SMART STREET LIGHT SYSTEM

A MINI-PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project **"SMART STREET LIGHT SYSTEM**" is the bonafide work of "**HARINISUBASHREE.S (210701072) , HARITHAAH.MS(210701079) and HELEN SHALINI.A (210701082) "** who carried out the project work under mysupervision.

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

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TABLE OF CONTENTS

CHAPTER NO. **PAGE**

TITLE

LIST OF FIGURES

LIST OF ABBREVIATION

ABBREVIATION ACRONYM

IR - Sensor Infra-Red Sensor

LDR- Light Dependent Resistor

MQTT- Message Queuing Telemetry Transport

ABSTRACT

Street lighting is an essential component of the infrastructure of cities; it brightens public areas, pedestrian pathways, and streets. But typical street lighting systems frequently display inefficiencies in terms of energy usage and upkeep procedures, requiring for the creation of creative solutions to deal with these issues. Our project aims at enhancing energy efficiency, lighting executives, and maintenance processes in urban contexts through using Internet of Things (IoT) technology in the planning and installation of a Smart Street Light System. Our Smart Street Light System's primary role is to automatically modify brightness in alignment with ambient factors and usage patterns in real time. Each street light fixture has motion sensors and Internet of Things (IoT) devices attached to it so that the system can detect the presence of vehicles or pedestrians and alter brightness levels accordingly. In order to save energy during times when there islow activity, the algorithm dims the brightness; yet, when motion is detected, the brightness increases in order to guarantee adequate light and improve safety on city streets. This adaptive lighting solution reduces energy waste while simultaneously boosting illumination levels and boosting visibility for both cars and pedestrians. Further, in order to minimize downtime and hurry up repair efforts, our system contains proactive defect detection techniques. The system continually monitors each street light's operational status through the combination of sensor-based monitoring and remote interaction, allowing for the real-time detection of any problems or malfunctions. When a problem presents itself, the system sends out alerts or notifications so that maintenance staff may take quick action and fix the situation. Our solution preserves continuous operating of the lighting infrastructure, lowers repair costs, and extends the service life of street light fixtures through the implementation of a proactive maintenance strategy. By doing the combination of Internet of Things (IoT) solutions, our project presents acomprehensive solution to enhance street lighting systems in urban contexts. Future smarter, more sustainable cities will be made attainable by our Smart Street Light System, which enhances maintenance processes, adjusts brightness levels dynamically, and utilizes less energy. All of these benefits mark an important advancement in the control of urban illuminating infrastructure.

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Urban street lighting is necessary for accessibility and safety, but the present systems sometimes waste energy and need expensive maintenance. Our project uses Internet of Things (IoT) technologies to create a Smart Street Light System to try to address these issues. This system uses real-time usage patterns to automatically alter brightness, saving energy during moments of inactivity and improving visibility when needed. Proactive problem identification processes also cut maintenance expenses and downtime. Our technology strives to build smarter, more sustainable urban settings through minimizing breakdowns, enhancing lighting executives, and lowering energy use.

1.2 SCOPE OF THE WORK

With the goal to maximize street lighting efficiency, a "smart street light system" incorporates wireless connectivity, sensors, and data analytics. This includes remote monitoring and control, predictive maintenance to prevent downtime, energy consumption optimization, and automatic brightness shift based on ambient light and traffic conditions.

1.3 PROBLEM STATEMENT

The energy consumption and maintenance practices of the prevailing street lighting infrastructure in urban areas are unproductive, leading to substantial operating expenses and adverse environmental impacts.Regardless of actual consumption patterns, conventional street lights operate at preset brightness levels, draining resources unnecessarily when there is not much activity. Additionally, an absence of preventative upkeep measures often results in prolonged downtime and increased repair costs.

1.4 AIM AND OBJECTIVES OF THE PROJECT

The objective of the project is to build a smart street light system that employs the Internet of Things and changes brightness in response to presence detection. This involves installing sensors that detect human presence, enabling the system to alter light brightness to increase when presence is sensed and reduce when it is absent. Thegadget will additionally have a capacity to report any broken lights, assuring timely maintenance and ongoing operation. The primary goal is to create a street lighting infrastructure that is energy-efficient and responsive, enhancing sustainability and safety in neighborhoods.

