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Street Light Control System

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Abstract: Automatic Street light systems require less maintenance than traditional street lights because they do not have any moving parts. Because the autonomous street light system is self-contained, it does not require any external wiring or grid connection. When the sunlight falls below the visible region of our eyes, the lights in this Street Light Control System will automatically turn on, and when the sunshine returns, the lights will immediately turn off.There is no requirement for manual operation in this project, such as setting the ON and OFF times. This system uses a motion detection sensor which helps to automatically increase the intensity of the street light when a car or pedestrian is noticed in the area. If there is no activity in the area, the light is automatically changed to a minimum light level that is optimum.
Keywords: Ultrasonic sensor, location determination, visually impaired, emergency alerts, hindrance detection.

I. INTRODUCTION

Street Lights. They are so much a part of our daily lives that we don't even recognize or acknowledge them at times. The only two things most people know about street lights are that they illuminate our sidewalks and roadways at night and that they are turned off and unused during the day. In our regular activities, we may not notice or glance at streetlights; but, as innovation accelerates, smart cities emerge, and the demand for energy efficient solutions grows, new technologies are enabling streetlights to gaze at us and notice our movements and location. Street lights will be critical in making cities smarter and more efficient.

More than ever before, modern street lighting systems are being challenged to perform more. These lighting systems are increasingly being evaluated for how well they reduce energy consumption, improve pedestrian and driver safety, and serve as the foundation for a variety of Internet of Things applications, in addition to their primary purpose of casting light onto dark roadways, parking lots, and public spaces.

Street lighting is a communal utility that uses a significant amount of electricity. According to research, between 18% and 38% of power resources are used to meet this need. With an increase in demand for electricity and a big disparity between supply and demand, issues such as power outages and inefficient consumption, such as bright street lighting in low-traffic areas, result in huge waste. It is necessary to improve consumption with Smart Street Light without jeopardizing public safety.

Installing a smart street lighting system that can recognize when to boost the intensity or switch off the lights completely can save electricity waste. This is possible because to motion detectors, which can detect moving things such as cars, people, and animals. Smart streetlights can potentially be used for a variety of other things. This device will also be fitted with a depth sensor that can detect flooding in the streets and send data to a server, which can then alert vehicles travelling through that region.

II. LITERATURE REVIEW

An automatic street light control system is a system that saves energy more efficiently than traditional street lights[1]. An automatic street light control system employs advanced automation technology to light the road. Because earlier street light systems waste 30–40 per cent of energy at night, the key objective of this system is to identify the amount of energy used and reduce the wastage of electricity when a vehicle passes along the road[1].

Installing a smart street lighting system that can recognise when to boost the intensity or switch off the lights completely can save electricity waste[2]. This is possible because of motion detectors, which can detect moving things such as cars, people, and animals. Smart streetlights can potentially be used for a variety of other things. This device will also be fitted with a depth sensor that can detect flooding in the streets and send data to a server, which can then alert vehicles travelling through that region[2]. This would aid in the prevention of mishaps.

LED lights are employed for street lighting, and photo-diodes and IR sensors are used to detect vehicle moments in this project [1]. The proposed solution [1] can reduce the amount of energy used for lighting in today's world.

Using motion detection sensors, the suggested system [2] determines when to increase the intensity or turn off the lights completely.

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As the system [2] controls the illumination of light, it saves energy and achieves higher efficiency which helps in building a smart city.

The main feature of this project [3] is to implement an automatic traffic warning system. This project [3] discusses the benefits of a Power line communication presents a real-world example of a system for reducing energy usage, lowering maintenance costs and traffic block in streets.

This project [4] is used to ensure, low power consumption, status monitoring, and light dimming as per external lighting conditions. This system [4] detects the movement of people through which the intensity changes, saves the extreme consumption of light and also reduces the cost of electricity.

The project [5] is being developed for the purpose of automating street light maintenance and lowering energy use. The application is installed in all street light circuits and is responsible for turning on and off the lights automatically as well as reporting any faults via the GSM Module.

This project [6] aims to develop an Automatic Smart Street Light system using LDR and Relay powered by solar. In the system [6], the street light will turn ON only if there is a vehicle passing through it, so the electrical wastage can be reduced.

The goal of this paper [7] is to reduce energy usage by using solar panels to power lamps. It aims to automate the switching on/off of streetlights and also automate switching the streetlight to control the unnecessary illumination of the streetlight and thus saving of electricity wastage.

