[1]Dr. A. Senthilkumar
[2]Dr. R. Rajalakshmi
[3]Dr. G. Malathi
[4]Dr. K. Vijayan
[5]K. Divya
[6]Dr. D. Kannan

Smart GPS Street Lamp Network

Abstract: - .The development of an automatic street light system using IoT technology integrates various components to enhance efficiency and reliability. This system relies on solar panels and batteries for power, ensuring sustainability and reducing reliance on the grid. The Light Dependent Resistor (LDR) continuously monitors ambient light levels, enabling the system to distinguish between daylight and nighttime conditions. By leveraging an ultrasonic sensor, the system can detect the presence of humans or vehicles, automatically adjusting the brightness of the street lights to optimize energy usage and enhance safety. Moreover, the integration of IoT connectivity allows for real-time monitoring and control of the street light system. Information regarding the status of components such as solar panels and batteries is transmitted through the IoT network. In the event of a fault condition, such as a malfunctioning solar panel or battery, the system promptly detects and relays this information, ensuring timely maintenance and uninterrupted operation. Additionally, the system incorporates a display, such as an LCD, to provide users with relevant information and status updates. This display serves as a visual interface for monitoring the performance of the street light system and receiving alerts about any issues detected. In summary, the automatic street light system leveraging IoT technology offers a comprehensive solution for efficient lighting management. By combining solar power, intelligent sensing, and IoT connectivity, it provides enhanced functionality, energy savings, and proactive maintenance capabilities, contributing to the development of smart and sustainable cities

Keywords: Automatic street light, IOT , Light Dependent Resistor, GPS , Solar Panel, LCD

I. INTRODUCTION

In recent years, the concept of smart cities has gained significant traction worldwide, driven by the need for more efficient and sustainable urban infrastructure. A key aspect of smart city development is the implementation of intelligent lighting systems, such as automatic street lights, which leverage advanced technologies like the Internet of Things (IoT) to improve energy efficiency and enhance public safety. This paper explores the design and implementation of an automatic street light system using IoT technology. The system integrates various components, including sensors, solar panels, batteries, and communication devices, to create a versatile and eco-friendly lighting solution for urban environments.

The primary objective of this system is to address the challenges associated with traditional street lighting, such as energy wastage and inefficient maintenance. By harnessing the power of IoT, the system can dynamically adjust the brightness of street lights based on environmental factors, such as ambient light levels and the presence of pedestrians or vehicles. This not only reduces energy consumption but also enhances visibility and safety on the streets. Furthermore, the integration of renewable energy sources, such as solar power, and proactive monitoring capabilities enable the system to operate autonomously and efficiently. Real-time data collection and analysis allow for the early detection of faults or malfunctions in components like solar panels or batteries, ensuring timely maintenance and uninterrupted operation. Moreover, the system provides users with a user- friendly interface, such as an LCD display, for monitoring system performance and receiving alerts about any issues detected. This empowers city administrators to make informed decisions and optimize the operation of the street light network. Overall, this paper aims to demonstrate the feasibility and benefits of implementing

[1] *Corresponding author: *Department of Electrical and Electronics Engineering, M.A.M. School of Engineering, Siruganur, Tamilnadu, India*

[2] *Department of Artificial Intelligence and Data Science , Trichy Engineering College, Trichy, Tamilnadu, India.*

[3] *Department of Electronics and communication Engineering, M.A.M.School of Engineering, Siruganur, Tamilnadu, India.*

[4] *Department of Mechanical engineering , M.A.M. School of Engineering, Siruganur, Tamilnadu, India*

[5] *Department of Electrical and Electronics Engineering, Karpagam Institute of engineering, coimbatore, Tamilnadu, India.*

[6] *Department of Mechanical engineering , M.A.M. School of Engineering, Siruganur, Tamilnadu, India*

[1]*bask2k1@yahoo.co.in,* [2]rajalaxmi.raj@gmail.com, [3]ursermala@gmail.com [4]latchuv2010@gmail.com, [5]divya.eeekarpagamtech.ac.in,[6]kannandrsm@gmail.com

an automatic street light system using IoT technology. By combining energy efficiency, sustainability, and smart monitoring capabilities, such systems have the potential to revolutionize urban lighting infrastructure and contribute to the development of smarter and more livable cities.

