AUTOMATIC STREET LIGHT SYSTEM

EMBEDDED OS AND DEVICE DRIVERS MINI PROJECT REPORT

Submitted by

MANINDRA. J

ESWARA VENKATA SAI. J

YASWANTH SAI. N

Under the Guidance of

DR. M. SATHESH

in partial fulfillment for the award of the degree

of

BACHELOR OF TECHNOLOGY

in

ELECTRONICS & COMMUNICATION ENGINEERING

Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
(Deemed to be University Estd. u/s 3 of UGC Act, 1956)

BONAFIDE CERTIFICATE

Certified that this Minor project-1 report entitled **"AUTOMATIC STREET LIGHT SYSTEM"** is the bonafide work of **"MANINDRA. J (21UEEC0109), ESWARA VENKATA SAI. J (21UEEC0112) and YASWANTH SAI. N (21UEEC0209)"** who carried out the project work under my supervision.

SUPERVISOR	**HEAD OF THE DEPARTMENT**
Dr. M. SATHESH	**Dr.A. SELWIN MICH PRIYADHARSON**
Assistant Professor	Professor
Department of ECE	Department of ECE

- -

Submitted for Minor project-1 work viva-voce examination held on:______________________

INTERNAL EXAMINER	**EXTERNAL EXAMINER**

ACKNOWLEDGEMENT

We express our deepest gratitude to our Respected Founder President and Chancellor **Col. Prof. Dr. R. Rangarajan**, Foundress President **Dr. R. Sagunthala Rangarajan**, Chairperson and Managing Trustee and Vice President.

We are very thankful to our beloved Vice Chancellor **Prof. Dr. S. Salivahanan** for providing us with an environment to complete the work successfully.

We are obligated to our beloved Registrar **Dr. E. Kannan** for providing immense support in all our endeavours. We are thankful to our esteemed Dean Academics **Dr. A. T. Ravichandran** for providing a wonderful environment to complete our work successfully.

We are extremely thankful and pay my gratitude to our Dean SoEC **Dr. R. S. Valarmathi** for her valuable guidance and support on completion of this project.

It is a great pleasure for us to acknowledge the assistance and contributions of our Head of the Department **Dr. A. Selwin Mich Priyadharson**, Professor for his useful suggestions, which helped us in completing the work in time and we thank him for being instrumental in the completion of third year with his encouragement and unwavering support during the entire course. We are extremely thankful and pay our gratitude to our Minor project -1 coordinator **Dr. Kanimozhi T**, for her valuable guidance and support on completing this project report in a successful manner.

We are grateful to our supervisor **Dr. M. SATHESH**, Assistant Professor ECE for providing me the logistic support and his/her valuable suggestion to carry out our project work successfully.

We thank our department faculty, supporting staffs and our family and friends for encouraging and supporting us throughout the project.

MANINDRA. J

ESWARA VENKATA SAI. J

YASWANTH SAI. N

TABLE OF CONTENTS

ABSTRACT

In urban environments, street lighting plays a critical role in providing safety and security for both pedestrians and vehicles. However, conventional street lighting systems often suffer from inefficiencies such as energy wastage and lack of adaptability to changing environmental conditions. The integration of sensor technologies offers a promising solution to address these challenges by enabling automatic control of street lights based on real-time environmental parameters. This paper proposes an Automatic Street Light System (ASLS) designed to enhance the efficiency of street lighting while reducing energy consumption and operational costs. The ASLS incorporates a variety of sensors including light sensors, motion sensors, and weather sensors to dynamically adjust the brightness of street lights according to ambient light levels, human presence, and weather conditions. By intelligently regulating the luminosity of street lights, the ASLS ensures optimal visibility and safety while minimizing energy wastage during periods of low activity or adequate natural illumination.

