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"IOT ENABLED SMART STREET LIGHT CONTROLLER USING THING SPEAK"

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ABSTRACT

A huge amount of electrical power of many countries is consumed in lighting the streets. However, vehicles pass with very low rate in specific periods of time and parts of the streets are not occupied by vehicles over time. The system that automatically switches off the light for the parts of the street having no vehicles and turns on the light for these parts once there aresome vehicles that are going to come. Logically, this system may save a large amount of the electrical power. In addition, it may increase the lifetime of the lamps. This system automatically controls and monitors the light of the streets. It can light only the parts that have vehicles and help on the maintenance of the lighting equipment's. Conventional street lighting system in areas with a low frequency of passerby are online most of the night without purpose. The consequence is that a large amount of power is wasted meaninglessly. The purpose of this work is to describe the intelligent street lighting (ISL) system, an approach to accomplish the demand for flexible public lighting system. The present system is like, the street lights will be switched on in the evening before the sun sets and they are switched off thenext day morning after there is sufficient light on the roads. This System gives the best solution for electrical power wastage. Also, the manual operations of the lighting system are completely eliminated. In this project, sensor used are, light dependent Resistor (LDR) to indicate a day/night time and the photoelectric sensors to detect the movement on the street. Result show that the saved energy may reach up to 65% and an increase of the lifetime of the lamps of 53%. The

Arduino IDE is used as brain to control the street light system.

LIST OF ABBREVIATIONS

IR Sensor	Infrared Sensor
LDR	Light Dependent Resistor
PIR	Passive infrared Sensor
PCB	Printed Circuit Board
LED	Light Emitting Diodes
HID	High Intensity Discharge
Node MCU	Node Microcontroller Unit
SoC	System on a Chip
PSU	Power Supply Unit
AC	Alternating Current
DC	Direct Current
TCP/IP	Transfer Control Protocol/Internet Protocol
Arduino IDE	Arduino Integrated Development Environment
ADC Pin	Analog to Digital Converter
GPIO	General Purpose input/Output
I^2C	Inter-Integrated Circuit
SPI	Serial Peripheral Interface
ESP 8266	Espress if System
VCC	Voltage Common Collector

CHAPTER 1 INTRODUCTION

1.1 OVERVIEW

The street lighting is one of the largest energy expenses of a city. A street lighting system can cut municipal street lighting cost is 50% to 70%. The smart street lighting system is a system that adjusts light output based on the usage and occupancy, i.e., automatic classification of pedestrian versus cyclist, versus automotive. The idea of designing a new system for the street-light that do not consume huge amount of electricity and illuminate large areas with the highest intensity of light is concerning each engineer working in this field. Providing street lighting is one of the most important and expensive responsibilities of a city. Lighting can account for 10–38% of the total energy bill in typical cities worldwide.

Street lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for economic and social stability. Inefficient lighting wastes significant financial resources every year, and poor lighting creates unsafe conditions. Energy efficient technologies and design mechanism can reduce cost of the street lighting. Manual control is prone to errors and leads to energy wastages and manually dimming during mid-night is impracticable. Also, dynamically tracking the light level is manually impracticable. The current trend is the introduction of automation and remote management solutions to control street- lighting

The system is mainly implemented to have automatic street light which can sense the daytime and night time, and automatically turns on and off according the night and day. Street light will only glow if there is darkness and someone is passing through the street. The street light (ON/OFF Status) will be accessed from anytime, anywhere through internet based on the real time system. The street controller should be installed on the pole light which consists of NodeMcu ESP8266. The data from the street light controller can be transfer to base station by using wireless technology to monitor the system. The operation of the system can be conducted using auto mode and manual mode the control system will switch on-off the lights are required timings and can also vary the intensity of the street light according to requirement

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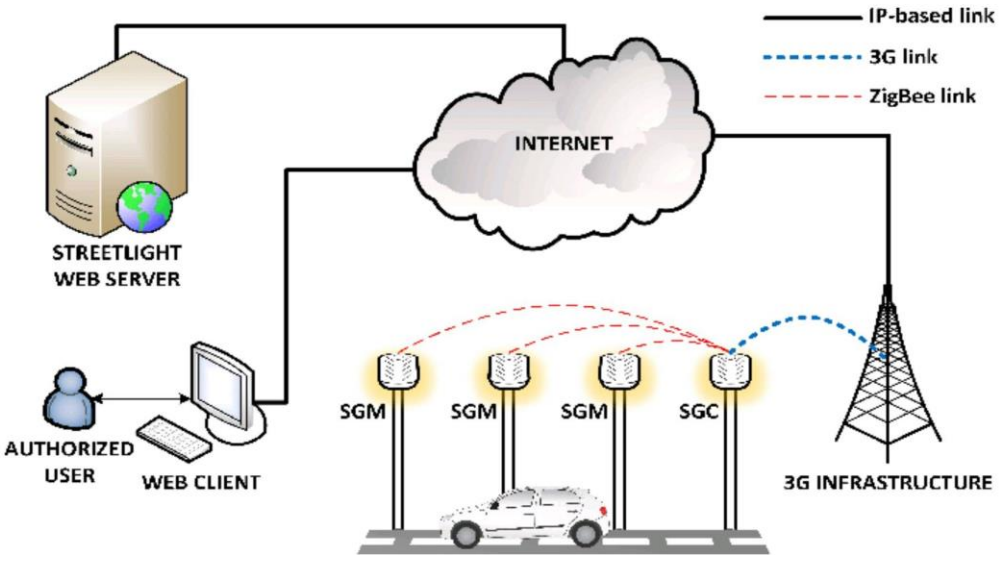
1.2 INTERNET OF THINGS

The Internet of Things (IoT) describes physical objects (or groups of such objects) with sensors, processing ability, software and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks. Internet of things has been considered a misnomer because devices do not need to be connected to the public internet, they only need to be connected to a network and be individually addressable. The field has evolved due to the convergence of multiple technologies, including ubiquitous computing, commodity sensors, increasingly powerful embedded systems and machine learning. Traditional fields of embedded systems, wireless sensornetworks, control systems, automation (including home and building automation), independently and collectively enable the Internet of things. In the consumer market, IoT technology is most synonymous with products pertaining to the concept of the "smart home", including devices and appliances (such as lighting fixtures, thermostats, home security systems, cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smartphones and smart speakers.
IoT is also used in healthcare systems. There are number of concerns about the risks in the growth of IoT technologies and products, especially in the areas of privacy and security, and consequently, industry and governmental moves to address these concerns have begun, including the development of international and local standards, guidelines, and regulatory frameworks.