1.1 INTERNET OF THINGS

The internet of things (iot) is the network of devices such as vehicles, and home appliances that contain electronics, software, actuators, and connectivity which allows these things to connect, interact and exchange data. the iot involves extending internet connectivity beyond standard devices, such as desktops, laptops, smart phones and tablets, to any range of traditionally dumb or non-internet-enabled physical devices and everyday objects. embedded with technology, these devices can communicate and interact over the internet,

The definition of the internet of things has evolved due to convergence of multiple technologies, real-time

FIG: 1.1 REPRESENTATION OF IOT

analytics,machine learning, commodity sensors, and embedded systems. Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the internet of things

Embedded System Applications

The applications of an embedded system basics include smart cards, computer networking, satellites, telecommunications, digital consumer electronics, missiles, etc.Wherever Times is specified,

II LITERATURE SURVEY

2.1 Real-time Urban Microclimate Analysis Using Internet of Things AUTHOR: Punit Rathore, Aravinda S. Rao, Sutharshan Rajasegarar, Elena Vanz [1]

Real-time environment monitoring and analysis is an important research area of Internet of Things (IoT). Understanding the behavior of the complex ecosystem requires analysis of detailed observations of an environment over a range of different conditions. In this regard, implemented an integrated geovisualization framework, built for real-time wireless sensor network data on the synergy of computational intelligence and visual methods, to analyze complex patterns of urban microclimate. A Bayesian maximum entropy based method and a hyper ellipsoidal model based algorithm have been build in our integrated framework to address above challenges. The proposed integrated framework was verified using the data set from an indoor and two outdoor network of IoT devices deployed at two strategically selected locations in Melbourne, Australia. The data from these deployments are used for evaluation and demonstration of these components' functionality along with the designed interactive visualization components.

2.2 Intelligent Street Lighting System author Monali Y. Khachane [2]

The current research work is carried out for designing and executing the advanced development in embedded systems for energy saving of street lights. In India at many places manual street lighting system is installed and taken cared by municipality. Evening before the sunset's street lights are switched ON and switched OFF in the next day morning. Another scenario is automated time setting is also used for street lighting. At few places after midnight all street lights are switched off. These all scenarios ultimately wasted up power.But the actual timing for these lights to be switched ON is when there is absolute darkness and glow only when there is a movement of vehicles or humans. To avoid the problems associated with street lighting system, the fully automated energy efficient system is proposed to perform the ON and OFF operations only when needed. Also the system is intelligent enough to communicate with the municipality office if any maintenance is needed. The proposed system is designed by using Arduino UNO and Bluetooth devices. Light Dependence Resistance (LDR) and Motion Sensors are used for designing the system. The proposed system is successfully fulfilled the designing purpose.

2.3 Title**:** IOT based smart and adaptive lighting in street lights Author: B.Abinaya, S.Gurupriya, M.Pooja [3]

The system is mainly used for smart and weather adaptive lighting in street lights. The project is implemented with smart embedded system that controls the street light based on detection of sunlight. During the night time the street light gets automatically OFF. The ON/OFF can be accessed anywhere anytime through internet. A camera is placed on top of the street light to track the actions performed on the road where the footages are stored in a server. In addition to this, a panic button is placed on the pole, in-case of any emergency or danger, the person indanger can press this button which raises an alarm at the nearby police station. Whenever the panic button is pressed, the footage at that time recorded by the camera is sent directly to the cloud account. The access of the account is given to the particular police station by which they can view the incident's spot. Each area's street lights are connected to the particular area's police station and each of them has a cloud accessible account. The manual operation using GSM technology is completely eliminated. Thus the system is mainly designed to ensure safety and to prevent energy wastage.