features of the ASLS include a centralized control system capable of monitoring and managing street lights in real-time, as well as a wireless communication network for seamless integration with existing infrastructure. Furthermore, the ASLS offers scalability and flexibility to accommodate diverse urban environments and evolving technological advancements. Through simulation studies and field trials, the effectiveness of the ASLS in improving energy efficiency, reducing carbon footprint, and enhancing public safety is demonstrated. The results indicate significant reductions in energy consumption and operational costs compared to traditional street lighting systems, while maintaining adequate illumination levels for pedestrians and motorists. Overall, the Automatic Street Light System represents a practical and sustainable approach to modernizing urban lighting infrastructure, contributing to the creation of smarter and more energy-efficient cities. Finally, the abstract would conclude by emphasizing the significance of the automatic street light system in contributing to the development of smarter, more sustainable, and more resilient urban environments.

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

In urban landscapes worldwide, street lighting serves as a fundamental element in ensuring safety, security, and functionality during nighttime hours. Traditional street lighting systems, however, are often characterized by static operation, inefficient energy usage, and limited adaptability to changing environmental conditions. As cities continue to grow and evolve, there is an increasing demand for smarter, more efficient solutions that can meet the dynamic needs of modern urban environments.

1.1 IMPORTANCE OF AUTOMATIC STREET LIGHT SYSTEM

The importance of automatic street light systems lies in their ability to revolutionize urban lighting infrastructure, offering a host of benefits that span energy efficiency, safety, sustainability, and operational efficiency. At the core of their significance is the capacity to intelligently manage lighting resources based on real-time conditions. By incorporating sensors and control mechanisms, these systems can dynamically adjust lighting levels in response to ambient light levels and pedestrian or vehicular activity, thereby minimizing energy waste and reducing carbon emissions associated with unnecessary illumination. From an energy efficiency standpoint, automatic street light systems play a pivotal role in conserving resources by ensuring that lighting is provided only when and where it is needed. By dimming or turning off lights during periods of low activity or ample natural light, these systems help municipalities and organizations significantly reduce their electricity consumption and operational costs associated with street lighting infrastructure. Moreover, automatic street light systems enhance safety by ensuring consistent and reliable illumination along roadways, pedestrian pathways, and public spaces. By maintaining optimal lighting levels at all times, these systems contribute to improved visibility for pedestrians, cyclists, and drivers, thereby reducing the risk of accidents and enhancing overall public safety.

1.2 TECHNOLOGIES OF AUTOMATIC STREET LIGHT SYSTEM

The technologies behind automatic street light systems encompass a diverse range of sensors, control mechanisms, communication protocols, and data analytics tools, all working together to optimize lighting efficiency and enhance operational performance. At the heart of these systems are sensors such as photocells, infrared (IR) sensors, and motion detectors, which monitor ambient light levels, detect pedestrian or vehicular activity, and trigger lighting adjustments accordingly. Photocells, for example, measure ambient light levels and automatically adjust street light intensity or turn them on/off based on predetermined thresholds. In addition to sensors, automatic street light systems often incorporate advanced control mechanisms, such as microcontrollers, programmable logic controllers (PLCs), or centralized lighting management systems. These control units receive input from sensors and execute predefined algorithms to regulate lighting levels, manage power consumption, and coordinate with other smart city infrastructure. Furthermore, communication technologies play a crucial role in enabling connectivity and interoperability within automatic street light systems. Wireless communication protocols such as Zigbee, LoRaWAN, or Wi-Fi facilitate data exchange between street lights, control units, and central monitoring stations, enabling real-time monitoring, remote management, and firmware updates. Data analytics tools and algorithms are also integral to automatic street light systems, enabling municipalities and organizations to derive actionable insights from collected data. By analyzing historical usage patterns, traffic flow data, and environmental conditions, these tools can optimize lighting schedules, predict maintenance needs, and identify opportunities for further efficiency improvements.

CHAPTER 2

LITERTAURE SURVEY

2.1 OVERVIEW

Tang, Hengyu [1] proposed a control core framework based on AT89S52 which controls street lights. This framework combines the various technologies of LCD, digital clock and a timer, photo-sensitive induction etc. when vehicles crossed by to conserve electricity the lights will turn on and vice versa. With this technology a large amount of power can be saved. In order to get the details of spoiled light and its information an auto-alarm function is used in this framework.