1.3 IoT APPLICATIONS

IoT applications promise to bring immense value into our lives. With newer wireless networks, superior sensors and revolutionary computing capabilities, the Internet of Things could be the next frontier in the race for its share of the wallet. The below shown figure.1.1 is the Sample IoT application.



CHAPTER 2 SYSTEM ANALYSIS

2.1 EXISTING SYSTEM

The System is usually a multi-functional prototype that has an aptitude to get rid of the manual operation of the old street lightning system by strategy of the self-automation. It aims at designing and executing the advanced development in embedded systems for energy saving of street lights and their maintenance at reduced cost with modern development. Street Lightning system has a feature as two sensors are used which are Light Dependent Resistor (LDR) to point a day/night time and therefore the passive infrared sensor (PIR) to detect the movement on the road. In this IoT context, among the all integrated wi-fi chips, ESP8266 is one of the best and it is a low-cost of wi-fi module.

A 32bit Tensilica Xtensa L106 micro-controller is integrated into it. Within less PCB area RF balun, low noise receive amplifier, power amplifier, filters and power management modules with minimal external circuitry are included in front end module. In Automatic Street Light Control System is not only easy but also the powerful technique. Relay uses an automatic switch in this system. It releases the manual work almost up to 100%. As soon as the sunlight goes under the visible region of our eyes this system automatically switches ON lights. Light Dependent Resistor (LDR) is a type of sensor which actually does this work and senses the light as our eyes does. As soon as the sunlight comes, visible to our eyes it automatically switches OFF lights. Such type of system is also useful for reducing energy consumption.

In this system is designed to detect the vehicle movement on the highways to switch ON only a block of the street light ahead of it and switch OFF the trailing light to save energy. During the night all the lights on the highways

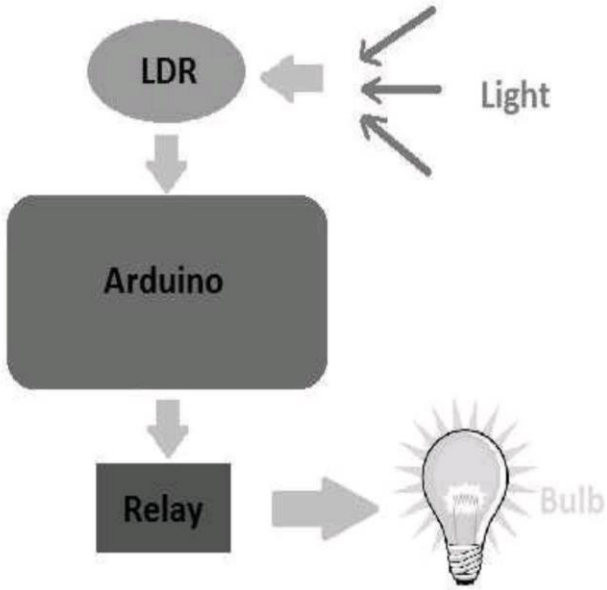
remain ON for the vehicle, but IoT of energy is wasted when there is no vehicle movement on the highways. The Wi-Fi ESP8266 MODULE is employed to upload to the important time information on the cloud through IOT panel.

2.1.1 Disadvantages

- There is a main risk from glare. A French Government report published in 2013 agreed that a luminance level higher than 10,000 cd/m2 causes visual discomfort whatever the position of the lighting unit in the field of vision.
- The initial cost of LED street lighting is high and as a consequence it takes several years for the savings on energy to pay for that. The high cost derives in part from the material used since LEDs are often made on sapphire or other expensive substrates.
- LED street lights make light pollution - particularly sky glow - significantly worse as they emit more blue and green light than the high- pressure sodium lights that are typically being replaced – colors to which the dark-adapted human eye is very sensitive.
- The major increase in the blue and green content of artificial sky glow arising from widespread LED lighting is likely to increase impacts on bird migration and other nocturnal animal behaviours.
- There is progressive wear of layers of phosphor in white LEDs, that with time lead to devices being moved from one photobiological risk group to a higher one.

2.2 PROPOSED SYSTEM

The system basically consists of a LDR, power supply, relays and Arduino Uno. The figure 2.1 is pictorial representation of system is given below:



The LDR senses the light and sends the data to Arduino. The Arduino analyze the data and gives its response to the LEDs through the relay mechanism. The Arduino is programmed in such a way it automatically adjusts the lights to give most accurate results.

2.2.1 Objectives

The main objective of this system is to implement an IoT based Automatic Street Lightning System. As the traffic decreases slowly during late-night hours, the intensity gets reduced progressively till morning to save energy and thus, the street lights switch on at the dusk and then switch off at the dawn, automatically. The process repeats every day. White Light Emitting Diodes (LED) replaces conventional HID lamps in street lighting system to include dimming feature. The intensity is not possible to be controlled by the high intensity discharge (HID) lamp which is generally used in urban street lights. LED lights are the future of lighting because of their low energy consumption and long life. LED lights are fast replacing conventional lights because intensity control is possible by the pulse width modulation. This proposed system uses an Arduino board. Strings of LED are
interfaced to the Arduino board. A programmed Arduino board is engaged to provide different intensities at different times of the night. This system is enhanced by integrating the LDR to follow the switching operation precisely and IOT to display the status of street on web browser and help in controlling it.

The main objectives are as follows:

- To avoid unnecessary Waste of light.
- Provide efficient, automatic and smart lighting system.
- Totally based on Renewable energy sources.
- Longer life expectancy.
- Energy Saving.