This system [8] has self-powered technology that can control and adjust the light level of the street light from afar. This system [8] is cost-effective, has technology that can detect road accidents and communicate the location.

This research [9] looks at the topic of energy-saving electrical equipment surveillance using IoT and wifi/LoRa. It is free of cost & long range of operation which can replace the wired network infrastructure of higher cost.

Using the LDR sensor and ADC module in this system [10], it will automatically turn on and off the street light dependent on the amount of sunshine present. Power wastage will be decreased as a result of this strategy.

The proposed system [11] is designed by using Arduino UNO and Bluetooth devices. The system [11] is designed with LDR and Motion Sensors. It is a fully automated energy efficient system that performs 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.

In this study [12], we use GSM technology, which saves energy by allowing us to monitor and control the system remotely. This technology will make defect identification and maintenance more convenient. The system [12] enables us to make the most efficient use of solar energy to power street lights.

This project [13] presents a design and construction of a wet and dry self-cleaning mechanism for a solar street light panel. It is simple, lightweight, easy to maintain, portable, and resistant to the elements; low-cost, long-life, powered by the solar panel's battery, and controlled automatically by a remote control or a timer.

In this project [14], the street light system, in which lights on when needed and light-off when not needed. It's an autonomous-distributed-controlled light system that turns on before pedestrians arrive and turns off before they leave, reducing power usage.

The program is intended so that lighting fixtures save electricity and function independently on a budget that is less expensive for the streets, and it responds swiftly to complaints [15]. An Energy Saving Lighting System with sensors and controllers can measure and account for the power usage of a given location's street light [15].

Automatic Smart Street Lights using solar are an efficient means of cutting energy consumption because certain street lights do not perform well, and it is frequently noticed that the street lights are remained on after sunrise, resulting in a significant waste of electricity [6]. The goal of this study [6] is to create a prototype of an Automatic Smart Street Light system and analyze how much energy it saves. The goal of this research [6] is to develop a Smart Street Light that uses solar panels to reduce electricity usage and work when there are vehicles or pedestrians present.

This study [8] discusses a cost-effective IoT-based novel solution that allows the authority's control room to track the accident. The technology discussed [8] can detect road accidents and communicate the location and car number to the appropriate authority. An emergency push button with face detection has also been included to assist anyone in need. The self-powered technology [8] can control and adjust the light level of the street light from afar.

In this paper [16], an Arduino-based Smart Street light system is proposed, which uses a light-dependent resistor to automatically turn on and off-street lights throughout the night or in overcast conditions. Furthermore, a passive infrared sensor was employed to detect vehicle activity during the night. During the day, regardless of vehicle traffic, the street light is turned off, however at night, if a vehicle movement is detected by a PIR sensor, the street light is turned on [16]. Highways, smart villages, and rural villages are the greatest candidates for the suggested system [16].

The goal of this project [7] is to reduce energy usage by using solar panels to power lamps. They have automated the turning on and off of streetlights to reduce superfluous illumination and thereby reduce electricity waste [7]. The components used [7] are an Arduino Uno, a Light Dependent Resistor (LDR), and a Real Time Check to automate the streetlight system (RTC).

With the use of IoT technology, a system was presented [17] that can automatically identify defective street lights (non-operating) and send that information, along with the position, to an android application. Furthermore, it is possible to achieve systematic switching on/off of street lights and progressive dimming of street lights based on vehicle movement, which benefits in energy conservation [17].

In this project [18], we created an FPGA-based automation system that controls street lights and saves energy by switching them on and off automatically. This system 18] will dynamically turn on and off lights based on items such as human bodies or cars, and the light intensity will rise or decrease when the speed of the vehicles or objects increases or decreases. The FPGA's LCD indicates the vehicle's speed. As a result, the maximum amount of power will be conserved. FPGA and ultrasonic sensors were used to achieve the proposed notion [18].

The system [19] explains how to design and build an automatic lighting control system. The designed electronic system [19] overcomes the shortcomings of previous technologies. Based on the results [19], the microcontroller calculates and automatically recognizes geographical regions, retrieves essential data for sunrise and sunset in the area, and guarantees that the lighting system operates in a very exact ON/OFF mode. The circuit detects light using a light sensor [19].