2.4 Smart Street Lighting System using IoT Author **:** Ms. M. Kokilavani, Dr. A. Malathi 2018 [4]

The internet of things (IoT) are able to implement transparently a very large amount of heterogeneous end systems, while digital service provides open access to sub set of data. The focus of this paper is smart street light system. In this system the street light systems are automatically ON and OFF according to the situation. This smart light system automatically detects the movements of the object on the street. In the traditional system IR sensor is used to detect the object. The microcontroller is used to control the process involve the net. This paper is focused on the controlling intensity of the light considering the object movement near the light. Two different sensors named light sensor and photo electric sensor are used. Once if the sun light goes under the visible region then this system automatically switches ON light. As soon as the sun light is visible then automatically switches OFF lights. This Smart light system is used to reduce energy consumption. In this smart system the system uses some of the sensors. This smart system is used to avoid unnecessary usage of electricity.

2.5 Internet of things based intelligent street lighting system for smart city A. Siva Puttal Reddy, Dr. J. Mohana **[5]**

This project aims for designing and executing the advanced development in embedded systems for energy saving of street lights. Currently, we have a manual system where the street lights will be switched ON in the evening before the sunsets and they are switched OFF in the next day morning after there is sufficient light on the outside[1]. But the actual timing for these lights to be switched ON is when there is absolute darkness. With this, the power will be wasted up to some extent. This project gives solution for electrical power wastage [2]. Also, the manual operation of the lighting system is completely eliminated. The proposed system provides a solution for energy saving. This is achieved by sensing and approaching a vehicle using an IR transmitter and IR Receiver couple. Upon sensing the movement the sensor transmits the data to the microcontroller which furthermore the Light to switch ON [4]. Similarly, as soon as the vehicle or an obstacle goes away the Light gets switched OFF as the sensor senses an object at the same time the status(ON/OFF) of the street light can be accessed from anywhere and anytime through the internet.

2.6 Street Lighting Control System Design Based on PLCC (Power Line Carrier Communication) Pravin P. Thosare, Amit V. Mohod 2018 [6]

Conventional street lighting systems in areas with a low frequency of passersby are on in the night without purpose. The consequence of this is that a large amount of power will be wasted. With the broad availability of modern technology like light-emitting diode lamps and everywhere available wireless internet connection, fast reacting, reliably operating, and power- conserving street lighting systems can be realized. The purpose of this work is to describe the Intelligent Street Lighting (ISL) system, a first approach to accomplish the demand for flexible public lighting systems. Monitoring of street lights and controlling is very much important in developing country to reduce the power consumption hence this paper presents a street light control system which combines various technologies like a photosensitive detector (LDR), infrared photoelectric control, Light Emitting Diodes (LED), power transistors, dual relays with transmission of controlling commands over existing power lines. This system contains power line carrier channel to detect the day and night conditions to turn lamps on, merely during night time. This system also includes fault detection and feedback circuit to indicate the present state of the control system.

2.7 Automatic Street Light Control Based on Vehicle Detection Using Arduino for Power Saving Applications P. Caroline Cynthia, V. Anthony Raj, S. Thomas George 2019 [7]

A large amount of electricity of many towns and cities is being expended in the all night street lighting systems. Street lighting systems are indeed very necessary, but in most of the areas the traffic density is very low during the late hours and midnight, there would be a huge waste of electricity resulting from such places if the streetlights are left unused. The main objective of this paper is to save energy, and by doing so we would be able to lighten few more houses. In this paper we are focus to reduce the wastage of unused electricity by using automatic street light based on vehicle detection. This system uses a microcontroller (Arduino) to switch on the streetlights depending on the vehicle or object detection. Also, since the lights don't stay on the whole night, the lifetime of the streetlights gets enhanced

2.8 Automatic Illumination Control Method for Indoor Luminaires Based on Multichromatic Quantum Dot Light-Emitting DiodesbbbHua Xiao , Guancheng Wang 2022 [8]