2.2.2 Advantages

- Maintenance cost reduction
- Energy saving
- Lightning system also reduces crime say murder, theft and plenty of more to a great- extend.
- Reduction of man power
- Major advantages of street lightning include prevention of the accidents and increase in the safety.

CHAPTER 3 SYSTEM SPECIFICATION

The idea of this system is to give information about the IoT smart street light system. The Thingspeak technology to get more control over the street lighting. In this system, the node mcu ESP8266, IR sensor, LDR sensor are interfaced. India facing one of the major Problem is maintenance of street lights. In India street lights are maintained manually, it is found that there is wastage of power by operating the street lights due to manual operations like switch on the light at day time. To reduce the manual errors by controlling, implementation is done using Thing speak for effective communication.

3.1 HARDWARE SYSTEM

The following equipment's are used in this system:

- Power supply
- LDR sensor
- NODEMCU ESP8266
- LEDs
- IR sensor
- Jumper wires

3.1.1 Power Supply

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others. This power supply section is required to convert AC signal to DC signal and also to reduce the amplitude of the signal. The available voltage signal from the main is 230V/50Hz which is an AC voltage, but the required is DC voltage with the amplitude of +5V and +12V for varies applications.

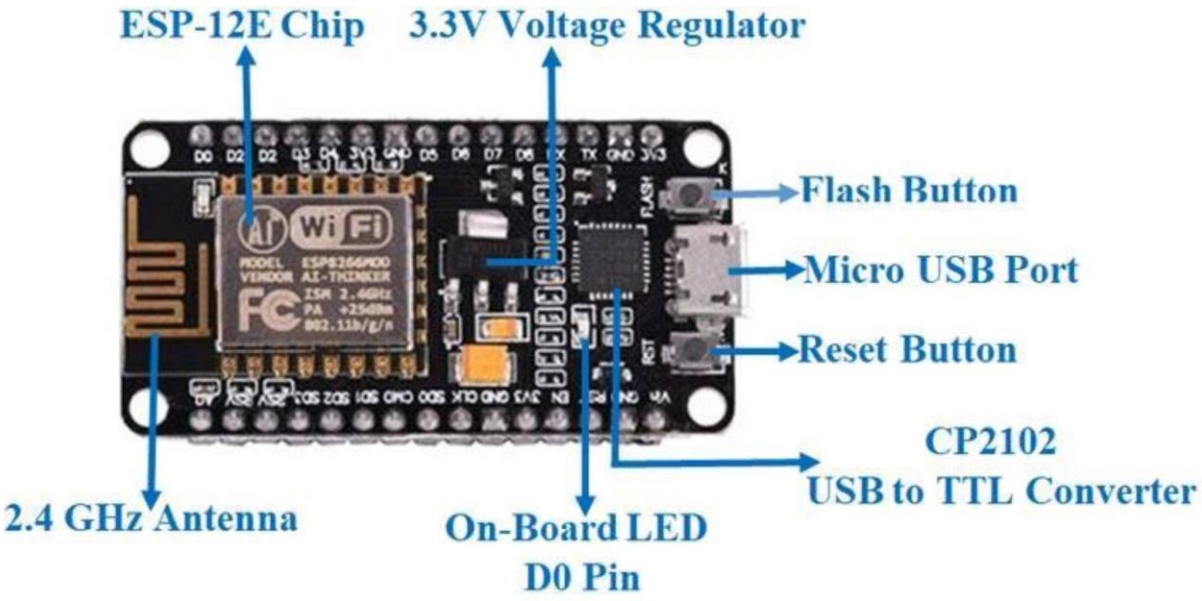
3.1.1 LDR Sensor

LDR stands for Light Dependent Resistor also known as photo-resistor. LDR is sensitive to light and its resistance changes according to the intensity of light falling on it. It is made up of high resistance semiconductor and its resistance increases in darkness and decreases in light. When light incident on the LDR exceeds some threshold, it absorbs the photons and allows electrons to jump into the conduction band. LDR generates a variable resistance which depends on the intensity of light falling on it. It is mainly used in electric circuits like street light, alarm clock, automatic brightness and contrast control etc.

3.1.2 NODEMCU ESP8266

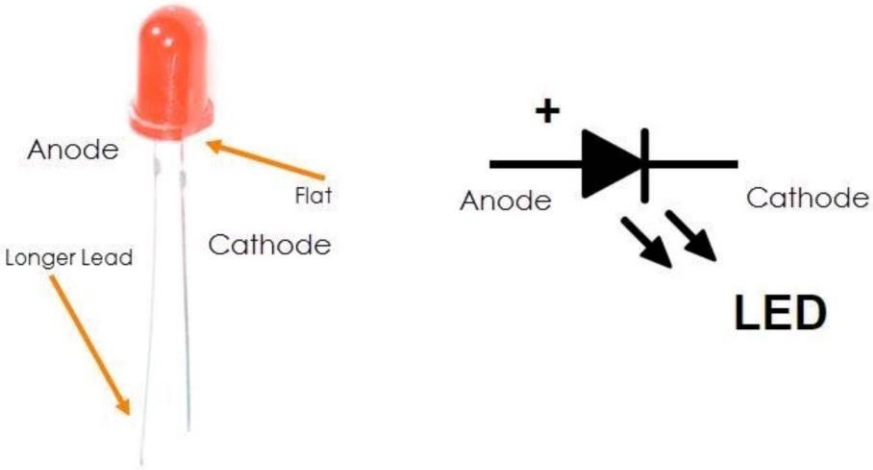
The Node MCU (Node Micro Controller Unit) is an opensource software and hardware development environment that is built around a very inexpensive System-on-a-Chip (SoC) called the ESP8266. And, you have to program it in low-level machine instructions that can be interpreted by the chip hardware. The ESP-8266 may be a low-cost Wi-Fi microchip with full TCP/IP Transfer control protocol/ Internet protocol). It makes the web connectivity possible for the IOT panel. ESP8266 offers a whole and self-contained W-Fi.

- 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2).
- General-purpose input/output (16 GPIO).
- Inter-Integrated Circuit (I²C) serial communication protocol.
- Analog-to-digital conversion (10-bit ADC).
- Serial Peripheral Interface (SPI) serial communication protocol.



