INTELLILIGHT - AN AUTOMATED SYSTEM FOR REAL TIME SMART STREET LIGHT MANAGEMENT

A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report **“INTELLILIGHT - AN AUTOMATED SYSTEM FOR REAL TIME SMART STREET LIGHT MANAGEMENT**” is the bonafide work of “**RESHMA A (2116210701211), RESHMA S (211621070213), SANDHYA S (2116210701226)** who carried out the work under my supervision. .

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ABSTRACT

In urban environments, efficient management of street lighting systems is important for ensuring safety, reducing energy consumption, and optimizing maintenance efforts. Exploring IoT for smart streetlights, this project integrates automatic light control based on sunlight intensity and increases the intensity of the light when there is a motion in the street and also detects fault. It proposes an automated system designed to address the challenges of real-time street light fault detection, and efficient maintenance within urban areas. Leveraging Internet of Things (IoT) technology, the proposed system integrates smart sensors, wireless communication modules such as WIFI, and data analytics algorithms to monitor the operational status of street lights continuously. By detecting faults such as bulb failures, electrical issues, or physical damage in real-time, the system enables prompt responses to ensure uninterrupted illumination. Furthermore, the system incorporates LDR sensor for detecting the intensity of light and IR sensor to detect the motion in the , facilitating security maintenance interventions and optimizing resource allocation. Through centralized data processing and analysis, the system provides actionable insights to municipal authorities for proactive maintenance planning, thereby enhancing the overall reliability and sustainability of street lighting infrastructure in urban environments. The implementation of this automated system promises to significantly improve operational efficiency, reduce downtime, and enhance public safety in cities while contributing to energy conservation, manual operation and cost savings.

ACKNOWLEDGMENT

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CHAPTER 1

INTRODUCTION

An important and essential role is being played by the Internet of Things in every one's regular life. There is a clear increase in the changes being made among the traditional systems, & other general household components and traditional systems for making a better life . The major problem of the available system of electricity is the issue of connectivity because of the major connections is manually handled by several contractors. Manually, the settings of the timer are done. Additionally, the timer needs 12 hours' of power supply continuously, setting the timer may interrupt in the loss of power supply continuously . IoT is characterized through largely shared, original world smaller things, and the capability of processing and with the storage of restriction that contains the presentation, confidentiality, consistency, and safety . Every devices are linked using IoT and many networks are convenient for delivering protected and effectual provisions for entire applications anywhere and anytime . The Internet of Technology is combined with IT (Information Technology) and OT (Operational Technology) in which the unstructured data generated by machines are studied for making improvements. IoT is combining of physical devices with sensors, electronics, and software using the internet, which allows the objects to fetch and interchange the data through the ecosystem. It is determined as IoT because all the components described here are utilized in making a better ecosystem. As it is already known that one of the major assets of the city's is street light which provides road safety and increases the security in city centers and houses too. There are many automation applications of IoT such as smart roads, smart parking, smart lighting, smart home, and many more. In the existing system that is the manual system of street lighting contains many issues like connectivity problems, maintenance problems, and the timing issue. These issues will be solved using the technology of IoT . This system depends on the smart and climatic flexibility of street lighting, management automatically . Several issues are simplified by automation in the economy of the world and regular life . Currently, the system of streetlight flexibility is majorly challenged. Controlling the distant area location is a major dilemma. Human mistakes lead to wastage of energy and the system's low performance . Currently, the street lights will be in ON state before the sunset and they get OFF after getting light in the atmosphere, sometimes the light will be in ON state whole day. As it is our responsibility to save energy, we need to take initiative in saving energy. Our project yields the best solution for electricity wastage. Automatic ON/OFF of the street light is an effective solution that will decrease the consumption of the lights of the streets up to 20 percent when the environment contains light.

1.1 PROBLEM STATEMENT

Current urban street lighting systems face significant challenges that undermine their efficiency and effectiveness. These systems are plagued by inefficient fault detection, lack of precise location tracking, and cumbersome maintenance operations, leading to increased downtime, energy waste, and safety concerns. Traditional maintenance approaches are predominantly reactive, addressing problems only after they occur, resulting in prolonged outages and higher operational costs. Moreover, the absence of real-time fault detection mechanisms and precise location tracking means that maintenance crews spend excessive time locating and fixing issues, further compounding the inefficiencies. Energy waste is another critical problem, as lights often remain on unnecessarily, consuming valuable resources. Safety is also compromised due to inadequate lighting, which can increase crime rates and the risk of accidents. To address these issues, an automated system integrating advanced sensors and automation for real-time fault detection and streamlined maintenance is essential. Such a system would enhance the reliability, efficiency, and safety of urban street lighting while significantly reducing operational costs for municipalities. This project aims to revolutionize street lighting by implementing a smart, automated solution that ensures consistent performance, optimal energy use, and heightened public safety.

1.2 SCOPE OF THE WORK

Smart street lights represent a cost-efficient solution for cities working to reduce energy consumption, enhance public safety, and foster further 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.

1.3 AIM AND OBJECTIVES

The main objective of this project is to save the electricity. Now a days, there are many issues regarding the electricity in rural areas. Since the power consumption is high in metropolitan cities and industries, there is no efficient electricity to provide in the rural areas. we are opting for non-renewable sources like solar energy and also from hardware sources like piezoelectric sensors and rotating speed breakers. By doing these, we can provide electricity to the rural areas too, since we are generating electricity from non-renewable sources. By the idea of our project, we can also save the power consumption. So that we can make our country a developed country by providing electricity to each and every region.

The main objectives of this project are:

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

CHAPTER 2

LITERATURE SURVEY

[1]The Internet of Things (IoT) has revolutionized interactions with the environment, significantly impacting the development of smart cities. IoT-based smart street light systems adjust light intensity based on ambient light and the presence of people or cars, enhancing energy efficiency and brightness. These systems also detect faulty lights and relay information to the cloud for maintenance. Remotely controlled and monitored, they reduce energy consumption, cut costs, and lower carbon footprints, contributing to improved maintenance and reduced downtime. Integrating these systems into a single IoT platform offers a comprehensive smart city solution.

[2]Streetlighting is crucial for safety but consumes significant electricity. Traditional systems waste energy by operating at full intensity regardless of ambient light. The proposed system, based on the Boltuino platform, enhances energy efficiency and fault detection by using LDR and IR sensors to adjust light intensity and detect traffic activity. It automatically identifies faulty lights and notifies authorities, reducing manual inspection time and improving maintenance. This system adapts to weather conditions, making streetlighting more efficient and responsive.