Energy saving and visual comfort are two main considerations in designing of automatic illumination control systems. However, energy-saving-oriented illumination control always causes optical spectra drifting in light-conversion-material-based white light-emitting diodes (WLEDs), which are conventionally used as artificial luminaires in indoor areas. In this study, we propose a method for InP quantum dot (QD)-based WLEDs to minimize optical energy consumption by considering the influence caused by the outdoor environment and neighboring WLED units. Factors of (a) dimensions of room window and WLED matrix, (b) distance between WLED units, lighting height, species of InP QDs, and (c) user distribution are taken into consideration in calculation. Parameters of correlated color temperature (CCT) and color rendering index (Ra) of the WLED matrix are optimized according to the lighting environment to improve user visual comfort level. By dynamically controlling the light ingredients and optical power of WLEDs, we optimize the received illuminance distribution of table tops, improve the lighting homogeneity of all users, and guarantee the lowest energy consumption of the WLED matrix. The proposed approach can be flexibly applied in large-scale WLED intelligent controlling systems for industrial workshops and office buildings. Keywords: white light-emitting diode; energy saving; illuminance control; spectral optimization

2.9 Low Power Automatic Light System Abhishek Koirala 2019 [9]

Energy production and consumption has been increasing over the last few decades. Electrical energy is no exception. In 2016, Worldwide electrical energy production was 2.9% higher than in 2015, while consumption was 3.2% higher than in 2015. These figures provides inspiration for us to come up with new approaches to energy conservation. Due to rapid urbanization, the checks and balances between production and consumption have been difficult to maintain. As technology progressed and the Internet went global, researchers had the idea of bringing electricity, appliances, and Internet together to create a convenient smart system. But convenience was not the only objective. The other important aspect smart energy management systems address is sustainable energy usage for future generations. Smart energy management systems target efficient use of electrical and other forms of energy. This report discusses the implementation of a smart energy management system on a small scale. The prototype consists of a low power automatic light on/off system and also a platform for viewing real-time usage of power consumption by the lights connected to the system

2.10Automatic Lighting And Control System For Classroom Harshithasindhe K H , Irshad K F (2022) [10]

In most of the educational institutions , the significant amount of energy is spent for illuminating the classrooms and for switching the fans, computers and so on. Sometimes due to unnecessary consumption of energy the energy costs may rise. practices. In order to minimise the energy consumption or to avoid energy waste during unoccupied and daylight hours ,here more efficient equipment is designed for utilization of improved lighting design Here we have established a lighting control system in which the light circuits and fans in classroom remain Off in the absence of students and switches on in their presence. When student enter classroom , Infrared energy emitted from the person activates the IR sensor and the aurdino acts as power saving device according to relay operations. By using IR Sensor is detected the relays are triggered and the fan and lights are switched On. Measuring the brightness of the cl motion LDR Sensor for classroom and also a sensor is used for the measuring the temperature, if the temperature is above 25°C the fans will be turned ON

III EXISTING SYSTEM

The street light is one of the huge expenses in a city.The cost spent is huge that all the sodium vapour lamps consume more power.The expense spent on the street light can be used for other development of the nation .Currently a manual system is used where the light will be made to switched ON/OFF i.e the light will be made to switched ON in the evening and switched OFF in the morning. Hence there is a lot of energy wastage between the ON/OFF. There are several existing automatic illumination systems available on the market today, each with their own unique features and capabilities. Some popular systems include:

Occupancy sensors: These sensors detect when someone enters or leaves a room and automatically turn the lights on or off accordingly. They are commonly used in commercial settings like offices and warehouses.

Daylight sensors: These sensors measure the amount of natural light in a room and adjust the artificial lighting to maintain a consistent light level. This can help reduce energy consumption and improve occupant comfort.

Time clocks: These systems turn lights on and off at predetermined times. They are often used in outdoor lighting applications like streetlights and parking lots.

Smart home systems: These systems use a combination of sensors, timers, and user preferences to adjust lighting levels throughout a home. They can be controlled remotely via a smartphone or voice commands.