3.1.1 LEDs

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The colour of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device. Infrared LEDs are used in remote-control circuits, such as those used with a wide variety of consumer electronics. The first visible-light LEDs were of low intensity and limited to red. Early LEDs were often used as indicator lamps, replacing small incandescent bulbs, and in seven-segment displays. Later developments produced LEDs available in visible, ultraviolet (UV), and infrared wavelengths, with high, low, or intermediate light output, for instance white LEDs suitable for room and outdoor area lighting.

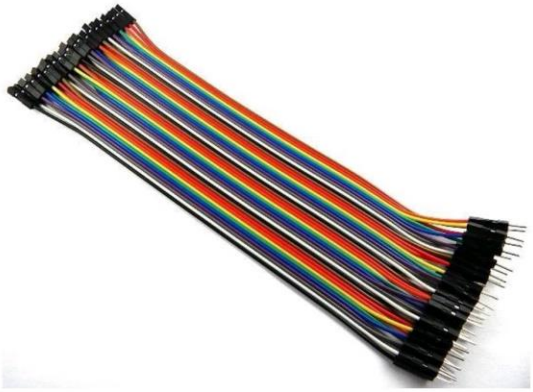


3.1.1 IR Sensor

IR sensors are used to detect if someone is crossing the street or not. It detects the obstacle or motion in the surrounding. The transmitter will transmit IR rays which will be reflected back if it falls on some object like person, animal, vehicles, etc. The reflected ray will be received by receiver diode and hence will confirm the presence of object and the corresponding LED will be glowed. This method will save significant amount of electricity as the street light will only turns on if there is someone present in the Street. IR sensor has 3 pins, two of which are VCC and ground and one is output pin. The output of IR sensor gets high if detects presence of some object. This pin is connected to GPIO pin of NodeMCU so whenever the IR sensor detects someone passing through the street it triggers the Street light. In our case one LED will be turned on.

3.1.1 JUMPER WIRES

A jump wire (also known as jumper, jumper wire, DuPont wire) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.



3.1 SOFTWARE SYSTEM

Software used in this Proposed system are,

- ARDUINO IDE
- THINGSPEAK

3.2.1 Arduino IDE

The Arduino Software (IDE) is an open-source software and it makes easy to the code and upload it to the board. It runs on the different plant from Windows, MAC OS, Linux. The environment is written in C and before running the IDE C software to be installed on the machine this software can be used with any Arduino board.

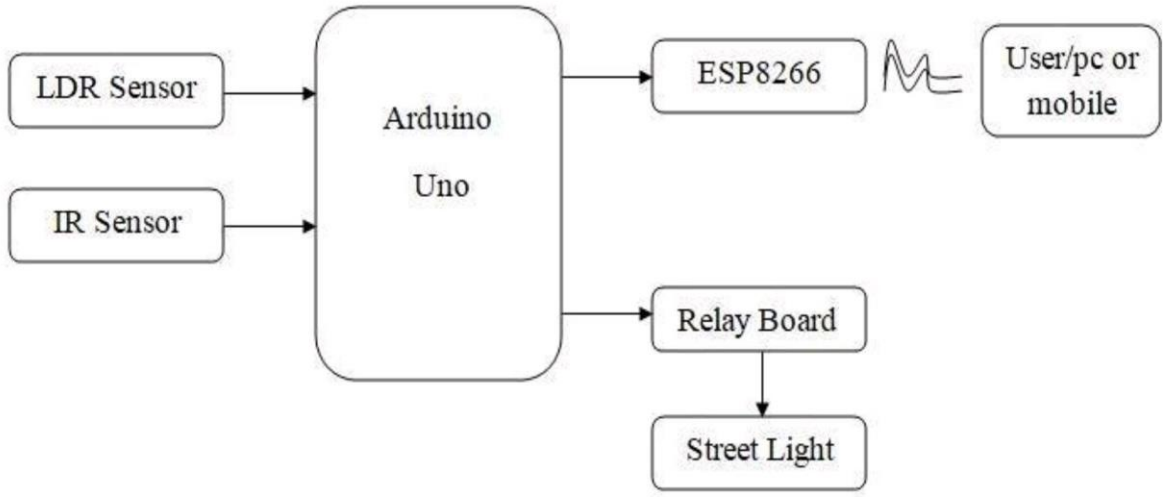
3.2.2 Thingspeak

ESP8266 Thingspeak is an analytic IoT platform service that allows you to aggregate, visualize and analyse live data streams in the cloud. ThingSpeak is an open wellspring of web of things (IoT) utility and API to purchase and recover records from issues abuse the hypertext move convention and MQTT convention over internet or through a near to space organize. ThingSpeak licenses the presentation of detecting component work programs, area following bundles, and an informal community of things with standing updates.

