins of the microcontroller. LDR is also attached with one of the pins in the MCU, which is again assigned to one of the pin mode.

connectWfi()

This function is basically used to connect the microcontroller with the Wi-Fi which will further help in sending the data to the online platform called thingspeak. The sensor data regarding the connected elements of the nodeMCU will be sent via this Wi-Fi to the online platform.

loop()

This function makes sure that the code in the function runs until the condition is satisfied. All the lines under this function is executed continuously until the alteration in the flag.

sendDataTS()

This particular function is basically going to send the data from various sensors connected to the nodeMCU and will send them directly to the thingspeak platform where we can easily see the live variations happening and how the variables changes with the time.

isrCount()

This function is basically used for counting of the variable. The IR sensor used in the project will be having the count of the no of people present inside the room which is nothing but the difference between the counters (outside and inside counter). And according to the difference which is no of people inside the room, the intensity of the light will be varied.

5.2 Result

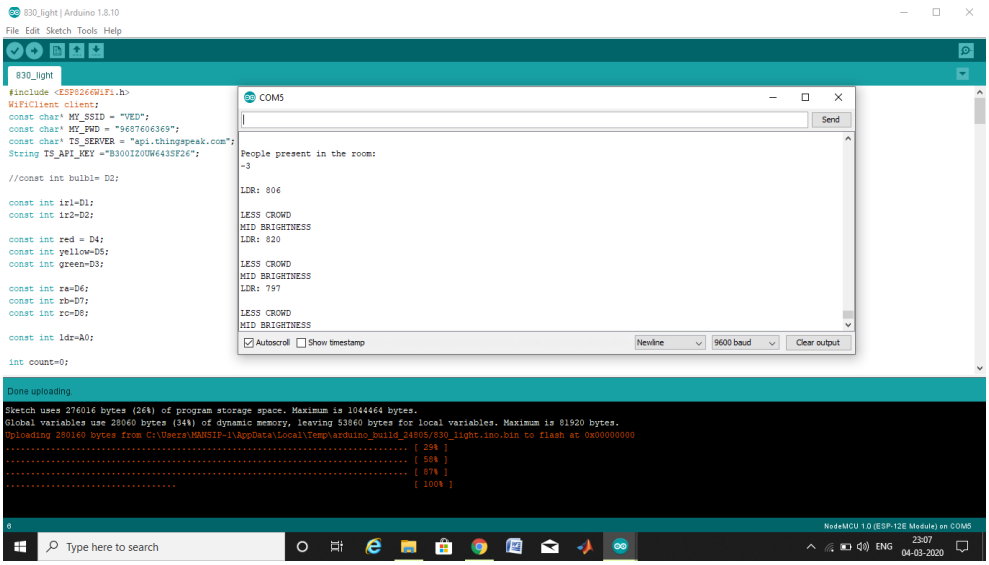

Figure 5.1: Status of Sensor Data

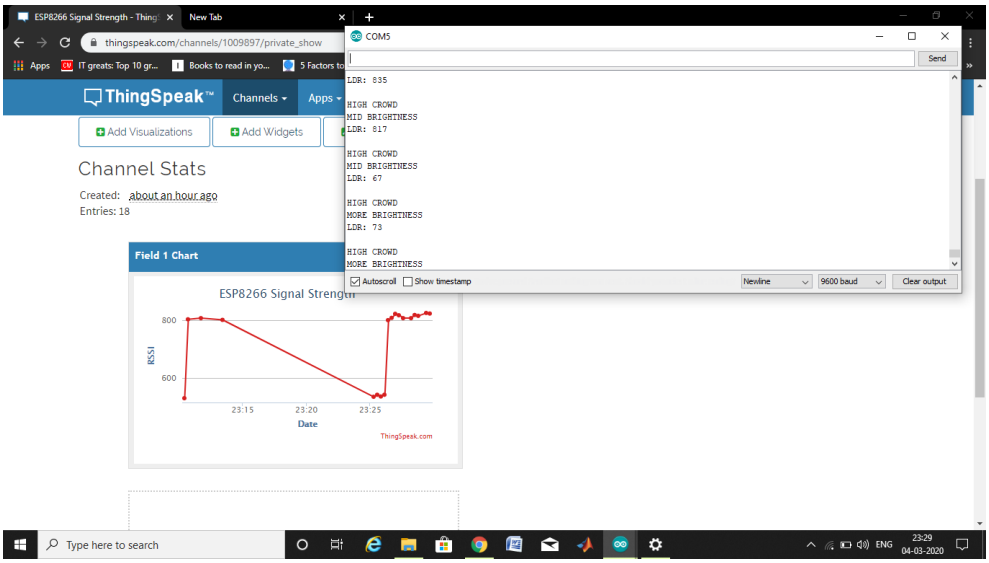

Figure 5.2 Uploading Data on ThingSpeak

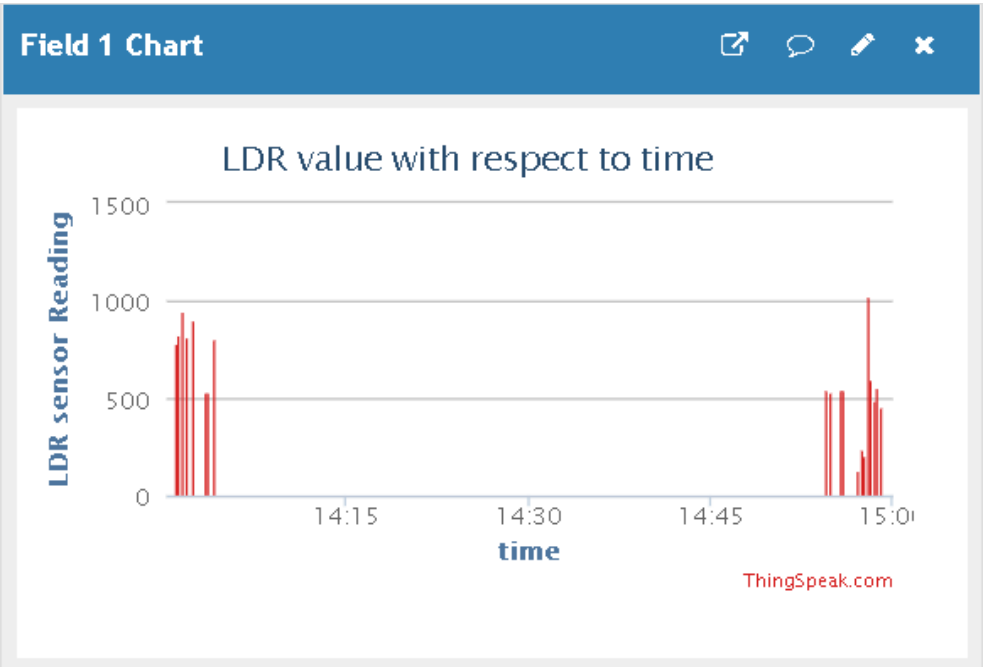

Figure 5.1 Intensity v/s Time Output

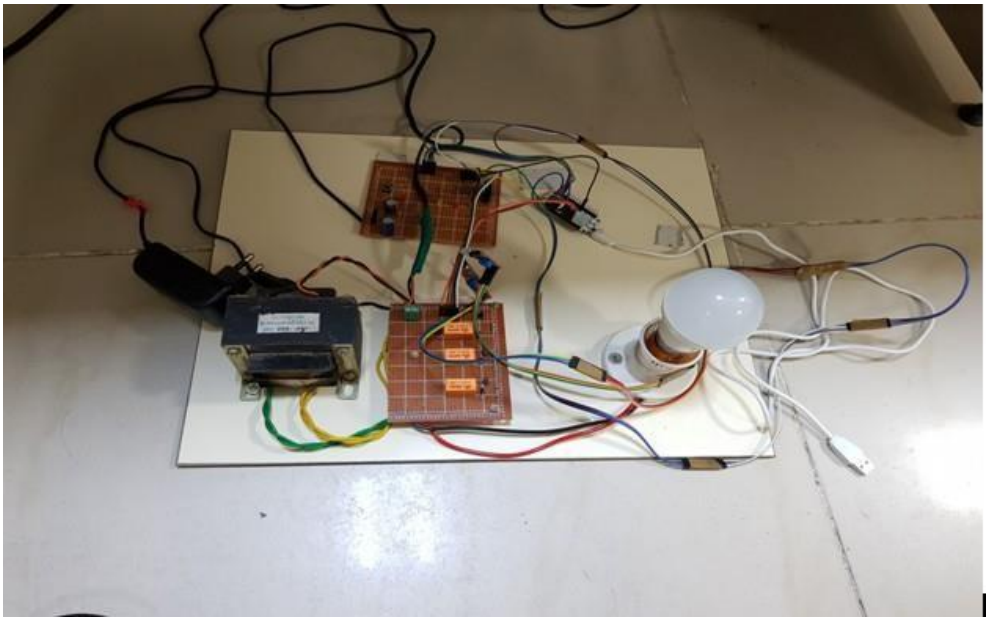

Figure 5.2: System Arrangement

Chapter 6: Summary of Result

6.1 Advantages of your work/result/methodologies

The important advantage of the given approach is that only energy is consumed just when it is needed, thereby reducing the cost of making available the energy to others. It is effective so it requires no human intervention for its operation.