Biodynamic lighting: This system uses sensors to mimic the natural rhythms of daylight, adjusting the color temperature of the lights throughout the day to promote health and wellness

3.1 EXISTING SYSTEM DRAWBACKS

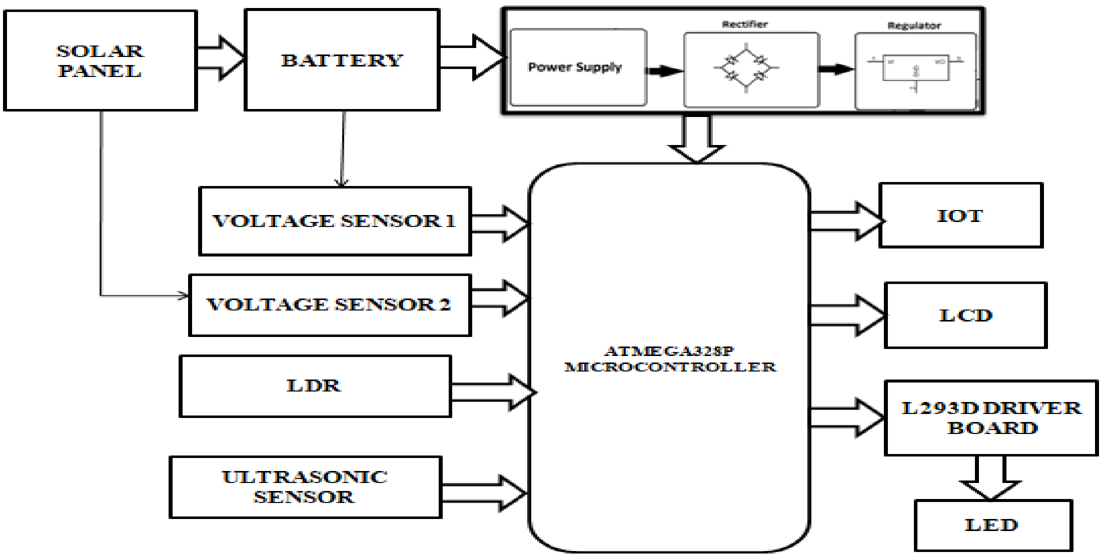
- *Manual switching ON/OFF is done on the street lights*
- *More Energy Consumption.*

IV PROPOSED SYSTEM

The proposed automatic street light system is designed to efficiently manage urban lighting using IoT technology and a combination of renewable energy sources. It comprises several interconnected components to ensure seamless operation and sustainability. Solar panels and batteries serve as the primary power source, providing energy for the system's operation. Light Dependent Resistors (LDRs) continuously monitor ambient light levels, enabling automatic switching between daytime and nighttime lighting modes. An ultrasonic sensor is integrated to detect human or vehicle presence, allowing the system to adjust the brightness of street lights accordingly. Controlled by an Arduino Uno microcontroller, the system utilizes IoT connectivity to transmit data and enable remote monitoring and control. Additionally, a LCD display provides administrators with real-time information and control over the system's operation. In the event of component faults such as issues with solar panels or batteries, the system promptly detects and relays this information through the IoT network, ensuring rapid response and maintenance. Furthermore, this proposed system offers numerous benefits for urban lighting management.

Its energy-efficient design optimizes power consumption by automatically adjusting lighting intensity based on environmental conditions and activity levels. By harnessing solar power and minimizing reliance on the grid, the system reduces carbon emissions and contributes to environmental sustainability. The integration of IoT technology enables real-time monitoring and control, allowing administrators to remotely manage the system's operation and receive alerts about any faults or malfunctions. The user-friendly interface provided by the LCD display enhances usability and facilitates system management. In the proposed system offers a comprehensive solution for intelligent and eco-friendly urban lighting, enhancing safety, efficiency, and sustainability in cities.

Fig



4.1 Proposed Block Diagram

4.1 ADVANTAGES

- Energy efficiency adjusts brightness based on environmental conditions, reducing energy consumption.

- Sustainability the solar power and minimizes reliance on the grid, lowering carbon emissions.
- Enhanced safety Detects presence of humans or vehicles, improving visibility and safety on the streets.
- Detects and reports faults in components, ensuring timely maintenance and uninterrupted operation.
- The utilizes IoT connectivity for real-time monitoring and adjustment of lighting settings.
- Provides administrators with easy-to-use interface for monitoring system performance and receiving alerts.