[3]This project introduces an IoT-enabled system to automate streetlight operation in rural areas, addressing energy wastage due to manual on/off practices. The system conserves energy and ensures safety by adjusting light intensity based on environmental conditions and detecting movement. It also includes a fault detection feature that alerts administrators to faulty lamps via a web dashboard. Lights operate at lower intensity during non-peak hours, increasing to full

intensity upon detecting movement. All events are synchronized with a cloud-based web application for remote access.

[4]Street lights are essential for public safety and convenience, especially in dark environments along walkways and streets. Conventional systems require human intervention to identify faulty bulbs and manage energy-saving measures, leading to inefficiencies and wasted energy. These lights often remain fully illuminated all night, regardless of vehicle density. To address this, a proposed system utilizes IoT technology to automatically detect faulty street lights and send location information to an Android application. The system also enables systematic switching on/off and progressive dimming based on vehicle movement, significantly enhancing energy conservation.

[5]With increasing urbanization, timely maintenance and accurate fault diagnosis of street lamps have become crucial. This paper proposes an intelligent fault diagnosis method using illumination detection, NB-IoT technology, and machine learning. Sensors collect illuminance data, which is analyzed to create street lamp turn-on models. Real-time data processing diagnoses faults and identifies fault types, with feedback provided to maintenance staff. An example verifies the method's effectiveness.

[6]With urbanization advancing, accurate fault diagnosis and timely maintenance of street lamps are essential. This paper proposes an intelligent method using illumination detection, NB-IoT technology, and machine learning. Sensors collect illuminance data, which is uploaded to build a database. Machine learning analyzes this data to construct lamp turn-on models and diagnose faults in real-time, identifying fault types and notifying maintenance staff. An example verifies the method's effectiveness.

[7]Street lighting is crucial for reducing nighttime accidents but can lead to energy waste and financial losses if poorly managed. This paper proposes a smart streetlight system using sensors, IoT technologies, Arduino, and GPS for effective management. The system includes hardware for monitoring and software for remote control. Testing showed reduced energy consumption, lower carbon footprint, efficient fault detection, precise fault location via GPS, and minimized downtime. The system is scalable to cover entire towns or nations.

[8]In smart cities, energy-efficient policies are essential for sustainable infrastructure. This paper proposes a smart streetlight system that adjusts lighting based on ambient conditions and detects faults using LDR sensors. Communication between poles is facilitated by Zigbee, with a master pole controlling slave pole intensity when vehicles are detected. Ferromagnetic sensors monitor vehicles for classification, speed, and length. Experimental results show 95% accuracy in vehicle classification and 20% energy savings with a 50-watt LED lighting system.

[9]Urbanization drives the need for sustainable infrastructure, with street lights playing a vital role in urban safety and visibility. This paper introduces a smart street lighting system based on Wi-SUN (Wireless Smart Ubiquitous Network), leveraging mesh topology for redundancy and IEEE 802.15.4g standard for sub-GHz band communication. Utilizing oneM2M middleware enables interoperability with various smart city verticals like weather and crowd monitoring. The system offers cost-effective control and IP-addressable lighting, ensuring consistent Wi-SUN coverage for future deployments.

CHAPTER 3

EXISTING SYSTEM

Existing street light control systems primarily rely on manual inspection, basic automation, and, to a lesser extent and technologies such as Power Line Communication (PLC) and GSM modules. Manual inspection methods, where maintenance crews regularly check and report on faulty lights, are labor-intensive and inefficient, often leading to delayed fault detection and prolonged downtime. Basic automated systems use timers or light-sensitive switches to control street lights but lack real-time fault detection and adaptive capabilities, resulting in energy wastage and inconsistent lighting performance. PLC-based systems provide real-time monitoring and fault reporting via existing power lines, but they can be expensive and complex to retrofit into existing infrastructure. GSM-based systems offer wireless communication for status updates and fault notifications, yet they incur ongoing service costs and can face coverage limitations. Compared to these existing systems, our proposed smart LED control system, utilizing the ESP32 microcontroller, LDRs, IR sensors, and the Blynk platform, addresses these disadvantages by offering real-time, sensor-based automatic control and remote monitoring via a user-friendly mobile app. This integration ensures higher energy efficiency and flexibility but may require a higher initial investment and depend on reliable internet connectivity for optimal performance. Additionally, the incorporation of manual override capabilities through the Blynk app provides users with direct control, further enhancing system adaptability. Despite potential challenges with initial setup costs and internet dependency, our system presents a modern, efficient solution to the limitations of current street light control methods.

CHAPTER 4

PROPOSED SYSTEM

This project focuses on designing and implementing a smart LED control system using an ESP32 microcontroller, Light Dependent Resistors (LDRs), Infrared (IR) sensors, and the Blynk platform. The system features two primary operational modes: automatic and manual, providing flexibility in controlling the LED based on environmental conditions and user preferences. The integration with the Blynk platform allows for remote monitoring and control, making the system highly user-friendly and adaptable. By utilizing the ESP32 microcontroller, the system is capable of processing sensor data and making real-time decisions about the LED's operation, enhancing energy efficiency and convenience.

In the automatic mode, the system uses the LDR to measure ambient light levels. The LDR's resistance varies inversely with the light intensity, which allows the system to detect whether it is day or night. If the ambient light level is below a predefined threshold, indicating low light conditions, the LED remains off. When the light level exceeds the threshold, the system then uses the IR sensor to detect motion within its range. If motion is detected, the LED is turned on to full brightness to provide adequate lighting. If no motion is detected, the LED is set to a dimmer level to conserve energy while still providing some illumination. In manual mode, users can override the automatic control through the Blynk mobile app. The app features a switch widget that allows users to turn the LED on or off directly, bypassing the automatic sensor-based logic. This manual control provides flexibility for users who may want to control the lighting based on their specific needs at any given time. Additionally, the Blynk platform allows for real-time monitoring of the system's status and sensor readings, giving users insights into the ambient light levels and motion detection data. This comprehensive approach ensures that the LED control system is both intelligent and user-friendly, leveraging modern IoT technology to create an efficient and adaptable lighting solution.