CHAPTER 2

LITERATURE SURVEY

This paper [1]talks about the latest advances in smart street lighting systems are outlined in this extensive review by Smith et al. (2018). It discusses about the way several advances in technology, such as sensor networks, IoT integration, and adaptive lighting control projects may minimize maintenance costs and promote energy efficiency.

This research [2] Kumar et al. (2020) explore the integration of Internet of Things technology in intelligent street lighting systems in this study. The paper emphasizes the importance of IoT in enabling dynamic control and optimization of street lighting infrastructure, including topics including motion detection, environmental sensing, and remote monitoring.

This project paper[3] is an IoT-based smart street lighting system which is energy-efficient is the focus of a study published by S. Jadhav et al. (2019). The studyfocuses on how effectively motion sensors and adaptive lighting algorithms performto reduce electricity expenses without compromising adequate illumination.

This research [4] gives an in-depth examination of smart street lighting systems, focusing optimization and control strategies that improve functionality and energy efficiency. It covers fault detection and dynamic brightness control techniques in addition to communication protocols and sensors.

This study [5] The design of a smart street lighting system is laid out in this article, with a focus on power-saving methods utilizing dynamic control and monitoring. It addresses applying cloud-based analytics, IoT sensors, and communication protocols for remote maintenance and energy optimization.

CHAPTER 3

SYSTEM SPECIFICATIONS

3.1 HARDWARE SPECIFICATIONS FOR APPLICATION

Processor	:	Pentium IV Or Higher
Memory Size	:	256 GB (Minimum)
HDD	:	40 GB (Minimum)

3.2 SOFTWARE SPECIFICATIONS

Operating System	:	WINDOWS 10
Application	:	ARDUINO IDE

3.3 HARDWARE COMPONENTS FOR PROTOTYPE

Sensor	:	IR-Sensor
Board	:	Arduino Uno
Screen	:	LDR

CHAPTER 4

MODULES DESCRIPTION

Arduino Uno

This is microcontroller setup for the car parking system which acts as the CPU of the whole system. This takes inputs from the Sensors and triggers the actuators.

IR - Sensor

This sensor is used to trigger an event at the time of car's entry or exit and sends the information to the controller.

LDR

LDR sensors in smart street light systems detect ambient light levels, enabling automatic adjustment of brightness for energy efficiency and adaptability to environmental changes.

MQTT

MQTT is used for data transmission, as it is easy to implement and communicate IoT data efficiently.

CHAPTER 5

SYSTEM DESIGN

5.1 FLOW CHART

A flowchart is a type of diagram that represents an algorithm, workflow or process. 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.

