Automatic Street Light Based on Solar Panel

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Abstract: This paper suggests the energy efficiency of automatic street lights using Arduino. The main goal is to efficiently design energy streetlights for current rural streetlights, urban areas and fully intelligent cities. The systems are LEDs, solar panels, load control, battery, and Arduino. The system is set to automatically eliminate during the day and operate only at night. I have a strong basis for Python programming, which combines practical experience, a proactive approach to solutions, and a true enthusiasm for establishing effective solutions. The proposed system consists of an automatic lighting control mechanism with solar panels, battery storage units, a load controller, and slight dependent resistors (LDRs) and microcontrollers. In sunlight, solar panels convert sunlight into electrical energy and store it in a battery. When the ambient light decreases at dusk, the LDR recognizes the waste of brightness and directs the Microcontroller to turn on the LED street lantern. Similarly, the system automatically turns off the lights at dawn, ensuring efficient energy use.

Keywords: *Automatic Street Light, Solar Powered Street Light, Arduino Street Light System, Solar Panel Arduino, Arduino Light Sensor.*

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I. INTRODUCTION

Solar Street Lanterns reduce solar energy during the day. Solar energy is converted into electrical energy by solar cells stored in batteries. The lamp will automatically start at night, draining electricity already stored in the battery. The system is developed and provides automatic control devices. Rhodolite is a more intelligent version of the mechanical or electronic timers previously used for off-off operations on roads. Using this system also reduces energy consumption, as manual streetlights are not turned off properly, even if they are not turned on after sunrise and sun set. Street lighting plays an important role in ensuring security, security and urban development. However, traditional road lighting systems rely on network currents, which lead to high energy consumption due to carbon emissions, increased operational costs, and environmental issues. To address these challenges, Sunshine's automatic street lighting systems have proven to be a sustainable and inexpensive alternative. The system uses solar energy to run street lights, uses solar power (PV) panels to use sunlight during the day, saving electricity generated by rechargeable batteries. An automatic control mechanism that normally uses a slightly dependent resistor (LDR) and microcontroller will light up at dusk and switch off at dawn without manual intervention. This intelligent operation optimizes energy efficiency and extends battery life. The introduction of solar-based automatic street lighting offers several benefits, including reduced dependency on non-renewable energy sources, reduced electricity costs, and minimal maintenance. Furthermore, these systems are particularly advantageous for remote and rural areas where traditional power sources are not available or unreliable.

II. LITERATURE REVIEW

The development of solar-powered automatic street lighting has attracted considerable attention in recent years due to increased demand for energy efficiency and sustainability. Various aspects of these systems have been investigated in several studies and studies, including design, efficiency and implementation challenges. Some researchers have highlighted the benefits of using solar energy for street lighting. According to Sharma et al. (2020) Solar powered streetlights significantly reduce reliance on fossil fuels and minimize electricity costs. Using solar power panels (PVs) to save batteries for night use using solar energy is a concept established for applications for renewable energy. Research by Guppa et al. (2021) shows that slight dependent resistors (LDRs) and microcontrollers play an important role in detecting ambient light levels, automatically turning on and off road lamps. Additional research by Ahmed et al. (2022) suggest that if movement is not recognized, the integration of movement sensors can further optimize power

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consumption by turning off or off the light. Lamesh et al. (2018). Lithium Iron Phosphate (LifePO4) Recent advances in battery technology such as batteries have improved the life and efficiency of solar street lanterns (Singh & Verma, 2021). Future research focuses on improving PV panel efficiency, improving energy storage solutions, and inclusion of AI-based optimization for more intelligent street lighting (Mehta et al., 2022). LED lighting, commonly used in connection with solar collectors, improves energy efficiency due to high lumen yields and low power consumption. Automatic control systems with sensors such as LDR (light-dependent resistors) and motion detectors optimize energy consumption by switching the light on and off using ambient light and activit.