CHAPTER 5

SYSTEM DESIGN

5.1 GENERAL

In this section, we would like to show how the general outline of how all the components end up working when organized and arranged together. It is further represented in the form of a flow chart below.

5.2 SYSTEM ARCHITECTURE DIAGRAM

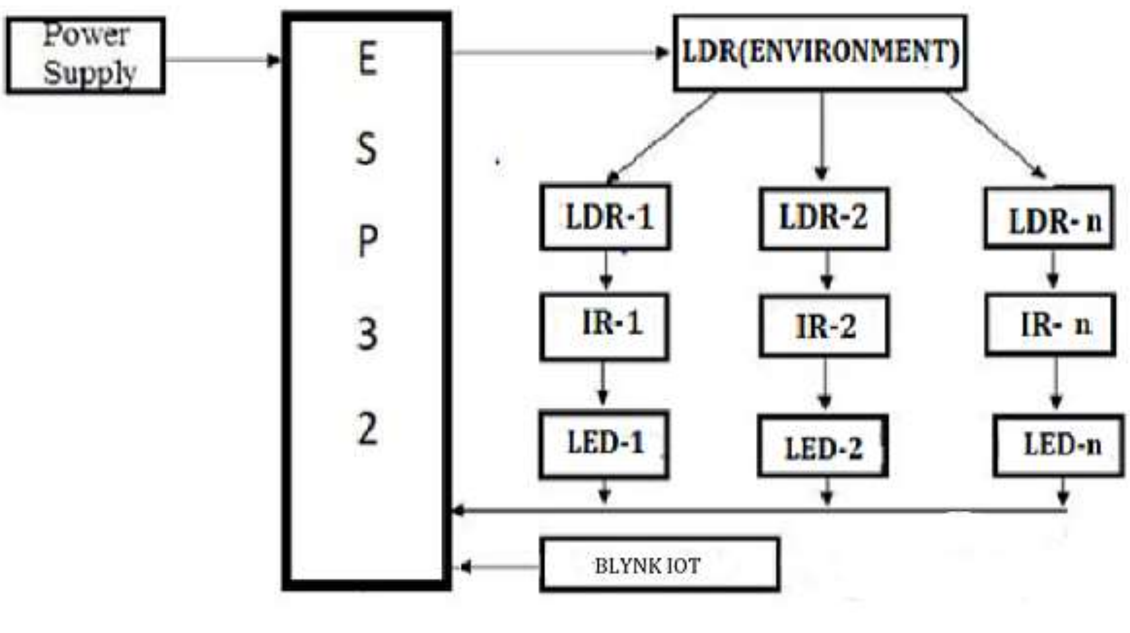


Fig **4.2** Architecture Diagram for Smart Street Light Management System

The system architecture revolves around an ESP32 microcontroller as the central hub, orchestrating the interactions between various components. Two LDRs capture ambient light levels, while two IR sensors detect motion or the presence of objects. This data feeds into the ESP32, which makes real-time decisions regarding LED activation and brightness levels. During the day, if brightness is high, LEDs remain off to conserve energy, whereas in low-light conditions, all LEDs illuminate at full intensity to ensure visibility and safety. The IR sensors further enhance security by detecting motion, prompting the ESP32 to adjust LED brightness accordingly. The system status and sensor data are stored in the cloud via a Wi-Fi module, allowing access from anywhere at any time. This enables remote monitoring and management of the street light system, making it easier to maintain and operate efficiently.This methodology ensures automated, efficient, and intelligent management of street lighting, enhancing energy savings, improving maintenance processes, and ensuring safety. Integral to the system is the integration with Blynk, a cloud-based platform, facilitating remote monitoring and control via a smartphone app. Users can effortlessly visualize sensor data, receive notifications on motion detection or system faults, and remotely adjust settings for enhanced convenience and peace of mind.

The ESP32's versatility allows for easy integration of additional sensors or actuators, enabling the system to adapt to evolving needs and accommodate future upgrades. Moreover, leveraging Blynk's cloud-based platform not only enables remote monitoring and control but also facilitates comprehensive data logging and analysis, empowering users to track long-term trends and optimize system performance further. Furthermore, the system prioritizes user experience by integrating with existing smart home ecosystems, offering compatibility with various automation protocols for enhanced convenience and flexibility. Additionally, its energy-efficient design extends beyond LED brightness control to include power management strategies, reducing operational costs and environmental impact. This comprehensive approach ensures the system's effectiveness, efficiency, and user-friendliness in outdoor lighting control applications.

5.3 DEVELOPMENTAL ENVIRONMENT

5.3.1 HARDWARE REQUIREMENTS

Component	Description
Center Server	Windows-based server for running central management software.
Embedded Controller	ESP32 microcontroller for individual street lights.
Light Sensor	Light Dependent Resistor (LDR) for detecting ambient light levels.
Motion Sensor	Infrared (IR) sensor for detecting motion to adjust lighting.
LED Light	Energy-efficient LED street lights.
WIFI Module	Integrated Wi-Fi in ESP32 for wireless communication.
Power Supply	Reliable power sources for embedded controllers and sensors.
Cabling	Power and communication cabling for connecting hardware components.