III. METHODOLOGY

The Smart Street light control system supports a dynamic control methodology. According to the proposed model, first of all, when it becomes dark, all the streetlights automatically switch on with low intensity. When a vehicle passes by, a block of streetlights glows with the high intensity and because the vehicle moves forward, the subsequent block of lights starts glowing with high intensity where the previous block reduces its intensity.

A. Existing System

The assiduity of road lighting systems is growing fleetly and going to complex with rapid-fire growth of assiduity and metropolises. Robotization, Power consumption and Cost Effectiveness are the important considerations in the present field of electronics and electrical affiliated technologies. To control and maintain complex road lighting systems more economically, colorful road light control systems are developed.

These systems are developed to control and reduce the energy consumption of a city's public lighting system using different technologies. The being work is done using HID lights. Presently, the HID is used for civic streetlights grounded on the principle of gas discharge, therefore the intensity isn't controlled by any voltage reduction system as the discharge path is broken. HID lights [20] are a type of electrical gas-discharge beacon which produces light using an electric bow between tungsten electrodes housed inside a translucent or transparent fused quartz or fused alumina bow tube. This tube is filled with both gas and essence mariners. The gas facilitates the bow's original strike. Once the bow is started, it heats and evaporates the essence mariners forming tube, which greatly increases the intensity of light produced by the bow and reduces its power consumption. High-intensity discharge lights are a type of bow beacon. Disadvantages of Existing System:

1) HID lamps consume a larger amount of power.
2) The lifespan of the HID lamps is comparatively less.
3) HID lamps cannot be used in all outdoor applications.
4) Brightness of the lights in the rear-view mirrors which causes a problem for drivers in front of your vehicle.

B. Proposed System

Since the HID lights are not cost-effective and not dependable, a smart road light system has been overcome by replacing the HID lights with LED. Due to robotization, power consumption and price effectiveness within the present field of electronics and electrical affiliated technologies, the assiduity of road lighting systems is growing fleetly and getting too complex with the rapid-fire growth of assiduity and metropolises. To control and maintain complex road lighting systems more economically, different types of road light control systems are developed.

These systems are developed to reduce the energy consumption of a public lighting system using various technologies which use IR motion detectors to detect the vehicle or pedestrianmovement after which the streetlight begins to increase its intensity. As the vehicle moves, the streetlight that was glowing with high intensity reduces its intensity again to low.

C. Block diagram

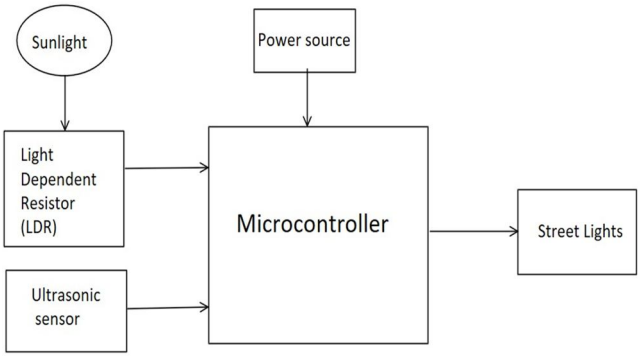


Fig1. Block Diagram of the Proposed System

IV. IMPLEMENTATION

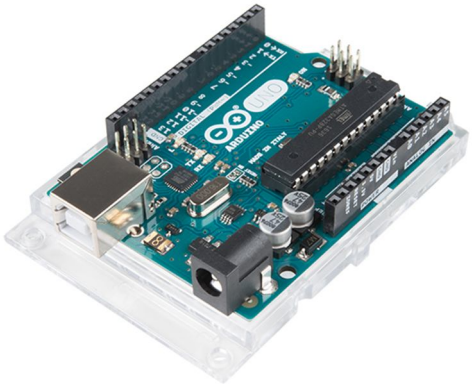


Fig 2. Arduino Uno R3.

A microcontroller is an integrated circuit (IC) device that regulates other aspects of an electronic system, primarily through a memory, peripherals, and a microprocessor unit (MPU). In our project we are using Arduino Uno R3 as our microcontroller.



Fig 3. GSM Module

In order to establish connection between a mobile device or computer and a GSM, a GSM module is a chip or circuit and in this project we have interfaced the module with Arduino [Fig. 7]. The European Telecommunications Standards Institute created the standard known as GSM (Global System for Mobile Communications, formerly Groupe Spécial Mobile) (ETSI). With a market share of over 90% and operations in more than 219 countries and territories, it was developed to explain the protocols for second-generation (2G) digital cellular networks used by mobile phones.