Xudan, Siliang [2] came up with a system with wireless sensor networks frame work to observe the progress. Based on latitude and longitude information the system is adjusted. Using sunset and sunrise procedures and the information of light intensity the system controls the street lights being kept in automatic programming mode. The system in addition makes use of digital temperature humidity sensor to humidity, real time and temperature of street lights.

Priyasree and Radhi [3] nominated control arrangement for a LED road lighting framework. The proposed control organization empowers disconnection of the road lighting framework from the mains amid pinnacle load time, lessening its effect in the distributed power framework natural utilization, decline the administration cost and screen the status data of every road lighting unit.

A.C. Kalaiarasan [4] volunteered a solar powered vitality-based road light with auto-following framework for augmenting power yield from a solar system that is desirable to increase the efficiency. So as to expand the power yielded from the sun light-based boards, one needs to keep boards lined up with the sun. by utilizing this approach, we can gain the maximum utilization from sun rays. This is a far most financially savvy arrangement than buying extra solar panels.

Budike. E.S. Lothar [5] invented a lightening control system consisting of modules like ballast control module, data processing module. The data processing module is connected with number of repeaters. The connections between data processing module, ballast module, repeaters and computer system through wireless connection comprises of a local area network. This system is developed to give the benefits of operating and controlling light intensity, automatic running of street lights and scheduling through web browser.

S.H. Jeong [6] set forth the development of Control System for street lights using Zigbee communication system. This system is presented in order to reduce the difficulties in maintenance of the lighting systems as well as to decrease the uneasiness of handling the same. This is monitoring and control system of street lights which makes use of system's control command to make the street lights on and off automatically.

Rajput and katav [7] propounded an intelligent street lighting system to lessen the large amounts of power wasted in street lightening system. This system makes use of different kind of sensors like CO2 sensor, noise sensor, light intensity sensor etc. To receive and send data between concentrator and system GSM modules are utilized.

Somchai Hiranvarodom [8] describes a similar analysis of photovoltaic (PV) road lighting framework in three distinct lights. To be specific, a low weight sodium light, a high weight sodium light and a fluorescent light have been utilized for establishment in every pole to decide the reasonable framework to introduce in a regular provincial zone of Thailand.