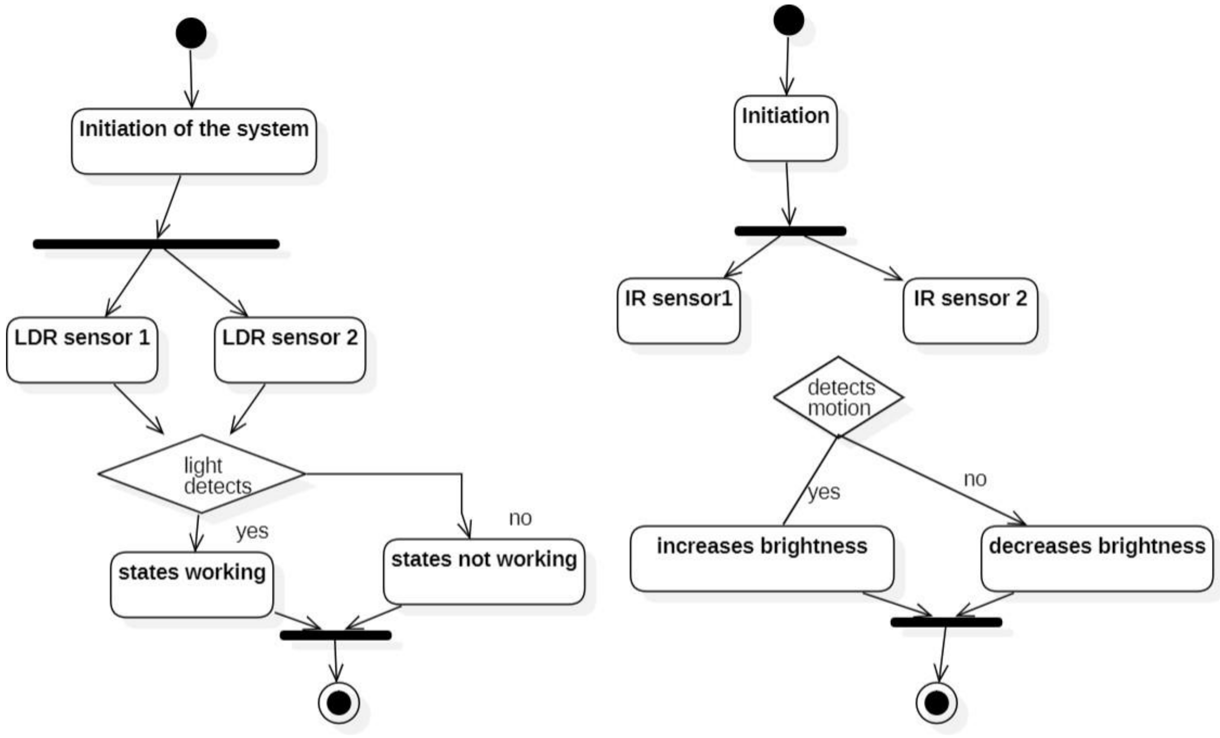

Figure 5.1 Flow Chart

5.2 CIRCUIT DIAGRAM

The circuit diagram explains the connections made with the hardware components and the board. The Arduino uno is connected with the Sensors, LDR and transistoran is given connection with the rails and the other input/output pins are connected to digital as per the requirements.