6.2 Scope of Future Work

Smart system of lighting is rapidly getting ready for an energy efficient candidate to replace current inflorescent lights in the apartments. These kinds of systems use LEDS for operating in sensor-rich environments to transfer lighting which is appropriate while formatting usage of energy. Longevity and high efficiency and large bandwidth makes LEDs desired components for lighting. Saving of energy from smart lighting systems are having the potential for significant economic impact while lights contribute more than 30% consumption of electric energy in developed countries, which costs them billions of dollars annually.

6.3 Unique Features of our Innovation/Project

This system deals saving the energy in the smart conference room, which uses the object detection and the energy efficiency algorithm in order to save the energy. Approaches for energy saving can be grouped in two parts, i.e., LDR-based and IR-based ones. System proposes a novel two-stage IOT framework where consumption of the light can be reduced with the help of sensors and IOT model. It shows that this framework enables new portrait for the saving of electricity in the smart room.

6.4 Future Enhancement

There are a few enhancements that can be made to this system to attain more accuracy in sensing and detection:

1. There are a lot of other sensors that can be used to accurately detect the occupancy of the room moreover sensors which can detect the presence of human being specifically is more suitable.

2. Changing the way of sending the data to the internet can make it more valuable.

3. The way the data is analyzed on the internet and stored in cloud platform can be changed so as to make the system more professional and implementation in real life scenario will be more efficient.

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Appendix

A1. Periodic Progress Report

PPR: 1

PPR Details

Periodic Progess Report : First PPR

Project : Smart Lighting System

Status : Reviewed

1. What Progress you have made in the Project ?

• Study on LDR sensor to detect the amount of external light present in the room. • Implementation of connecting LDR with the microcontroller circuit. • Coding Implementation to complete the working of LDR based on the constraints.

2. What challenge you have faced ?

• Issue in finding how the values of LDR sensors will be recorded. • Which boundary of range to be considered in the program to identify the amount of external light present in the room.

3. What support you need ?

• Selecting the platform required to record the data values of sensors. • Selecting the boundary range for efficient outcome of the module.

4. Which literature you have referred ?

• Automatic Light- DIM and DIP Control for Automobiles- by International Journal of Engineering Trends and Technology (IJETT). • Development of Programmable Relay Switch Using Microcontroller – by American Journal of Remote Sensing

PPR: 2

PPR Details

Periodic Progess Report : Second PPR

Project : Smart Lighting System

Status : Reviewed

1. What Progress you have made in the Project ?

• Study on ThingSpeak Platform. • Plotting the real time value on the internet using thingspeak platform.

2. What challenge you have faced ?

• Initially difficulty in sending data to the thingspeak platform.

3. What support you need ?

• How to connect thingspeak platform to the hardware.

4. Which literature you have referred ?

• IoT: NodeMCU 12e X Arduino Uno, Results of an experimental and comparative survey –by International Journal of Advance Research in Computer Science and Management Studies. • Smart Home Automation and Security System using Arduino and IOT –by International Research Journal of Engineering and Technology (IRJET)

PPR: 3

PPR Details

Periodic Progess Report : Third PPR

Project : Smart Lighting System

Status : Reviewed

1. What Progress you have made in the Project ?

• Implementation of code in arduino IDE to upload data to the thingspeak platform. • Study on relay circuit.

2. What challenge you have faced ?

• Connecting with the server. • Selecting the type of relay that can be augmented to the already built circuit.

3. What support you need ?

• To analyze and test the data on thingspeak platform. • Which type of relay to be used.

4. Which literature you have referred ?

• IoT Based Home Automation System Using ThingSpeak – by Researchgate. • Sensor Information Retrieval From Internet of Things: Representation and Indexing – by Researchgate. • Development of Programmable Relay Switch Using Microcontroller – by American Journal of Remote Sensing

PPR: 4

PPR Details

Periodic Progess Report : Forth PPR

Project : Smart Lighting System

Status : Reviewed

1. What Progress you have made in the Project ?

• Connection of transformer with the relay circuit. • Connection of bulb with the relay circuit. • Interfacing of the relay module with the micro-controller.

2. What challenge you have faced ?

• Selecting the type of relay that can be augmented to the already built circuit. • Interfacing of the two modules.

3. What support you need ?

• Which type of relay to be used? • Connecting the two different modules.