CHAPTER 4 SYSTEM DESCRIPTION

4.1 SYSTEM BLOCK DIAGRAM

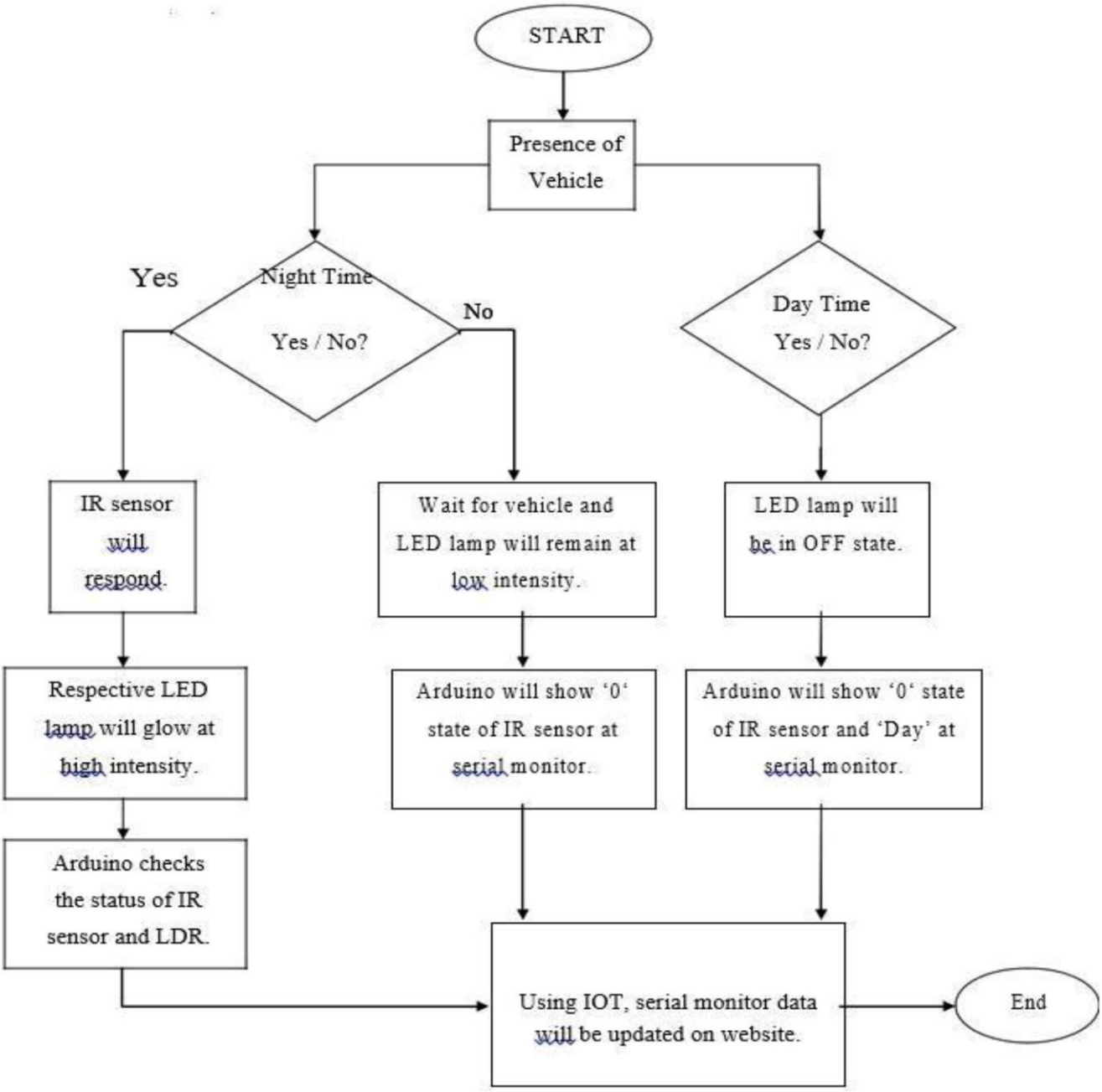
A block diagram is a diagram of a system in which the principal parts or functions are represented by blocks connected by lines that show the relationships of the blocks. They are heavily used in engineering in hardware design, electronic design, software design, and process flow diagrams.
Block diagrams are typically used for higher level, less detailed descriptions that are intended to clarify overall concepts without concern for the details of implementation. Contrast this with the schematic diagrams and layout diagrams used in electrical engineering, which show the implementation details of electrical components and physical construction.



4.1 FLOWCHART

A flowchart is a type of diagram that represents a workflow or process. A flowchart can also be defined as a diagrammatic representation of an algorithm, a step-by-step approach to solving a task.
The flowchart shows the steps as boxes of various kinds, and their order by connecting the boxes with arrows. This diagrammatic representation illustrates a solution model to a given problem. Flowcharts are used in analyzing, designing, documenting or managing a process or program in various fields.
Internet of Things is a term of opening new possibilities of interacting with electronic devices by digitally interfacing them possibly providing information in a very simple user-friendly format to a smart device and connected to the same network as the rest of the system. In this system, every device is required to be operate in the basis of IoT, are connected to each other on the same network. The system architecture is adaptive system and it consists LDR sensors,

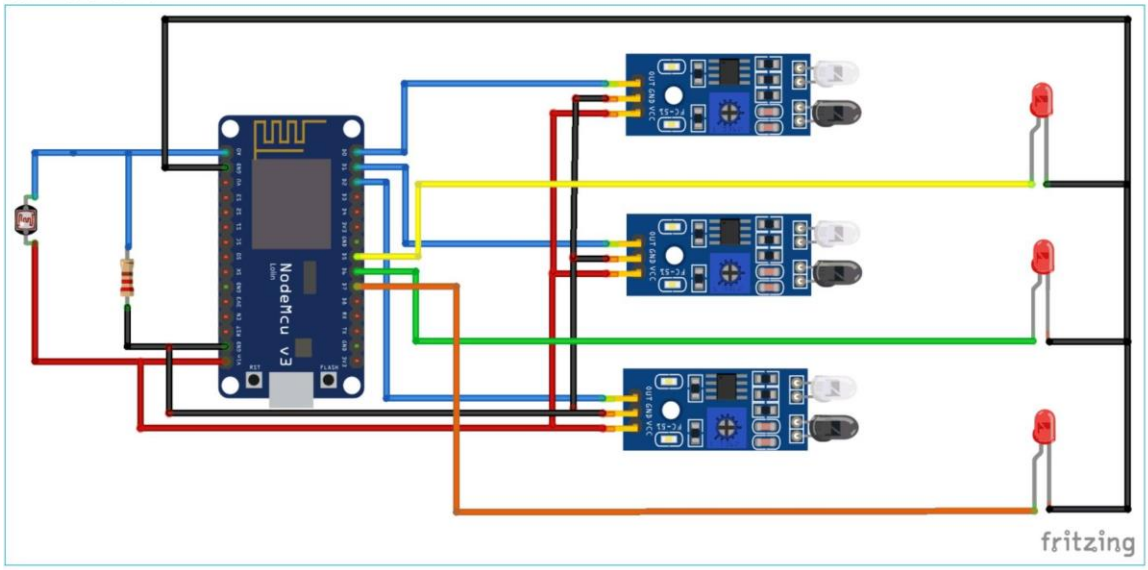
NODEMCU ESP8266, relay, Bulb. In this system NODEMCU microcontroller acts as the brain of the entire system. All the sensors used in this system are connected to micro controller. LDR is light dependent resistor. When the day time sunlight falls on it, its resistance decreases and makes the light to switch off. When the night time, light do not fall on the sensor, so its resistance increases and triggers the light to switch On. IR sensor acts an automatic switch and electromagnetic switch it is connected to the micro controller by relay driver. It is highly reliable and automatically switches ON and OFF the lights.