Fig 4. Light Dependent Resistor

A photoresistor, typically referred as a light-dependent resistor, is a light-sensitive electrical component. The resistance fluctuates as light strikes it. The resistance of the LDR can differ by orders of magnitude, only with resistance dropping as the light intensity rises. In our project we use LDR to change street light intensity with respect to what time of the day it is how much is the intensity of natural light.

V. RESULTS

The following are theresults that are obtained to assess the proposed system

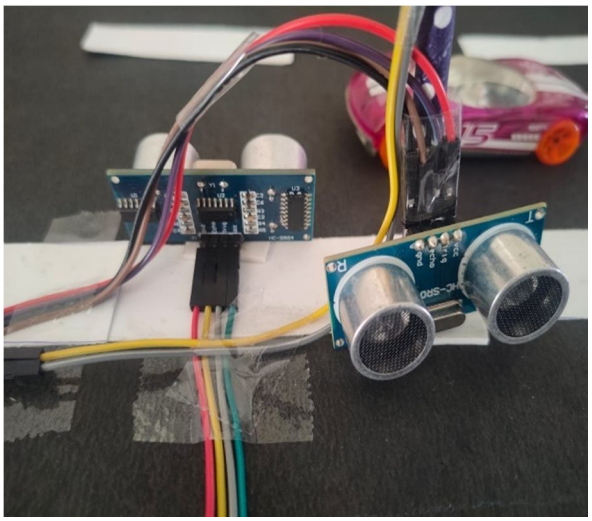


Fig5. Ultrasonic sensor working

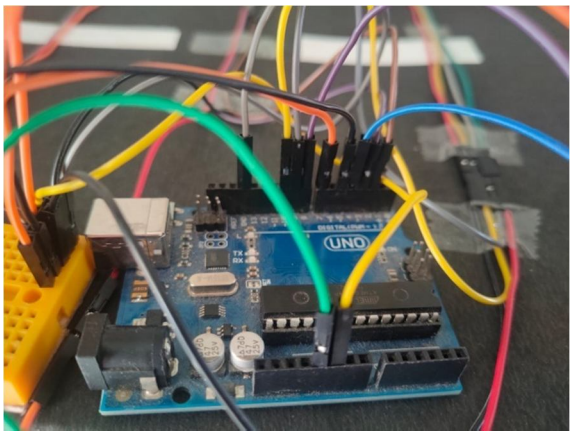


Fig 6. Connections of Arduino

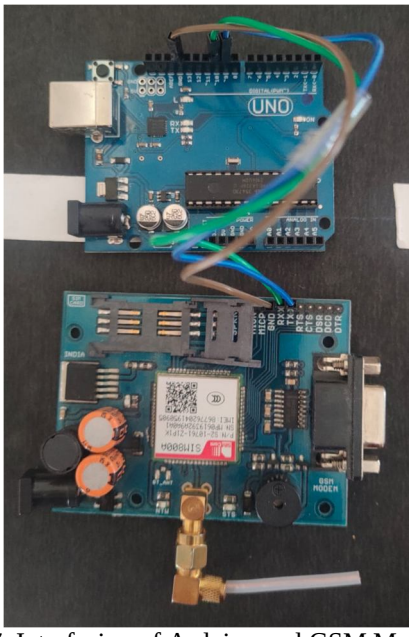


Fig 7. Interfacing of Arduino and GSM Module

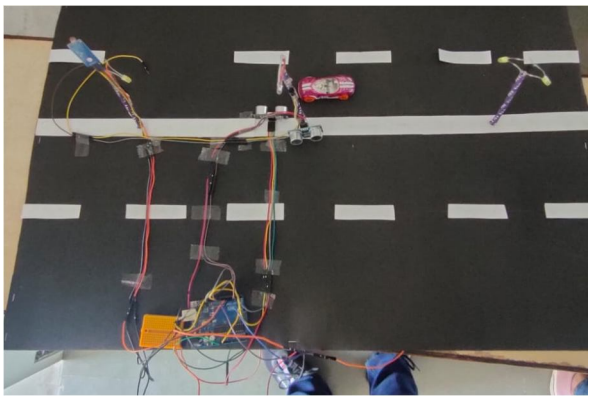


Fig 8.The whole system

VI. CONCLUSION

This paper describes the system that controls the illumination of light; it saves energy and achieves higher efficiency which helps in building a smart city, using Solar panel the solar energy will be converted into electrical energy hence power consumption will be very low. Automatically switch ON lights when sunlight goes below the visible region and automatically switches OFF lights when sunlight comes, visible to our eyes.