Table 5.3.1 Hardware Requirements

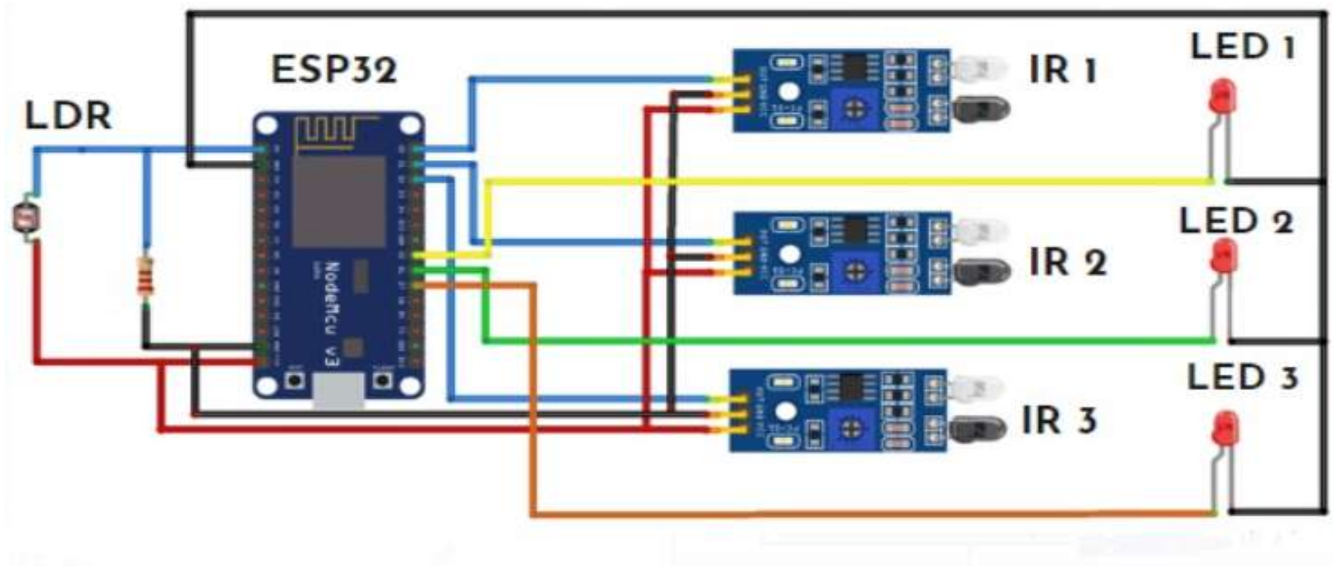
5.3.2 SOFTWARE REQUIREMENTS

The software requirements document is the specifications of the system. It should include both a definition and a specification of requirements. It is a set of what the system should rather be doing than focus on how it should be done. It is useful in estimating the cost, planning team activities, performing tasks, tracking the team, and tracking the team's progressthroughout the development activity.

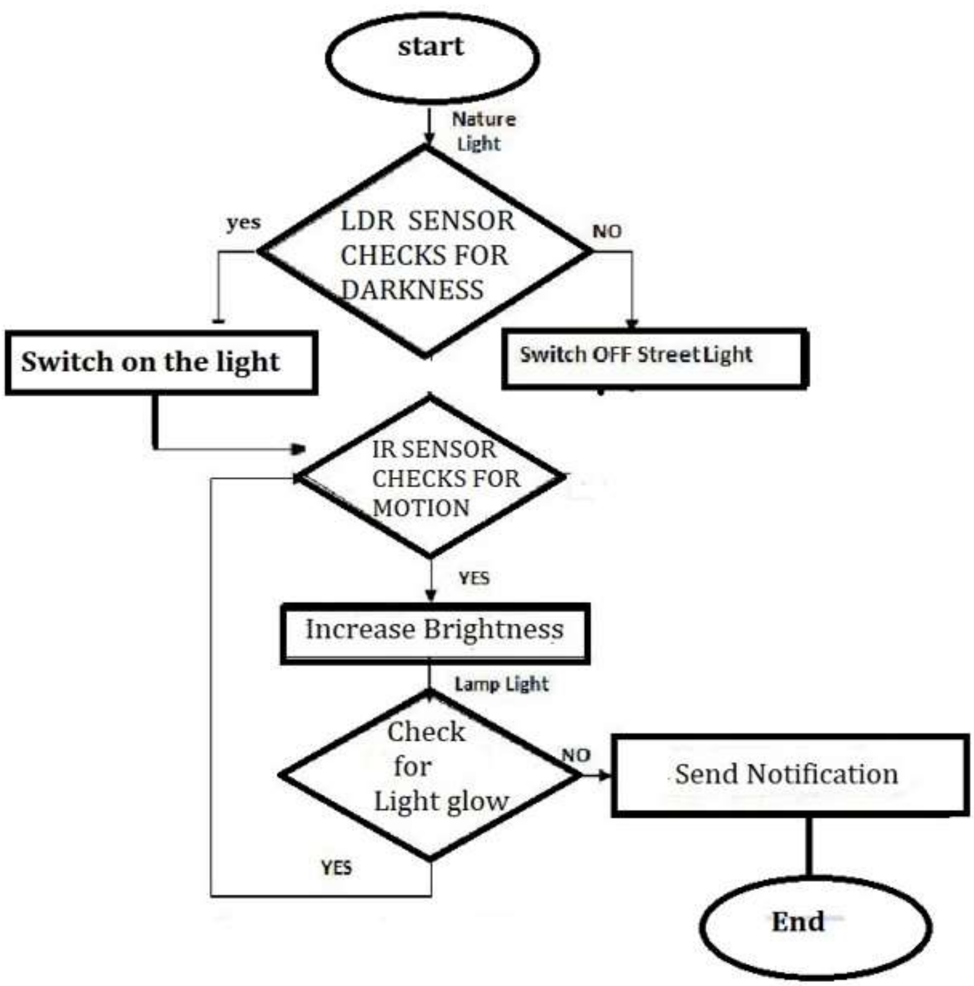
Category	Requirements
Operating System	Windows
Programming Language	Python
Integrated Development Environment (IDE)	Arduino IDE for programming ESP32.

Table 5.3.2 Software Requirements

5.4 CIRCUIT DIAGRAM



5.5 FLOW DIAGRAM



CHAPTER 6

PROJECT DESCRIPTION

6.1 METHODOLODGY

The street light control and fault detection system with cloud storage is implemented through an Arduino program. Nowadays, street lamps are operated manually. However, this system automates the ON/OFF control and fault detection of street lamps. The system uses an LDR (light dependent resistor) to check the ambient light conditions. If the LDR detects bright conditions, the system identifies it as daytime. If it detects darkness, the system recognizes it as nighttime and switches ON the street lights.

During night time, if motion is detected by an IR sensor, the system increases the intensity of the street lights to provide better visibility for pedestrians and vehicles. This adaptive lighting ensures energy savings while maintaining safety.

Additionally, the system monitors the street lights for any faults. If a light is not functioning properly, indicated by abnormal LDR values, the system detects the fault and sends an alert message to the ward member and ward service man via a GSM module.

In manual mode, users can directly control the LED through the Blynk mobile app. This mode is activated via a switch widget in the app, allowing users to turn the LED on or off regardless of the sensor readings. Also it has gauge that shows the range of intensity sensed by LDR sensor. The system is connected to the Blynk platform, enabling remote monitoring and control of the LED and sensor data visualization. This integration of automated sensor-based control with manual override via a mobile app provides a flexible and user-friendly lighting solution.