CHAPTER 3

BLOCK DIAGRAM AND COMPONENTS

3.1 BLOCK DIAGRAM

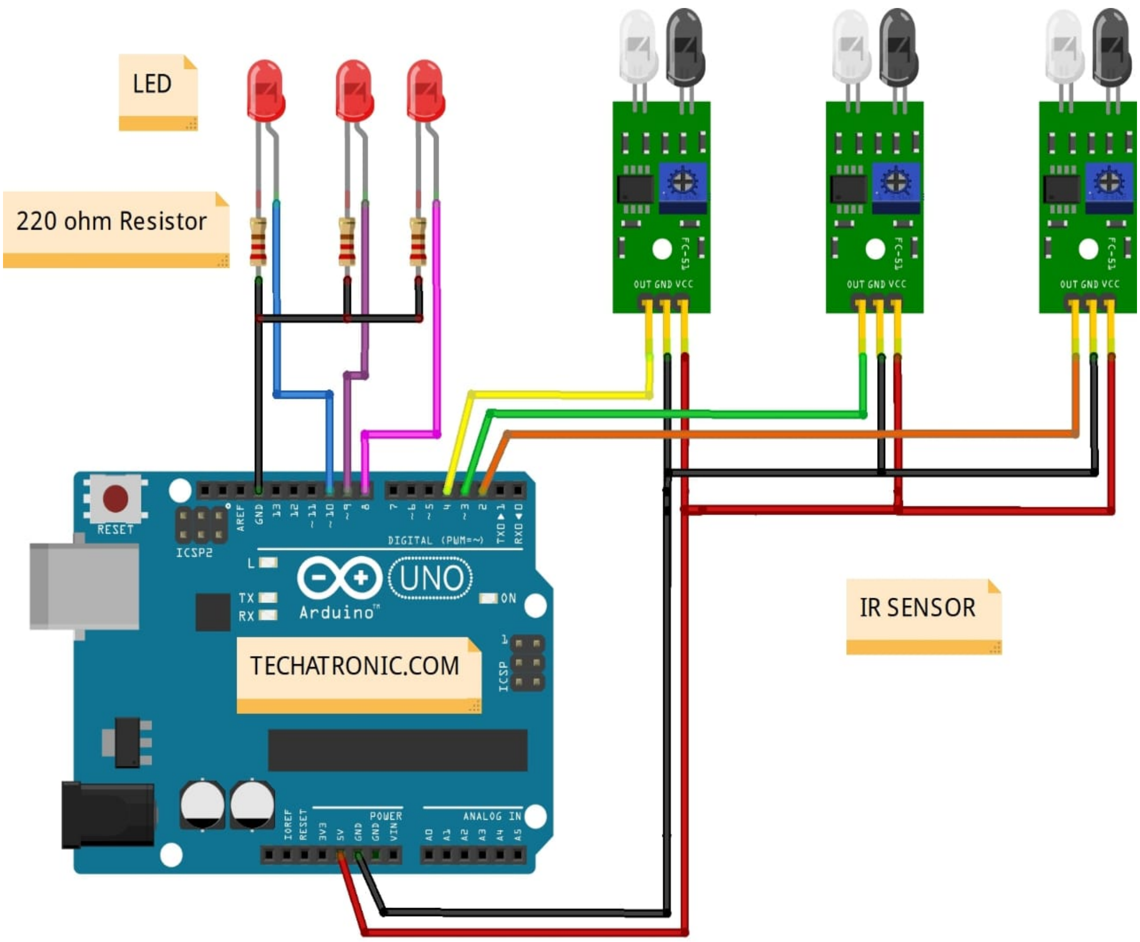

Figure 3.1: **BLOCK DIAGRAM**

3.2 HARDWARE COMPONENTS

1. ARDUINO UNO: Arduino Uno is the Atmega328P microcontroller. This microcontroller is responsible for executing the program instructions and controlling input/output operations. The Atmega328P on the Arduino Uno typically runs at 16 MHz. This clock speed determines how fast the microcontroller can execute instructions. The Arduino Uno has a total of 14 digital input/output pins. These pins can be configured as either inputs or outputs in software. They can be used to interface with digital sensors, control LEDs, motors, and other digital devices. In addition to digital pins, the Arduino Uno has 6 analog input pins. These pins can read analog voltage levels from sensors or other devices. The analog-to-digital converter (ADC) on the microcontroller converts these analog voltages into digital values that can be read by the Arduino.

2. IR SENSOR: IR sensors work based on the principle that all objects emit some level of infrared radiation. This radiation is invisible to the human eye but can be detected by specialized sensors. IR sensors typically consist of an emitter and a receiver. The emitter emits infrared radiation, and the receiver detects the radiation. When an object comes within the detection range of the sensor, it reflects or emits infrared radiation, which is then detected by the receiver. IR sensors are widely used in motion detection systems for security, lighting control, and energy efficiency purposes. IR sensors can detect the presence or absence of objects within a certain range, making them suitable for applications such as object detection, obstacle avoidance, and proximity sensing.

3. LED: Light Emitting Diodes (LEDs) are semiconductor devices that emit light when an electric current passes through them. They operate on the principle of electroluminescence, where electrons and holes recombine within the semiconductor material, releasing energy in the form of photons (light). LEDs have become ubiquitous in various applications due to their energy efficiency, longevity, compact size, and versatility. Compared to traditional incandescent bulbs and fluorescent lamps, LEDs consume less power and have a much longer lifespan, typically lasting tens of thousands of hours. This longevity is attributed to their solid-state construction, absence of filaments or gas-filled tubes, and minimal heat generation. LEDs are available in a wide range of colors, including red, green, blue, and white, with the ability to produce millions of hues by mixing different colors. They are also highly efficient light sources, converting a higher percentage of electrical energy into visible light, which reduces energy consumption and operating costs.