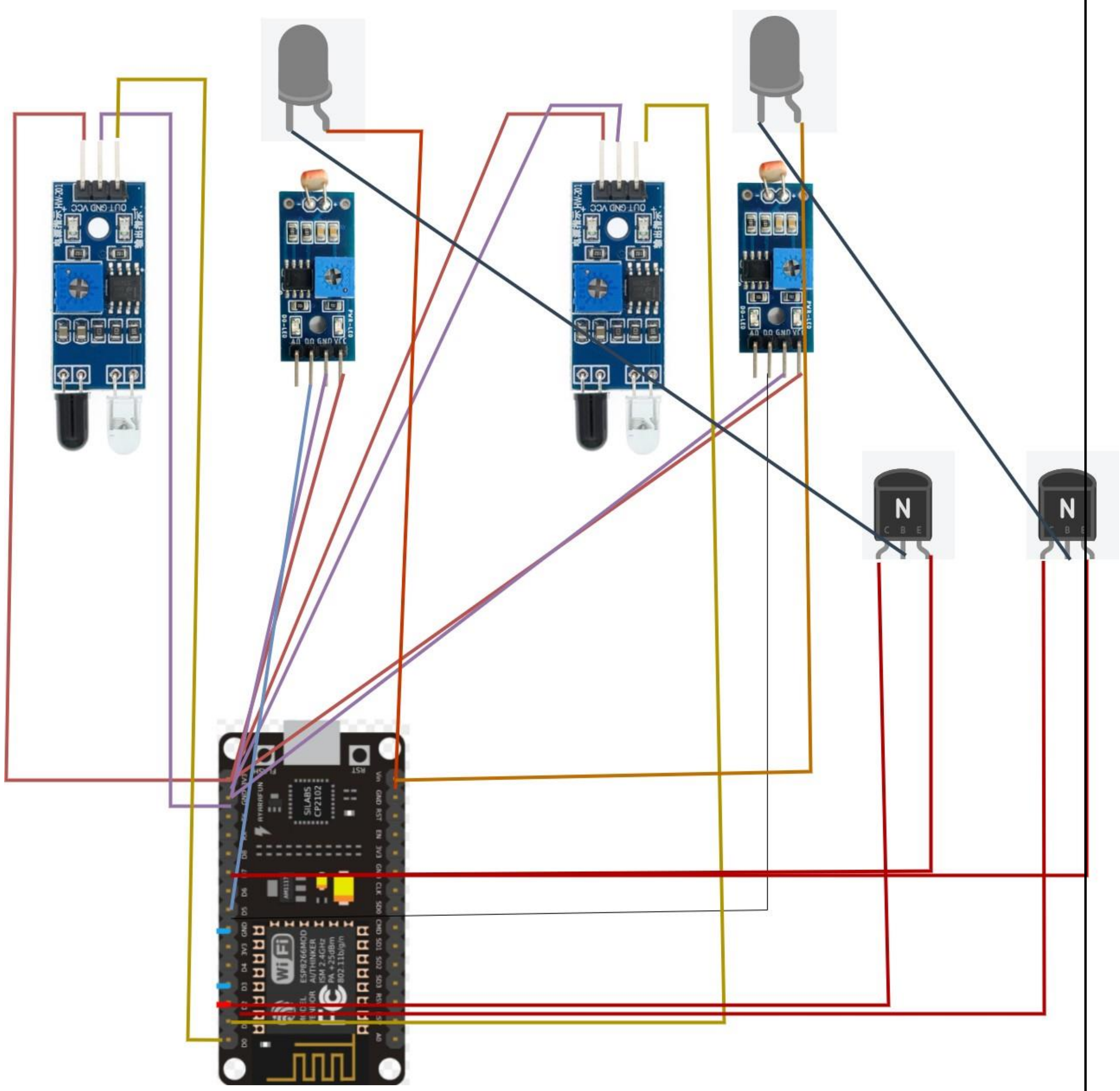

Figure 5.2 Circuit diagram

From the above figure 5.2, the connections are made

CHAPTER 6

CODING

1. Setup

```
void setup() {
  Serial.begin(115200);
  delay(10);

  Serial.println(F("Adafruit MQTT demo"));

  // Connect to WiFi access point.
  Serial.println(); Serial.println();
  Serial.print("Connecting to ");
  Serial.println(WLAN_SSID);

  WiFi.begin(WLAN_SSID, WLAN_PASS);
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
  Serial.println();

  Serial.println("WiFi connected");
  Serial.println("IP address: "); Serial.println(WiFi.localIP());
  pinMode(ldr1,INPUT_PULLUP);
  pinMode(ldr2,INPUT_PULLUP);
  pinMode(ir1,INPUT_PULLUP);
  pinMode(ir2,INPUT_PULLUP);

}
```

2. Loop

```
void loop() {

  MQTT_connect();

if(!digitalRead(ldr1)){
  photocell1.publish("street light at ambattur working");

}
else{
  photocell1.publish("street light at ambattur not working");
}
delay(5000);
if(!digitalRead(ldr2)){
  photocell2.publish("street light at avadi working");
}
else{
  photocell2.publish("street light at avadi not working");
}
delay(5000);
if(!digitalRead(ir1)){
analogWrite(led1,255);
}
else{
  analogWrite(led1,50);
}
if(!digitalRead(ir2)){
  analogWrite(led2,255);
}
else{
  analogWrite(led2,50);
}
  // ping the server to keep the mqtt connection alive
  // NOT required if you are publishing once every KEEPALIVE seconds
  /*
  if(! mqtt.ping()) {
    mqtt.disconnect();
  }
  */
}

void MQTT_connect() {
  int8_t ret;
```

```
  if (mqtt.connected()) {
    return;
  }

  Serial.print("Connecting to MQTT... ");

  uint8_t retries = 3;
  while ((ret = mqtt.connect()) != 0) {
       Serial.println(mqtt.connectErrorString(ret));
       Serial.println("Retrying MQTT connection in 5 seconds...");
       mqtt.disconnect();
       delay(5000); // wait 5 seconds
       retries--;
       if (retries == 0) {
         while (1);
       }
  }
  Serial.println("MQTT Connected!");
}
```