6.2 COMPONENTS DESCRIPTION

The list of components used are

- ESP32
- LDR sensor
- IR sensor
- LED
- Breadboard
- Jumper wires

ESP32:

The ESP32 is a powerful microcontroller commonly used in IoT (Internet of Things) projects. It has built-in Wi-Fi and Bluetooth capabilities, making it suitable for wireless communication tasks. The ESP32 can be programmed to read sensor data, control other devices, and communicate with other systems over the internet.

LDR (Light Dependent Resistor) sensor:

An LDR sensor is a type of resistor whose resistance varies with the amount of light falling on it. It's often used to detect the intensity of light in the surrounding environment. In a project, the LDR sensor can be used to measure ambient light levels, which can then be used to trigger certain actions or decisions in the program running on the ESP32.

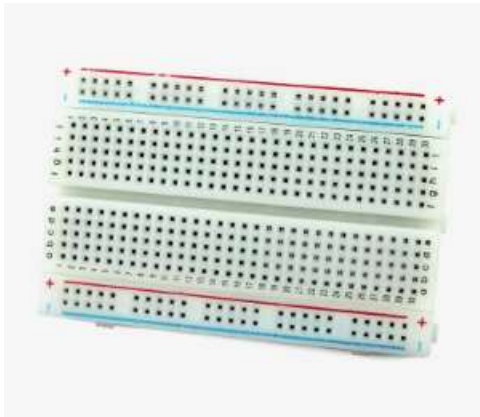
IR sensor:

An IR (Infrared) sensor detects infrared radiation emitted by objects. These sensors are commonly used in proximity sensing applications, motion detection, and object detection. With an IR sensor, you can detect the presence or absence of an object within its range, and this information can be used to control various aspects of your project.

LED (Light Emitting Diode):

LEDs are electronic components that emit light when an electric current passes through them. They're often used as visual indicators in electronic circuits. In your project, LEDs could be used to visually indicate certain conditions or states, such as whether the ambient light level is above or below a certain threshold, or whether an object has been detected by the IR sensor.

Breadboard:



A breadboard is a prototyping tool used to build and test electronic circuits without soldering. It consists of a grid of holes into which electronic components can be inserted and interconnected using jumper wires. Breadboards are commonly used in electronics projects to quickly prototype and test circuit designs before moving to more permanent solutions.

Jumper wires:

Jumper wires are used to create electrical connections between components on a breadboard or between a breadboard and other components. They're flexible wires with connectors at each end that can be easily inserted into the holes on a breadboard or connected to the pins of electronic components. Jumper wires allow you to quickly and easily establish connections between different parts of your circuit.

CHAPTER 7

RESULTS AND DISCUSSIONS

7.1 OUTPUT

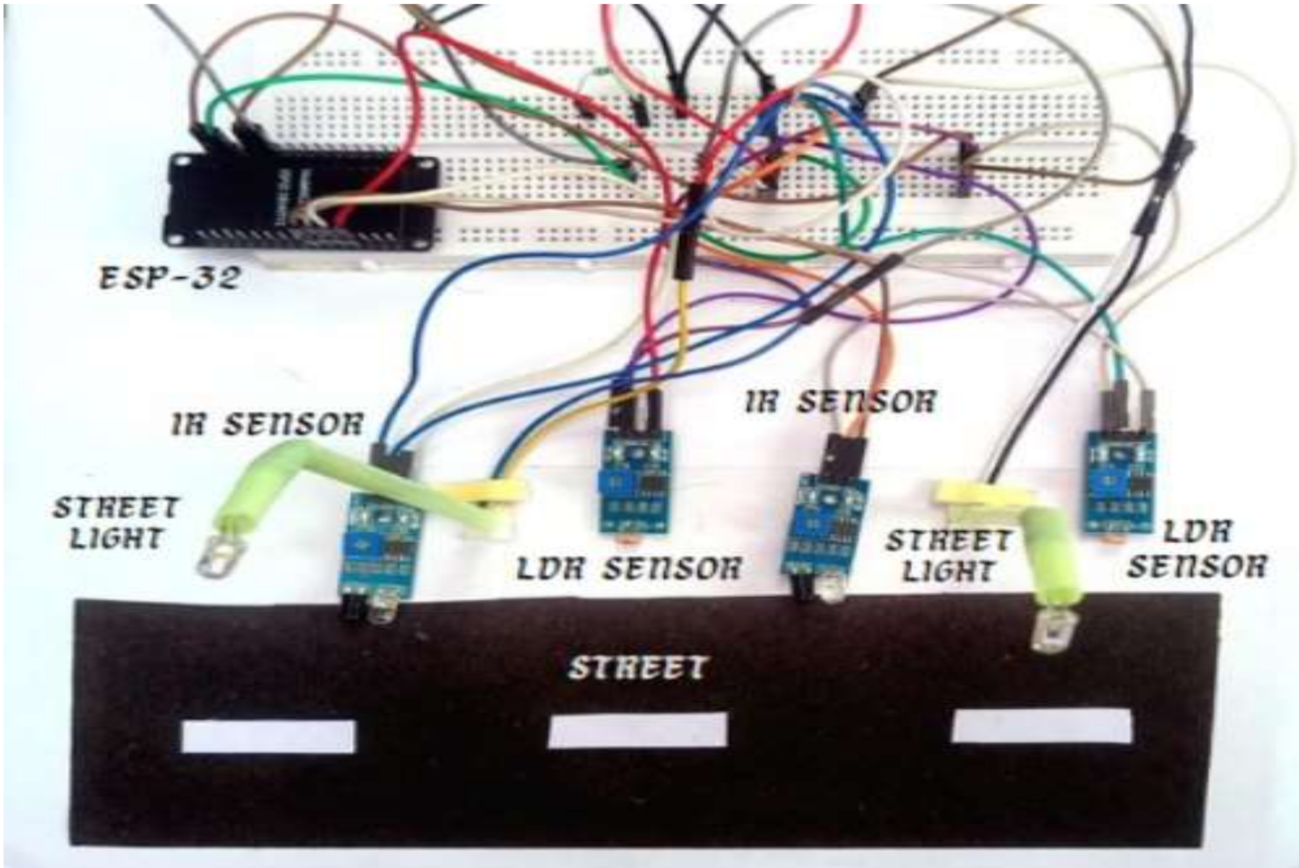


Fig 7.1.1 Upper View of Overall Project with All Components

The above image provides a comprehensive overview of the entire IoT-based street light fault detection system, illustrating how all components are seamlessly integrated using jumper wires. This view highlights the interconnectedness of each element, showcasing the practical layout and physical connections that make the system operational**.**