V.HARDWARE REQUIREMENTS

5.1 SOLAR PANEL

..

Fig 5.1: solar planel.

A solar panel is a set of solar photovoltaic modules electrically connected and mounted on a supporting structure. A photovoltaic module is a packaged, connected assembly of solar cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 320 watts. The efficiency of a module determines the area of a module given the same rated output - an 8% efficient 230 watt module will have twice the area of a 16% efficient 230 watt module. A single solar module can produce only a limited amount of power; most installations contain multiple modules. A photovoltaic system typically includes a panel or an array of solar modules, an inverter, and sometimes a battery and/or solar tracker and interconnection wiring.

5.2 ARDUINO UNO

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE)1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform. The ATmega328 on the Arduino Uno comes preprogrammed with a boot loader that allows uploading new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol. The Uno also differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter

- **TWI** (**T**wo **W**ire **I**nterface) / I²C: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.
- **AREF (A**nalog **Ref**erence): Reference voltage for the analog inputs

5.3 TEMPERATURE SENSOR

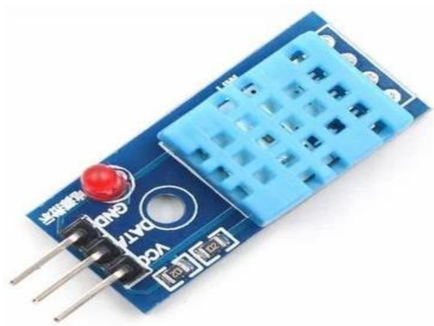


Fig 5.3 Temperature Sensor

The DHT11 sensor is a widely used digital temperature and humidity sensor. It is a cost-effective and easy-to-use component known for its accuracy and simplicity in measuring environmental conditions.

5.4 DUST SENSOR

Dust Sensor is a simple air monitoring module with onboard Sharp GP2Y1010AU0F. It is capable of detecting fine particle larger than0.8μm in diameter, even like the cigarette smoke. Analog voltage output of the sensor is linear with dust density.

5.5 LIGHT SENSORS:

A Light Sensor generates an output signal indicating the intensity of light by measuring the radiant energy that exists in a very narrow range of frequencies basically called "light", and which ranges in frequency from "Infra-red" to "Visible" up to "Ultraviolet" light spectrum. The Light Sensor is a passive devices that convert this "light energy" whether visible or in the infra-red parts of the spectrum into an electrical signal output. Light sensors are more commonly known as "Photoelectric Devices" or "Photo Sensors" because the convert light energy (photons) into electricity (electrons).

Photoelectric devices can be grouped into two main categories, those which generate electricity when illuminated, such as Photo-voltaics or Photo-emissive etc, and those which change their electrical properties in some way such as Photo-resistors or Photo-conductors. This leads to the following classification of devices

5.6 THE PHOTOCONDUCTIVE CELL:

A Photoconductive light sensor does not produce electricity but simply changes its physical properties when subjected to light energy. The most common type of photoconductive device is the Photo resistor which changes its electrical resistance in response to changes in the light intensity. Photo resistors are Semiconductor devices that use light energy to control the flow of electrons, and hence the current flowing through them. The commonly used Photoconductive Cell is called the Light Dependent Resistor or LDR

5.7 TYPICAL LDR

As its name implies, the Light Dependent Resistor (LDR) is made from a piece of exposed semiconductor material such as cadmium sulphide that changes its electrical resistance from several thousand Ohms in the dark to only a few hundred Ohms when light falls upon it by creating hole-electron pairs in the material.

Fig 5.7.1The Light Dependent Resistor

The net effect is an improvement in its conductivity with a decrease in resistance for an increase in illumination Also, photo resistive cells have a long response time requiring many seconds to respond to a change in the light intensityMaterials used as the semiconductor substrate include, lead sulphide (PbS), lead selenite (PbSe), indium anti monad (InSb) which detect light in the infra-red range with the most commonly used of all photo resistive light sensors being Cadmium Sulphide (Cds).