4.1 CIRCUIT DIAGRAM

This circuit mainly consists ESP8266, LDR sensor, IR sensors and LEDs.

Here the LDR sensor is used to detect whether it is daytime or night time. Since LDR sensor generates variable resistance based on the amount of light falling on it, it has to be connected like a potentiometer. One end of the LDR sensor is connected to 5V and other end is connected to fixed resistance which is further connected to ground. NodeMCU has one ADC pin (A0) which is connected to point between fixed resistance and one end of the LDR sensor as shown in the circuit diagram. Since the LDR sensor gives variable resistance therefore variable voltage will be generated according to the amount of light falling on LDR.
IR sensors are used to detect if someone is crossing the street or not. It detects the obstacle or motion in the surrounding. The transmitter will transmit IR rays which will be reflected back if it falls on some object like person, animal, vehicles, etc. The reflected ray will be received by receiver diode and hence will confirm the presence of object and the corresponding LED will be glowed. This method will save significant amount of electricity as the street light will only turns on if there is someone present in the Street. IR sensor has 3 pins, two of which are VCC and ground and one is output pin. The output of IR sensor gets high if detects presence of some object. This pin is connected to GPIO pin of NodeMCU so whenever the IR sensor detects someone passing through the street it triggers the Street light. In our case one LED will be turned on.



4.1.1 Working of the circuit

- The output from the LDR is connected to the A0 and initially LDR flag and LDR value is set to zero. The value of LDR reference value is initialized and set to 500(baud rate). If the Arduino UNO reads any value from LDR whose value is less than the LDR reference value than it will turn on the street lights.
- The output from lR1 and lR2, lR3, and object lR4 are connected to the pin A1, A2, A3, A4 and reference value of all sensor is set to 500(baud rate) which corresponds to led connected to ~3, ~5, ~6, ~9, and ~10.
- Another four-proxy value for each object sensor are set to zero and if any object sensor detects any presence of objects, then Arduino UNO compares the value with the object reference value. If the sensed value is less than the reference value it will glow with 100% of its intensity otherwise LEDs will be off.
- The first and the last LED glows continuously to detect the start and end of the road.

CHAPTER 5

CONCLUSION AND FUTURE ENHANCEMENT

5.1 CONCLUSION

The proposed system is easy to setup and implement and it doesn't require extra maintenance compared to the already existing system. The efficiency of automated systems is more than the manual systems. We can also reprogram these devices with respect to our needs. By using the API key, the generated data is stored in Thing speak database.
This Smart Street light not only helps in rural areas but also beneficial in urban areas too. While moving towards more advancement require more power so use of renewable resources is useful and advantageous.
"IoT enabled Smart Street Lighting controller using thing speak" is a cost effective, practical, eco-friendly and the safest way to save energy and the light status information can be accessed from anytime and anywhere. It clearly tackles the two problems that world is facing today, saving of energy and also disposal of incandescent lamps, very efficiently.

5.2 FUTURE ENHANCEMENT

This system can be further enhanced by writing logic into the code and that can be able to retrieve information of the time of sunset and sunrise from a reliable weather reporting source and automate the process completely by turn ON the street light at the time of sunset and turn it OFF by sunrise. This further eliminates human intervention and a manual visit to the location of the street lights will be required only in case of a malfunction.Smart street light represents a cost-efficient solution for cities working to reduce energy consumption, enhance public safety and foster developments in intelligent infrastructure.For cities looking to invest in smart technology, intelligent street lighting offers the chance to reap outsized benefits for a relatively small investment. In its simplest form, networked LED lighting promises to lower energy costs by using motion detectors to provide illumination only when needed. Beyond energy efficiency and advanced lighting capabilities, city planners looking to harness data-driven intelligence can use networks of smart street lights as the foundation on which to build powerful smart city applications.While there are a variety of smart city initiatives that can benefit both officials and citizens, adaptive lighting offers city planners the most bang for their buck. First and foremost, it can be implemented piecemeal and without a massive overhaul of existing infrastructure - by simply replacing street lights that already need to be upgraded. Smart street lights can be outfitted with a vast array of sensors and cameras to collect critical data, help cities make well-informed decisions, and improve city useability for residents. On top of the Internet of Things (IoT), street lights can communicate with each other wirelessly while monitoring traffic conditions, tracking maintenance updates, alerting officials to potential security risks, and more.Easily scaled, and extremely flexible, intelligent lighting systems will very likely be at the forefront of urban development as cities begin to take a leap into the future.