4. 220 OHM RESISTOR: A 220 ohm resistor is a fundamental component in electronics, valued for its ability to regulate current flow in circuits. Its resistance value, measured in ohms, determines the degree to which it impedes the passage of electrical current. The "220" designation indicates its resistance, and the unit "ohm" quantifies its resistance level. This resistor is commonly color-coded with red, red, brown, and gold or silver bands, denoting its value, tolerance, and

sometimes temperature coefficient. With a power rating typically around 0.25 watts (1/4 watt), this resistor can handle a specific amount of power without overheating.In practical applications, the 220 ohm resistor serves various purposes.

5. BREAD BOARD: A breadboard is a fundamental tool in electronics prototyping, providing a convenient platform for building and testing circuits without the need for soldering. Its design consists of a grid of holes, typically organized in rows and columns, with metal clips or spring connectors underneath each hole. These connectors allow electronic components, such as resistors, capacitors, integrated circuits, and wires, to be easily inserted and interconnected. The breadboard's main advantage lies in its versatility and reusability. Components can be inserted into the breadboard's holes and connected together using jumper wires, enabling rapid experimentation and iteration during the prototyping phase of electronics projects.

6. JUMPER WIRES: Jumper wires are essential components in electronics prototyping and circuit building, serving as flexible connectors to establish electrical connections between various components on a breadboard or other circuit platforms. These wires typically consist of a thin conductor, such as copper, encased in insulating material, with connector pins or tips at each end for easy insertion into breadboard holes or connection points on electronic components. The primary purpose of jumper wires is to create electrical pathways between different points on a breadboard or circuit board, enabling the flow of current and facilitating communication between components.

7. ARDUINO INTEGRATED DEVELOPMENT ENVIRONMENT (IDE): The Arduino software, also known as the Arduino Integrated Development Environment (IDE), is a powerful and user-friendly tool designed to simplify the process of programming and uploading code to Arduino microcontroller boards. It provides a comprehensive set of features and functionalities tailored to the needs of both beginners and experienced users in the electronics and programming communities. At its core, the Arduino IDE offers a simple yet powerful code editor with syntax highlighting, auto-indentation, and code completion features, making it easy to write and edit Arduino sketches (programs). The IDE supports the Arduino programming language, which is based on Wiring, a simplified variant of C and C++. This language abstracts many of the complexities of traditional programming languages, making it accessible to users of all skill levels. One of the defining features of the Arduino software is its seamless integration with Arduino hardware. The IDE includes a built-in library of pre-written code, known as libraries, which provide easy-to-use functions for interfacing with various hardware components, such as sensors, actuators, displays, and communication modules. These libraries simplify the process of writing code for common tasks, allowing users to focus on the functionality of their projects rather than the intricacies of low-level hardware programming.

CHAPTER 4

SOURCE CODE

```
void setup()
{
  Serial.begin(9600); // sensor buart rate
  pinMode(2,INPUT);  // IR Sensor output pin connected
  pinMode(3,INPUT);  // IR Sensor output pin connected
  pinMode(4,INPUT);  // IR Sensor output pin connected
  pinMode(8,OUTPUT); // LED PIN
  pinMode(9,OUTPUT); // LED PIN
  pinMode(10,OUTPUT); // LED PIN
}
void loop()
{
  int s1 = digitalRead(2); // IR Sensor Sensor output pin connected
  int s2 = digitalRead(3); // IR Sensor Sensor output pin connected
  int s3 = digitalRead(4); // IR Sensor Sensor output pin connected
  Serial.println(s1); // see the value in serial mpnitor in Arduino IDE
  Serial.println(s2); // see the value in serial mpnitor in Arduino IDE
  Serial.println(s3); // see the value in serial mpnitor in Arduino IDE
  delay(1000);
 if(s1 == 1 )
 {
  digitalWrite(8,HIGH);  // LED ON
  delay(1000);
 }
 else
```

```
{
 digitalWrite(8,LOW);  // LED OFF
}
if(s2 == 1 )
{
 digitalWrite(9,HIGH);  // LED ON
 delay(1000);
}
else
{
 digitalWrite(9,LOW);  // LED OFF
}
if(s3 == 1 )
{
 digitalWrite(10,HIGH); // LED ON
 delay(1000);
}
else
{
 digitalWrite(10,LOW); // LED OFF

}  }
```