4. Which literature you have referred ?

• DESIGN AND FABRICATION OF AUTOMATIC STREET LIGHT CONTROL SYSTEM – by research gate • Automatic Home Lighting solutions using Human Detection, Sunlight Intensity and Room Temperature – by International Research Journal of Engineering and Technology (IRJET)

A2. Business Model Canvas

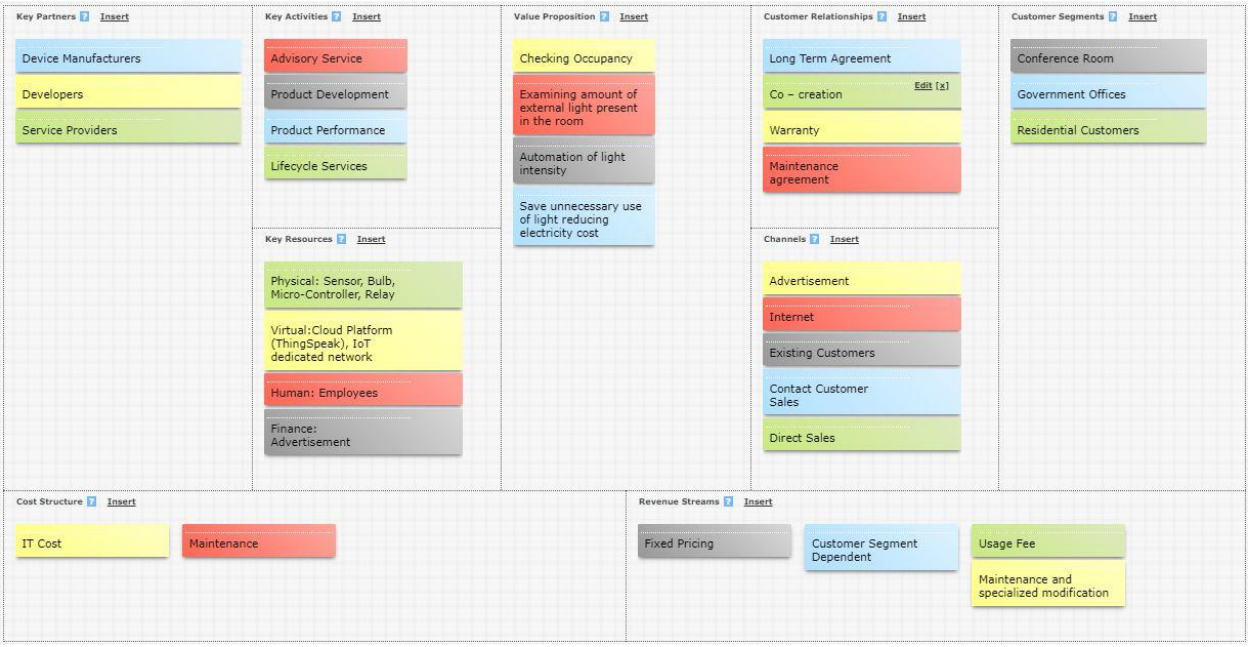

Figure 3: Proposed Business Model Canvas

Key Partners

- Device Manufacturer:

  Device Manufacturing Company will fulfill our need of elements in our project such as the sensors used, micro-controller, bulb etc.

- Developers:

  Developers are a key partner in designing and developing the model as per the requirement.

- Service Providers:

  Internet Service provider completes our need of interfacing our IoT model over the internet as per the requirement.

Key Activity

- Advisory Service:
  To provide energy audit and solution design.
- Product Development:
  In order to provide installation and integration final product is developed.
- Product Performance:
  To save energy.
- Lifecycle Services:
  To provide services such as support, maintenance and performance.

Value Proposition

- Checking Occupancy
- Examine amount of external light present in the room
- Automation of light intensity
- Save unnecessary use of light reducing electricity cost.

Key Resources

- Physical:
  Sensor, Bulb, Micro-Controller, Relay
- Virtual:
  Cloud Platform(ThingSpeak), IoT dedicated network
- Human:
  Employees
- Finance:
  Advertisement

Customer Relationship

- Long Term Agreement
- Co – creation:
  A personal relationship is created through the customer's direct input to the final outcome of the company's products/services.
- Warranty
- Service/Maintenance Agreement

Customer Segments

- Conference Room:
  Place where most of the people gather for business meeting etc. use this system to for efficient use of energy.
- Government Offices:
  In such public places the flexible lighting system is required as there is no individual responsible for switching ON/OFF the lights depending upon the need.
- Residential customers:
  People who use the system as a luxury and saving light energy as per the amount of external light present in the room.

Channels

- Advertisement
- Internet
- Existing Customers
- Contact Customer Service
- Direct Sales

Cost Structure

- IT Cost
- Maintenance

Revenue Streams

- Fixed Pricing – Resource and Volume Dependent
- Customer Segment Dependent
- Usage Fee – fees based on electricity used by customers.
- Maintenance and specialized modification