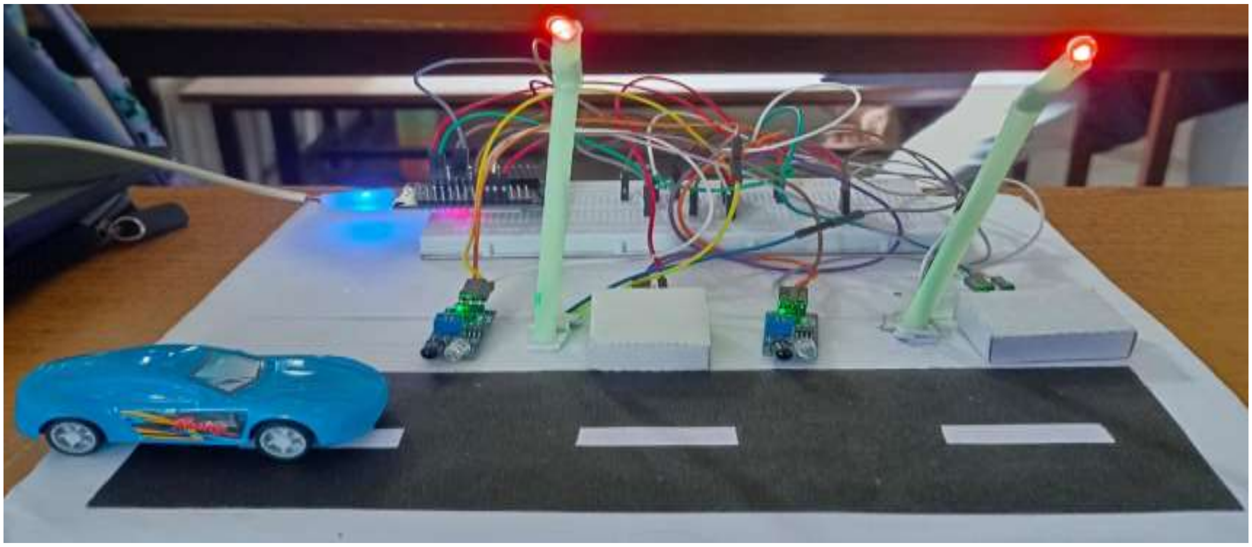


Fig 7.1.2 THE FRONT VIEW OF THE SMART STRRET LIGHT SYSTEM WITH LED’S AND SENSORS

The front view of the smart street light system provides a clear and detailed visual representation of how the components are arranged and function together in the final implementation. This perspective focuses on the physical layout and accessibility of the LEDs and sensors that form the core of the system's operation.

Fig 7.1.3. WEB DASHBOARD OF BLYNK APP

This User interface helps the user to control the LED using their Mobile phones or Laptops manually whenever required. The Gauge shows the intensity of the LED light to the user.

7.2 RESULT

7.2.1 Scenario during Day under Full Brightness

At daytime due to full environmental brightness, no LEDs are ON and the value of LDR remains almost constant. The intensity varies depending on brightness.

7.2.2 Scenario during Night under Full Darkness

At night due to zero environmental brightness, all LEDs are ON and the value of LDR here too remains almost constant as the LDR would not sense any light all night. The value of LDR which is referred as external brightness and on the other hand the value of intensity. By looking at the gauge in the blynk we could say that as the external brightness increases, LEDs becomes low and as the external brightness decreases the value of LEDs becomes high. When it is totally dark outside the Intensity reaches to the peak. The IR sensor will detect a vehicle, or human or animal, passing on the road as object.

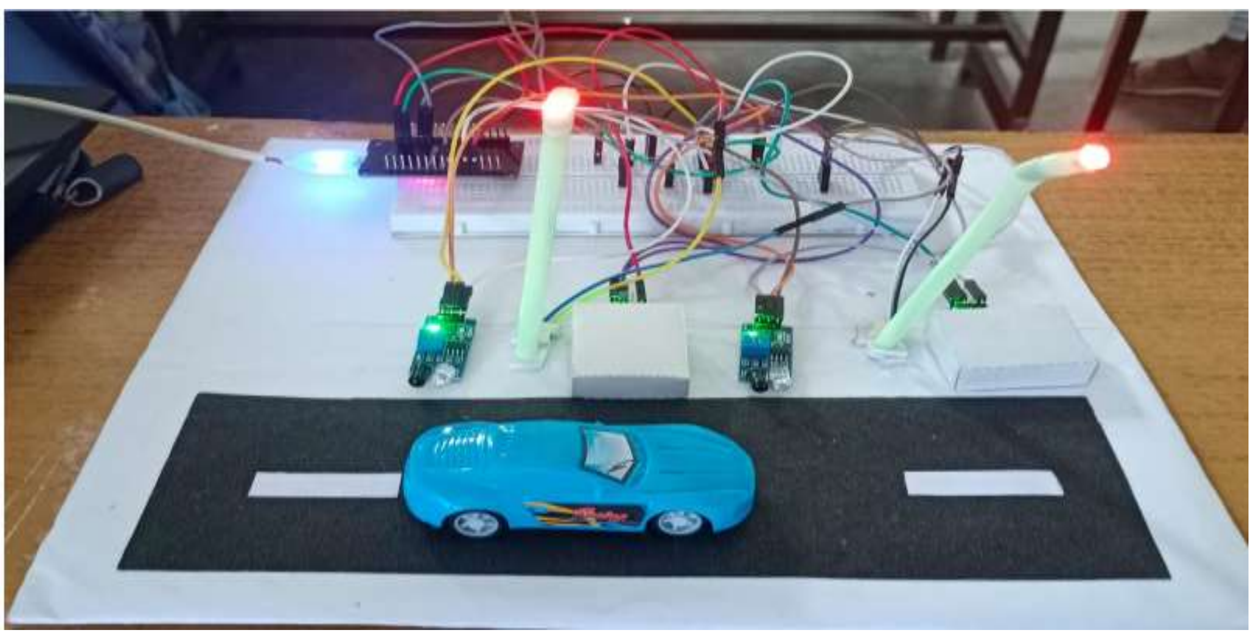


Fig 7.2.2 .1 OVERALL SETUP

This image shows how the led responds when its dark and when there is no motion detected.The LED light glows with low intensity to save power.