CHAPTER 7

SCREEN SHOTS

1. CONNECTION

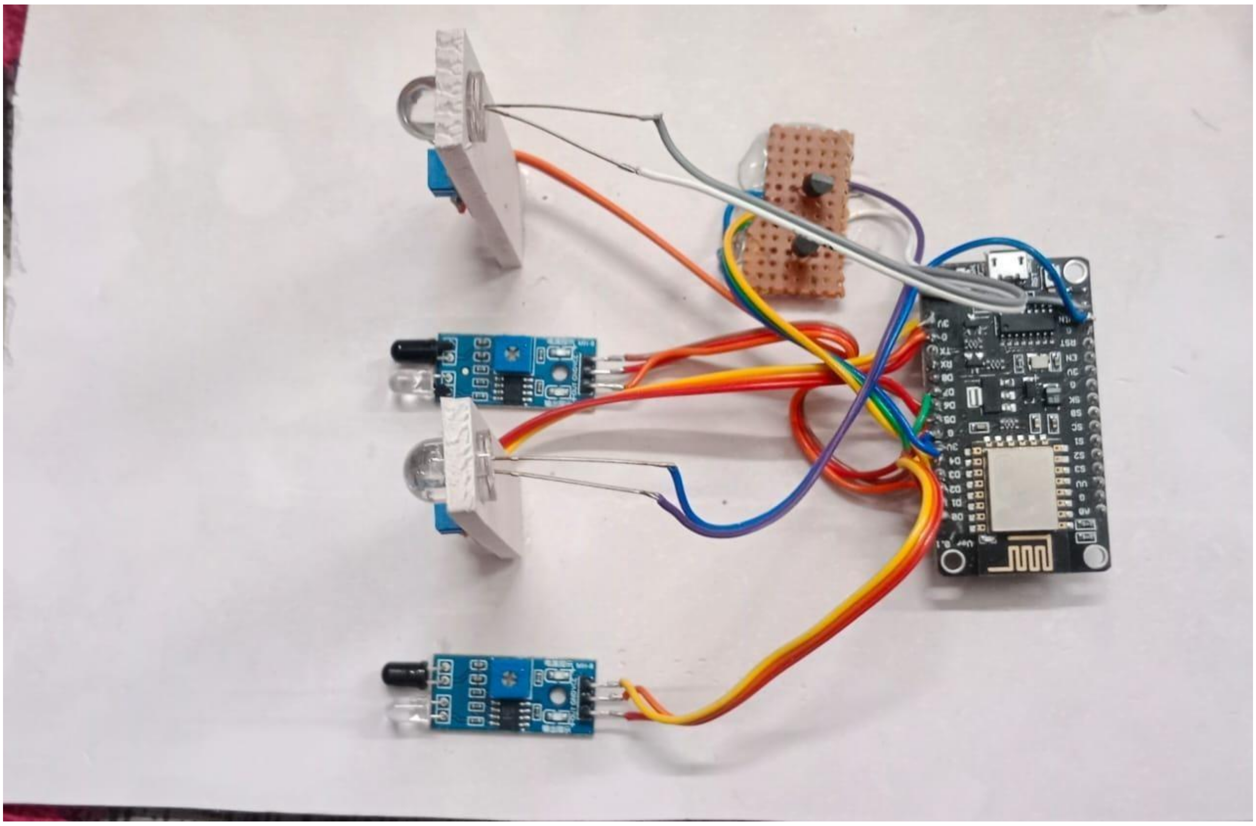

Figure 7.1 Connection Setup

Upon successful connection, light will be detected in the LDR module and one out of the two lights in the IR sensors will light up denoting that people are present and have a successful connection. In the figure(see 7.1) if the IR sensor detects motion of any vehicle, and will in turn increase the brightness of the lights. When the sensor does not detect any vehicle the intensity of the light is reduced. The LDR sensor detects and informs us whether the lights are working properly or not and updates every 5 seconds.

CHAPTER 8

CONCLUSION AND FUTURE ENHANCEMENT

In conclusion, the incorporation of IoT-enabled smart street light system has led to significant strides in urban lighting infrastructure by achieving its goals of enhancing sustainability, safety, and efficiency. The system effectively decreases energy consumption and ensures ideal illumination levels based on real-time requirements through combining presence detection and dynamic brightness management.

Future enhancements to the Internet of Things' smart street light system will include including solar power along with additional renewable energy sources, using innovative sensor technologies for precise identification and environmental monitoring, implementing artificial intelligence into practice in predictive maintenance algorithms, and developing dynamic adaptive lighting algorithms. Efficiency, safety, and sustainability can also be further improved through cooperation with other smart city systems, social platforms, environmental impact monitoring, emergency response integration, energy storage solutions, and edge computing capabilities.

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