A.1 SCREENSHOTS

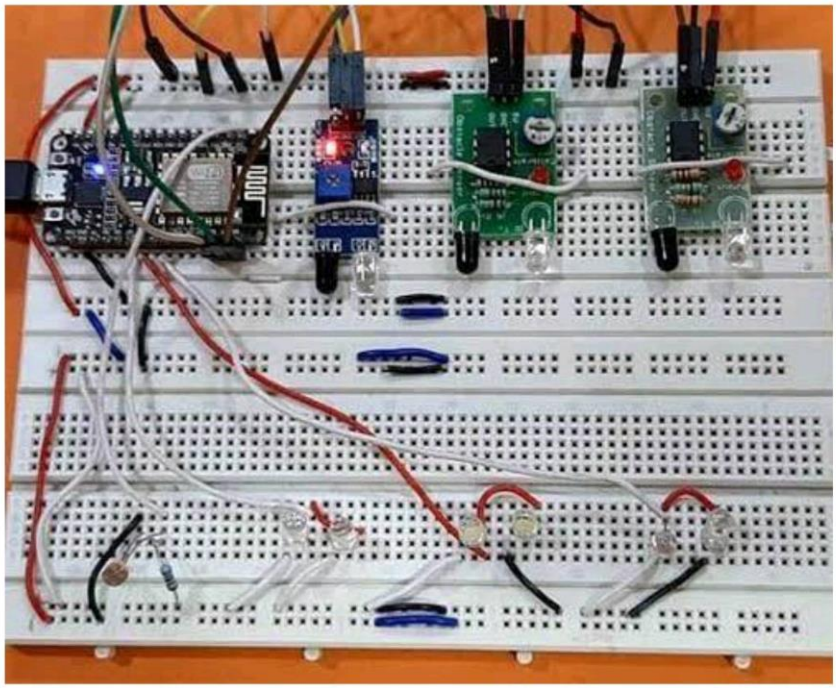


Figure.A.1 IoT based smart street light controller

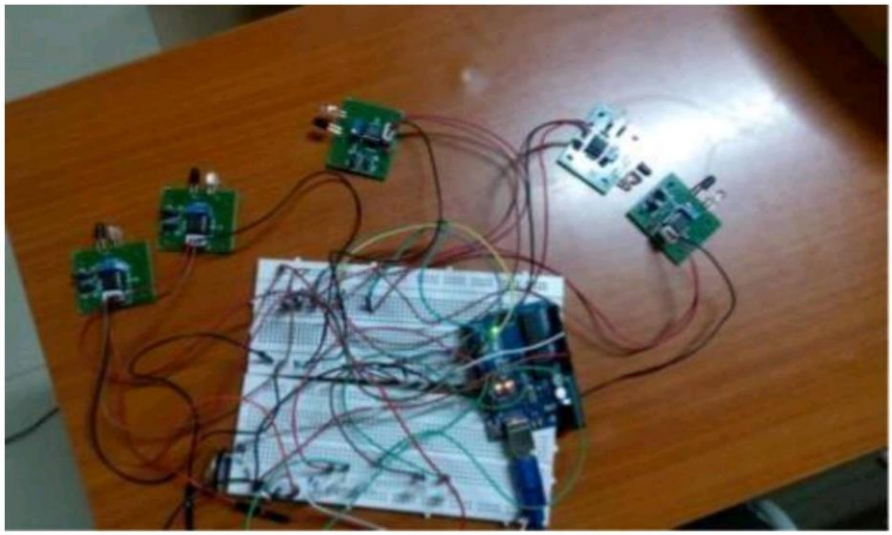


Figure.A.2. Initial Setup Phase 1

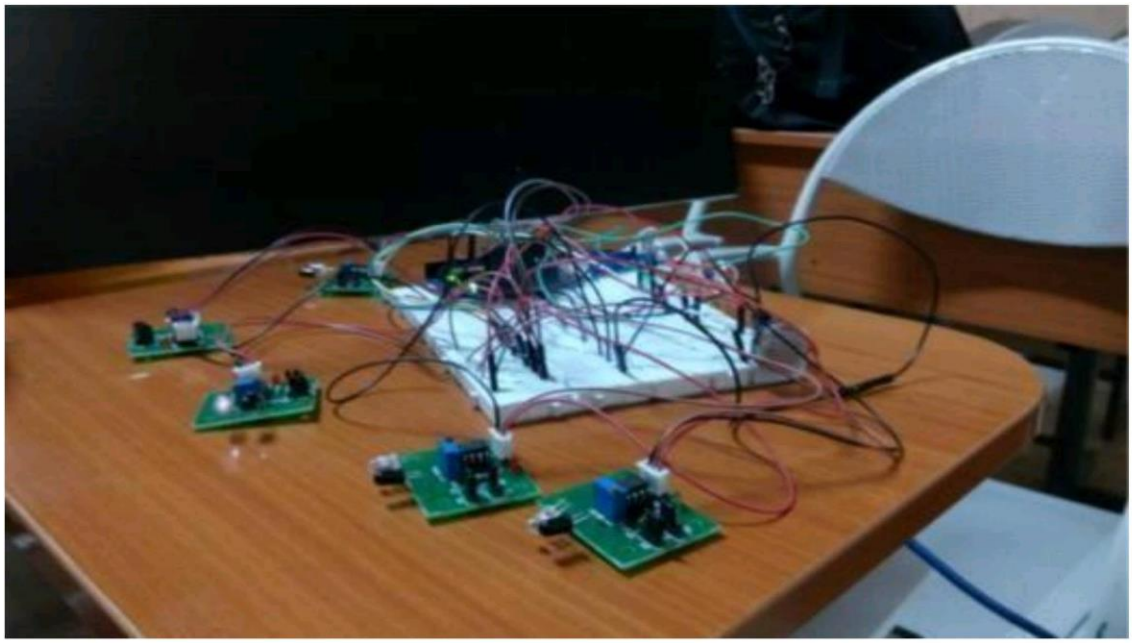


Figure.A.3. Initial Setup Phase 2

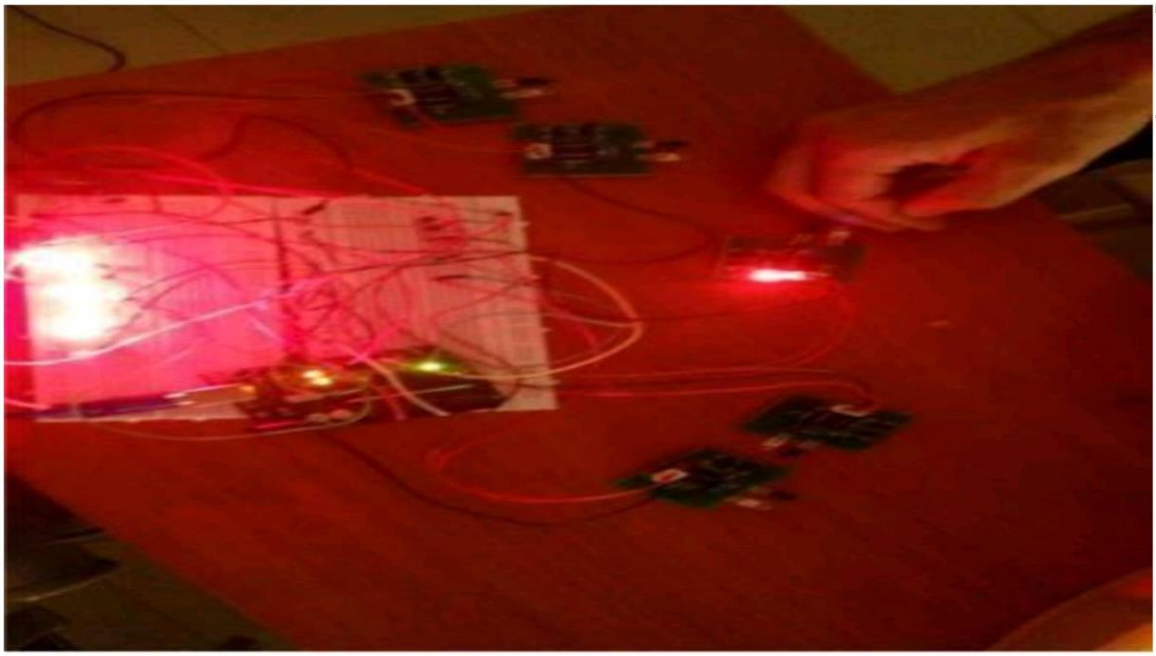


Figure.A.4. Object Detection

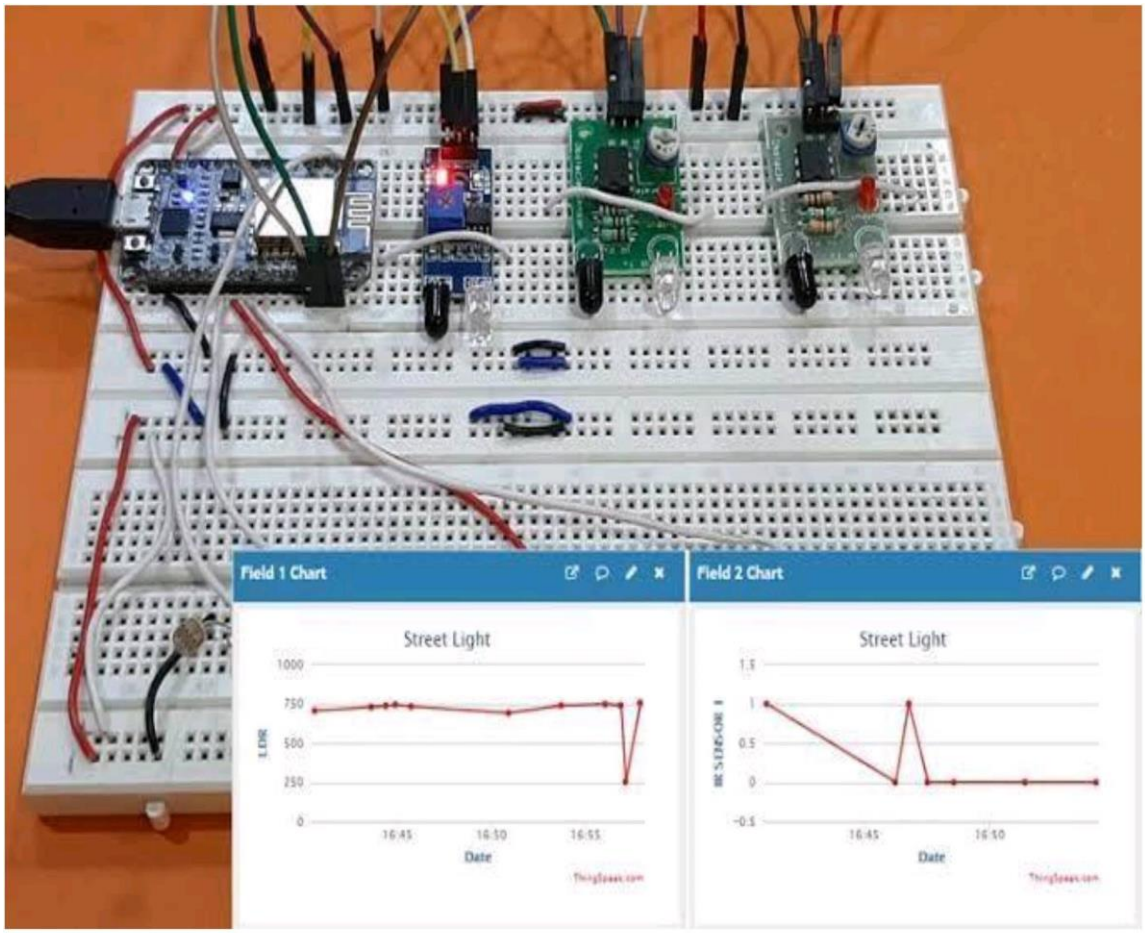


Figure.A.5. Chart Graph Representation

REFERENCES

1. Soledad Escolar, Jesus Carretero, Maria-Cristina Marinescu and Stefano Chasse (2014) "Estimating Energy Savings in Smart Street Lighting by using an Adaptive Control System" International Journal of Distributed Sensor Networks Volume, Article ID 9715.
2. 2017 IEEE Region 10 humanitarian Technology conference (R10-HTC)
3. Kolban, Kolbans. N (2015) http://espressif.com/en/products/esp8266/ and Book on ESP8266, an introductory book on ESP8266.
4. Isah Abdulazeez Watson, Oshomah Abdulai Braimah, Alexander Omoregie (March 2015) "Design and Implementation of an Automatic Street Light Control System" International Journal of Emerging Technology and Advanced Engineering, Volume 5, Issue 3.
5. Deepanshu Khandelwal, Bijo M Thomas, Kritika Mehndiratta, Nitin Kumar (April- 2015) "Sensor Based Automatic Street Lighting system" International Journal of Education and Science Research Review Volume- 2, Issue-2.
6. Bruno, A., Di Franco, F. and Rascona, G. 2012. Smart street lighting. EE Times