CHAPTER 8

CONCLUSION AND FUTURE ENHANCEMENT

8.1 CONCLUSION

In conclusion, the implementation of Street Light Fault Detection and Location Tracking using IoT represents a significant advancement in urban infrastructure management. By harnessing the power of IoT sensors, data analytics, and automation, this system offers proactive monitoring, early fault detection, and precise location tracking for street lights. The advantages of such a system include improved maintenance efficiency, reduced operational costs, enhanced energy efficiency, and enhanced public safety. Moreover, future extensions such as predictive maintenance, energy harvesting, and integration with other urban systems hold promise for further enhancing the system\'s capabilities. Overall, Street Light Fault Detection and Location Tracking using IoT not only contributes to the creation of smarter and more sustainable cities but also fosters a safer and more efficient urban environment for residents and visitors alike across various domains.

8.2 FUTURE ENHANCEMENT

Future extensions for Street Light Fault Detection and Location Tracking using IoT involve enhancing predictive maintenance capabilities, integrating sustainable energy sources like energy harvesting, and developing self-healing networks for continuous operation. Additionally, there's potential for integrating environmental monitoring sensors, traffic management systems, and mobile app interfaces for citizen engagement. Smart grid integration can optimize energy usage, while advanced data analytics and visualization tools enable better decision-making. Autonomous maintenance vehicles could automate repair tasks, and integration with emergency response systems could prioritize maintenance during crises. These extensions aim to create a more intelligent, adaptive, and integrated system that contributes to safer and resilient cities.

APPENDIX

SOURCE CODE:

```
#define BLYNK_TEMPLATE_ID "TMPL3qeyDalVN"
#define BLYNK_TEMPLATE_NAME "led"
#define BLYNK_AUTH_TOKEN "xT5LKHx6W7fuAoQSFoB5fhYqco5V5oef"
#define BLYNK_PRINT Serial

#include <WiFi.h>
#include <WiFiClient.h>
#include <BlynkSimpleEsp32.h>

const int ldrPin1 = 34;
const int ledPin1 = 4;
const int irPin1 = 35;

const int ldrPin2 = 32;
const int ledPin2 = 2;
const int irPin2 = 33;

bool automaticMode = true;

char auth[] = BLYNK_AUTH_TOKEN;
char ssid[] = "Resh";
char pass[] = "244466666";

BlynkTimer timer;
```

```
void setup() {
  pinMode(ldrPin1, INPUT);
  pinMode(ledPin1, OUTPUT);
  pinMode(irPin1, INPUT_PULLUP);

  pinMode(ldrPin2, INPUT);
  pinMode(ledPin2, OUTPUT);
  pinMode(irPin2, INPUT_PULLUP);

  Serial.begin(115200);
  delay(1000);
  Blynk.begin(auth, ssid, pass);
  timer.setInterval(1000L, readSensors);
}

void loop() {
  Blynk.run();
  timer.run();
}

void readSensors() {
  int ldrValue1 = analogRead(ldrPin1);
  int scaledLdrValue1 = map(ldrValue1, 0, 4095, 0, 500);
  Blynk.virtualWrite(V5, scaledLdrValue1);

  int irValue1 = digitalRead(irPin1);

  if (automaticMode) {
```

```
  if (ldrValue1 < 3000) {
    analogWrite(ledPin1, LOW);
  } else {
    if (irValue1 == LOW) {
      analogWrite(ledPin1, 255);
    } else {
      analogWrite(ledPin1, 50);
    }
  }
}

int ldrValue2 = analogRead(ldrPin2);
int scaledLdrValue2 = map(ldrValue2, 0, 4095, 0, 500);
Blynk.virtualWrite(V6, scaledLdrValue2);

int irValue2 = digitalRead(irPin2);

if (automaticMode) {
  if (ldrValue2 < 3000) {
    analogWrite(ledPin2, LOW);
  } else {
    if (irValue2 == LOW) {
      analogWrite(ledPin2, 255);
    } else {
      analogWrite(ledPin2, 50);
    }
  }
}
```

```
  if (ldrValue1 < 3000 && analogRead(ledPin1) != LOW) {
    Blynk.notify("LED 1 is faulty!");
  }

  if (ldrValue2 < 3000 && analogRead(ledPin2) != LOW) {
    Blynk.notify("LED 2 is faulty!");
  }
}

BLYNK_WRITE(D4)
{
  int switchState = param.asInt();
  if (!automaticMode) {
    if (switchState == 1) {
      analogWrite(ledPin1, 255);
    } else {
      analogWrite(ledPin1, LOW);
    }
  }
}

BLYNK_WRITE(D2)
{
  int switchState = param.asInt();
  if (!automaticMode) {
    if (switchState == 1) {
      analogWrite(ledPin2, 255);
```

```
    } else {
      analogWrite(ledPin2, LOW);
    }
  }
}

BLYNK_WRITE(D3)
{
  int switchState = param.asInt();
  automaticMode = (switchState == 1);
  if (automaticMode) {
    readSensors();
  } else {
    analogWrite(ledPin1, LOW);
    analogWrite(ledPin2, LOW);
  }
```

REFERENCES

[1] J. V. Anchitaalagammai, S. M. Alim, C. V. A. Sarthy, S. Kirithic and A. S. Kumar, "IoT Based Automated Street Light Control with Fault Detection and Reporting System," 2023 5th International Conference on Inventive Research in Computing Applications (ICIRCA), Coimbatore, India, 2023, pp. 1739-1744, doi: 10.1109/ICIRCA57980.2023.10220674. keywords: {Costs;Smart cities;Brightness;Lighting;Switches;Light emitting diodes; Control systems ;Smart Street Light;IoT;Human Detection;Power Saving},

[2]D. Saha, S. M. Sorif and P. Dutta, "Weather Adaptive Intelligent Street Lighting System With Automatic Fault Management Using Boltuino Platform," 2021 International Conference on ICT for Smart Society (ICISS), Bandung, Indonesia, 2021, pp. 1-6, doi: 10.1109/ICISS53185.2021.9533234. keywords: {Costs;Adaptive systems;Fault detection;Brightness;Manuals;Maintenance engineering;Light emitting diodes;Smart Street Lighting;Internet of Things;Fault Detection;Weather Adaptive;Power Saving},