Cadmium sulphide is used in the manufacture of photoconductive cells because its spectral response curve closely matches that of the human eye and can even be controlled using a simple torch as a light source. Typically then, it has a peak sensitivity wavelength (λp) of about 560nm to 600nm in the visible spectral range.

The most commonly used photo resistive light sensor is the ORP12 Cadmium Sulphide photoconductive cell. This light dependent resistor has a spectral response of about 610nm in the yellow to orange region of light. The resistance of the cell when un illuminated (dark resistance) is very high at about 10MΩ's which falls to about 100Ω's when fully illuminated (lit resistance).

To increase the dark resistance and therefore reduce the dark current, the resistive path forms a zigzag pattern across the ceramic substrate. The CdS photocell is a very low cost device often used in auto dimming, darkness or twilight detection for turning the street lights "ON" and "OFF", and for photographic exposure meter type applications.

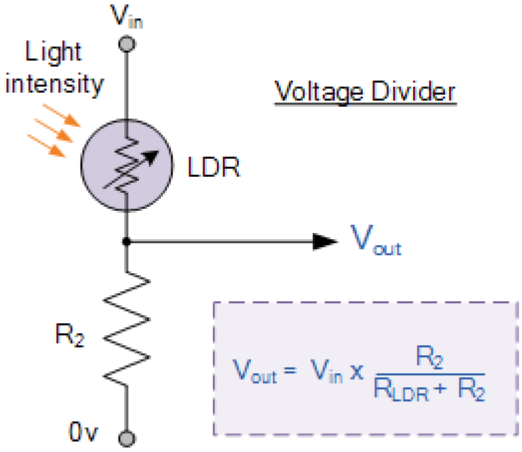


Fig 5.7.2 Voltage Divider Circuit with LDR

Connecting a light dependent resistor in series with a standard resistor like this across a single DC supply voltage has one major advantage, a different voltage will appear at their junction for different levels of light.

The amount of voltage drop across series resistor,R_2 is determined by the resistive value of the light dependent resistor, R_{LDR}. This ability to generate different voltages produces a very handy circuit called a "Potential Divider" or Voltage Divider Network.

The Arduino project started at the Interaction Design Institute Ivrea (IDII) in Ivrea, Italy. At that time, the students used a BASIC Stamp microcontroller at a cost of $100, a considerable expense for many students. In 2003 Hernando Barragán created the development platform Wiring as a Master's thesis project at IDII, under the supervision of Massimo Banzi and Casey Reas, who are known for work on the Processing language. The project goal was to create simple, low-cost tools for creating digital projects by non-engineers. The Wiring platform consisted of a printed circuit board (PCB) with an ATmega168 microcontroller, an IDE based on Processing and library functions to easily program the microcontroller. In 2003, Massimo Banzi, with David Mellis, another IDII student, and David Cuartielles, added support for the cheaper ATmega8 microcontroller to Wiring. But instead of continuing the work on Wiring, they forked the project and renamed it Arduino. Early arduino boards used the FTDI USB-to-serial driver chip and an ATmega168. The Uno differed from all preceding boards by featuring the ATmega328P microcontroller and an ATmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