The system explains how to design and build an automatic lighting control system. The desired electronic system overcomes the shortcomings of previous technologies. Based on the results, the microcontroller calculates and automatically recognizes presence movement of people, vehicle and animal through which the intensity changes and guarantees that the lighting system operates in a very exact ON/OFF mode. In no activity situation in the area, the light is automatically adjusted to an optimized minimum light level.

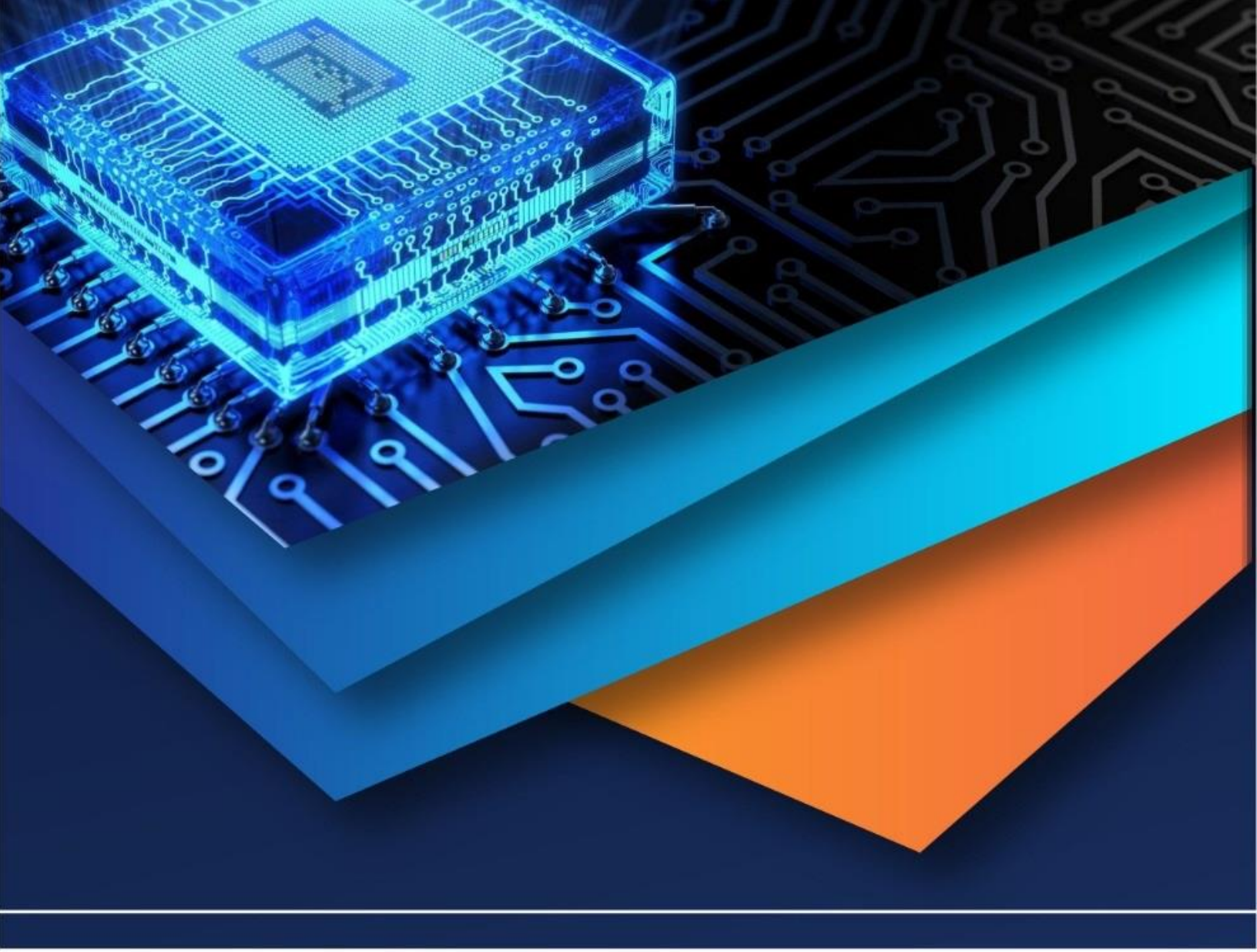
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