[3]V. Karpagam, R. S. A. Kumar, S. M. Shree and S. H. Haran, "IoT Smart Streetlight System for Semi-Urban Areas with Fault Detection," 2023 2nd International Conference on Vision Towards Emerging Trends in Communication and Networking Technologies (ViTECoN), Vellore, India, 2023, pp. 1-6, doi: 10.1109/ViTECoN58111.2023.10157015. keywords: {Energy consumption;Costs; Fault detection ; Energy conservation;Sensor systems;Safety;automating streetlight;faulty lamp detection;Cloud;IoT) (Internet of Things);DHT11 Sensor;PIR Sensor;LDR (Light Dependent Resistor);Node MCU},

[4]P. Karthikeyan, M. Karthik, V. Deepikapriya, S. Divya Briya, R. Dharanishwarma and S. Janakirthick, "Design and Implementation of Smart Street Light Automation and Fault Detection System," 2022 2nd International Conference on Power Electronics & IoT Applications in Renewable Energy and its Control (PARC), Mathura, India, 2022, pp. 1-7,

doi: 10.1109/PARC52418.2022.9726622. keywords: {Fault diagnosis;Energy consumption; Systematics; Fault detection; Brightness; Switches; Smart Streetlight;IoT ;Automation},

[5]D. Tang, F. Ding, B. Deng, P. Zhang, Q. Wang and H. Lv, "An Intelligent Fault Diagnosis Method for Street Lamps," 2021 International Conference on Internet, Education and Information Technology (IEIT), Suzhou, China, 2021, pp. 300-303, doi: 10.1109/IEIT53597.2021.00073. keywords: {Fault diagnosis;Lighting; Machine learning; Maintenance engineering ;Data models;Robustness; Real-time systems;intelligent fault diagnosis;narrowband Internet of things;machine learning},

[6]D. Tang, F. Ding, B. Deng, P. Zhang, Q. Wang and H. Lv, "An Intelligent Fault Diagnosis Method for Street Lamps," 2021 International Conference on Internet, Education and Information Technology (IEIT), Suzhou, China, 2021, pp. 300-303, doi: 10.1109/IEIT53597.2021.00073. keywords: {Fault diagnosis;Lighting ; Machine learning ; Maintenance engineering;Data models;Robustness;Real-time systems;intelligent fault diagnosis;narrowband Internet of things;machine learning},

[7]P. E. Lartsey, D. T. Ayitey, A. Acakpovi and R. E. Arthur, "IoT Based Street Light Controller and Monitoring System," 2021 IEEE 8th International Conference on Adaptive Science and Technology (ICAST), Accra, Ghana, 2021, pp. 1-7, doi: 10.1109/ICAST52759.2021.9682127. keywords: {Wireless sensor networks; Software design ; Wireless networks ; Urban areas;Lighting;Hardware;Software;streetlight;automatic system ; remote control; microcomputing ;energy efficiency},

[8]M. Singh, S. Saxena and A. R. Prusty, "Energy Efficient Intelligent Lighting System For Smart Cities," 2022 IEEE Conference on Interdisciplinary Approaches in Technology and Management for Social Innovation (IATMSI), Gwalior, India, 2022, pp. 1-6, doi: 10.1109/IATMSI56455.2022.10119268. keywords: {Technological innovation;Smart

cities;Roads;Lighting; Zigbee;Switches;Energy efficiency;Sensor systems;Monitoring;Physical design;IoT;Renewable energy;LDR;Zigbee;AMR},

[9]V. Naware, A. Gupta, U. Mogadali, A. Vattem and A. M. Hussain, "Smart Street Light System using Wi-SUN and oneM2M," 2024 IEEE Applied Sensing Conference (APSCON), Goa, India, 2024, pp. 1-4, doi: 10.1109/APSCON60364.2024.10465845. keywords: {Wireless communication;Wireless sensor networks;Smart cities;Roads;Lighting;Switches; Luminescence;oneM2M;Smart street lighting;Smart city;Urban deployment;Wi-SUN},

[10] LoRa," International Journal for Modern Trends in Science and Technology, vol. 7, no. 12, pp. 242-245, 2021.

[11] Ashok Kumar Nanduri et al, "IoT based Automatic Damaged Street Light Fault Detection Management System," (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 11, No. 8, 2020.

[12] C. Subramani et al., "Energy Efficiency and Pay-Back Calculation on Street Lighting Systems," The 11th National Conference on Mathematical Techniques and Applications, AIP Conf. Proc., vol. 2310, no. 1, 2019.

[13] G.PRAVEEN et al , "National Highway Street Light Faulty Detection & Monitoring System," Journal of Emerging Technologies and Innovative Research (JETIR), Volume 6, No. 4, April 2019.

[14] Intelligentsystem for monitoring andcontrolling of street lightusing the GSMtechnology, International conference on information processing, December 16- 19, 2015, by Swati rajes Parekar, prof ManojM. Dongre.

[15]B. K. Subramanyam, K. Bhaskar Reddy, P. Ajay Kumar Reddy, "Design and Development of Intelligent Wireless Street Light Control and Monitoring System Along

With GUI", International Journal of Engineering Research and Applications (IJERA)Vol. 3, Issue 4, Jul- Aug 2013, pp.2115- 2119.

[16]Anila Devi Y, V. Jaya Prakash, "GSM Based Remote Control System of High Efficiency Intelligent Street Lighting System Using A Zigbee Network of Devices and Sensor" International Journal of Science and Research (IJSR) P.P 2319- 7064.

[17] R. Angeline, B. Gokul, B. Prashanth, P. Hareesh, Animesh Singh "Monitoring and Controlling of Street Lamp using GSM Technology", International Research Journal of Engineering and Technology (IRJET) Oct 2018.

[18] M. Shariz Ansari, Tanmay Srivastava, Rishabh Saxena, Saurabh Singh "GSM Based Street Light Automation" International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (An ISO 3297: 2007 Certified Organization)Vol. 4, Issue 5, May 2015

[19] B.Abinaya, S.Gurupriya, M.Pooja "IOT BASED SMART AND ADAPTIVE LIGHTING IN STREET LIGHTS "2017 Second International Conference On Computing and Communications Technologies(ICCCT"17)

[20] Veena P C, Paulsy Tharakan, Hima Haridas, Ramya K, Riya Joju, Ms. Jyothis T S "Smart Street Light System based on Image Processing"2016 International Conference on Circuit, Power and Computing Technologies [ICCPCT]