5.8 HARDWARE OUTPUT

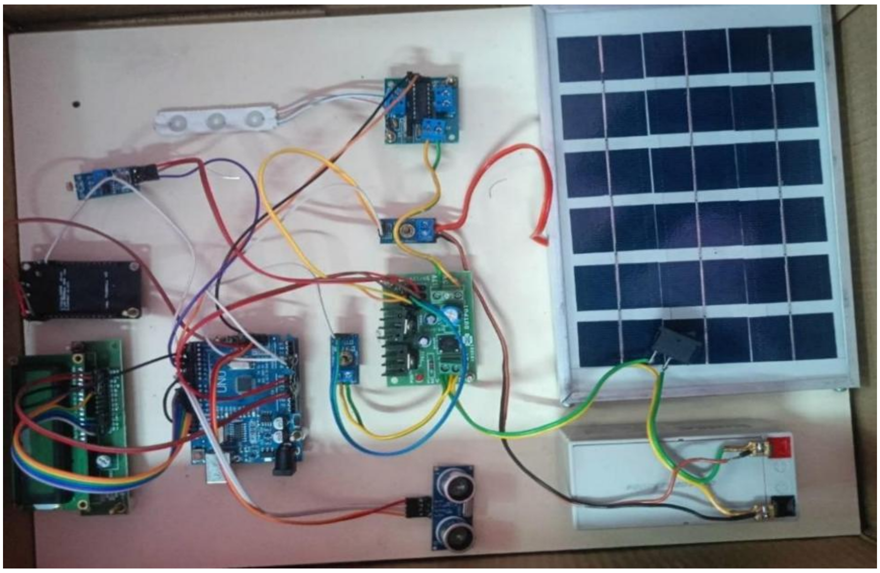


Fig 5.8 Hardware of Smart Street Lighting System with GPS & IoT

6.CONCLUSION

In conclusion, the proposed automatic street light system represents a significant advancement in urban lighting management, offering a sustainable, efficient, and intelligent solution for modern cities. By integrating renewable energy sources such as solar panels and utilizing advanced technologies including IoT connectivity and sensor-based control, the system optimizes energy usage and enhances safety on the streets. The system's ability to adjust lighting levels based on ambient conditions and human or vehicle presence ensures optimal visibility while minimizing energy wastage. The inclusion of real-time monitoring and remote control capabilities through IoT connectivity enhances system reliability and enables proactive maintenance. With its user-friendly interface and seamless operation, this system not only improves the quality of urban life but also contributes to the development of smarter and more sustainable cities. Moving forward, further research and development in this area could lead to even more innovative solutions for urban lighting management, paving the way towards a brighter and more efficient future for urban environments worldwide.

REFERENCES

[1]. Hua Xiao , Guancheng Wang, Wenda Zhang, Sirong Lu, Bingxin Zhao, Zhanlang Wang, Yanglie Li and Jiada Liu .“Automatic Illumination Control Method for Indoor Luminaires Based on Multichromatic Quantum Dot Light-Emitting Diodes” MDPI Journal, october 2022

[2].Debu C, “Street Lighting in India and Need for Energy efficient Solutions”, https:/ / www.mapsofindia.com/myindia/government/street-lighting-in-india-and-need-for-energyefficient- solutions

[3].https://en.wikipedia.org/wiki/Internet_of_things

[4]“An Introduction to the Internet of Things (IoT)” Part 1. Of “The IoT Series, Lopez Research LLC, November 2013

[5]https://www.tutorialspoint.com/internet_of_things/internet of things_overview.htm

[6] Prof K. Y. Rajput, Gargeyee Khatav, Monica Pujari, Priyanka Yadhav, “Intelligent Lighting System Using GSM”, International Journal of Enginerring Science Invention,ISSN(Online):2319)-6734,Vol 2 Issue 3,March 2013

[7] Roxana Alexandru, Vijay Gami, Vivek Aggarwal, Jiaxi Sun, Pei Tu, Iulian Ionascu, Niccolo‟ Lamanna , Dr Javier Barria , “Smart LED Street Lighting”, Feasibility Report, http://www.ee.ic.ac.uk/niccolo.lamanna12/yr2proj/

[8] Sindhu.A.M, Jerin George, Sumit Roy, Chandra J, "Smart Streetlight Using IR Sensors", IOSR Journal of Mobile Computing & Application (IOSR-JMCA) e- ISSN: 2394-0050, P-ISSN: 2394-0042.Volume 3, Issue 2. (Mar. - Apr. 2016), PP 39-44

[9] Reinhard Mu¨ llner and Andreas Riener ,"An energy efficient pedestrian aware Smart Street Lighting system", International Journal of Pervasive Computing and Communications, Vol. 7 No. 2, 2011, pp. 147-161

[10] Chetna Badgaiyan, Palak Sehgal, "Smart Street Lighting System", International Journal of Science and Research (IJSR), Volume 4 Issue 7, July 2015,pp. 271-274