CHAPTER 5

CONCLUSION

In conclusion, the automatic street light system represents a significant advancement in urban infrastructure, offering numerous benefits in terms of energy efficiency, safety, and convenience. By incorporating sensors and control mechanisms, these systems intelligently adjust lighting levels based on ambient light conditions and pedestrian or vehicular activity, ensuring that adequate illumination is provided when and where it is needed most. From an environmental perspective, automatic street light systems contribute to energy conservation and carbon emissions reduction by minimizing unnecessary lighting during daylight hours and adjusting lighting levels based on real-time conditions. This not only helps municipalities and organizations meet sustainability goals but also reduces operational costs associated with street lighting.

Moreover, automatic street light systems enhance safety by ensuring consistent and reliable illumination along roadways, sidewalks, and other public spaces, thereby reducing the risk of accidents and improving visibility for pedestrians, cyclists, and drivers. Additionally, by reducing reliance on manual intervention for lighting control, these systems free up resources and manpower that can be allocated to other critical tasks and services. In terms of convenience, automatic street light systems offer a hassle-free solution for municipalities and property owners by automating the process of managing and maintaining street lighting infrastructure. With features such as remote monitoring and control, predictive maintenance, and fault detection, these systems streamline operations and enhance overall efficiency. Overall, the adoption of automatic street light systems represents a positive step towards creating smarter, more sustainable, and safer urban environments. By harnessing the power of technology to optimize lighting resources and improve public infrastructure, these systems contribute to the well-being and quality of life for residents and communities worldwide.

REFERENCES

[1] Hengyu Wu, Minli Tang and Guo Huang, ”Design of multi-functional street light control system based on AT89S52 single-chip microcomputer,” The 2nd International Conference on Industrial Mechatronics and Automation, Wuhan, 2010, pp. 134-137.

[2] X. Shentu, W. Li, L. Sun and S. Gong, ”A new streetlight monitoring system based on wireless sensor networks,” The 2nd International Conference on Information Science and Engineering, Hangzhou, 2010, pp. 6394-6397.

[3] Priyasree, Radhi H Kauser, Rafiya E, vinitha Gangatharan, N. (2012). “Automatic Street Light Intensity Control and Road Safety Module Using Embedded System,” International Conference on Computing and Control Engineering (ICCCE 2012), At Coimbatore Institute of Information Technology, 2012.

[4] C.Bhuvaneswari, R.Rajeswari and C.Kalaiarasan “Analysis of Solar Energy Based Street Light with Auto Tracking System,” International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 2, Issue 7, July 2013.

[5] “Wireless internet lighting control system”, Budike. E.S. Lothar (Power web Technologies), US patent 7,167,777, Jan 23, 2007.

[6] J. d. Lee, K. y. Nam, S. h. Jeong, S. b. Choi, H. s. Ryoo and D. k. Kim, ”Development of Zigbee based Street Light Control System,” 2006 IEEE PES Power Systems Conference and Exposition, Atlanta, GA, 2006, pp. 2236-2240.

[7] K.Y.Rajput, Gargeyee Khatav , Monica Pujari , Priyanka Yadav, “Intelligent Street Lighting System Using Gsm,” International Journal of Engineering Science Invention, Volume 2, Issue 3, March, 2013, PP.60-69.