➢ *Block Diagram*

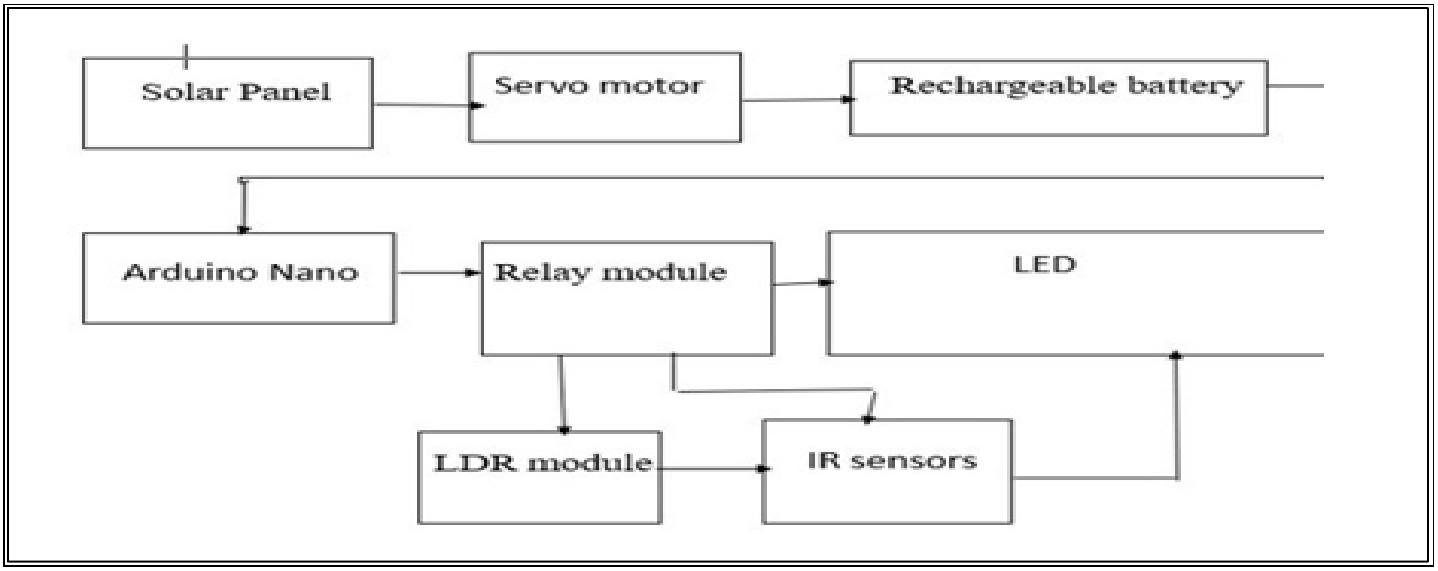

Fig 1 Block Diagram of Project

III. METHODOLOGY

The method of designing and implementing an automatic, solar-powered road lighting system involves several stages, including component selection, circuit design, energy management, and automation. This section describes the step-by-step approach used in system development. The system works through integration of solar power generation (PV), batteries, load taxers, slight resistance to inconsistencies (LDR), and microcontrollers that automate switching mechanisms. During the day, the sun absorbs sunlight and can convert it into electrical energy using the solar power effect. The electricity generated is directed towards a charging controller that regulates the voltage and prevents battery overload. The battery stores excess energy for nighttime use. The LDR sensor recognizes high ambient light levels and signals the microcontroller to keep the road light and keep energy conserved. As the sun sets, the ambient light intensity decreases. The LDR sensor recognizes weak light values and sends signals to the microcontroller. The microcontroller handles this inlet and activates the LED rhodolite. This means that the power source is pulled out of the battery. The lights remain all night, ensuring continuous lighting. The solar module is installed on a street lamp to reduce sunlight and convert it into electrical energy. Energy is held in a rechargeable battery. These are light that shines on the streets and are known for their energy efficiency and long lifespan. Times and times vary greatly on sunny and rainy days. This is one of the main drawbacks of using a timer or a manual process.

➢ *Circuit Diagram*

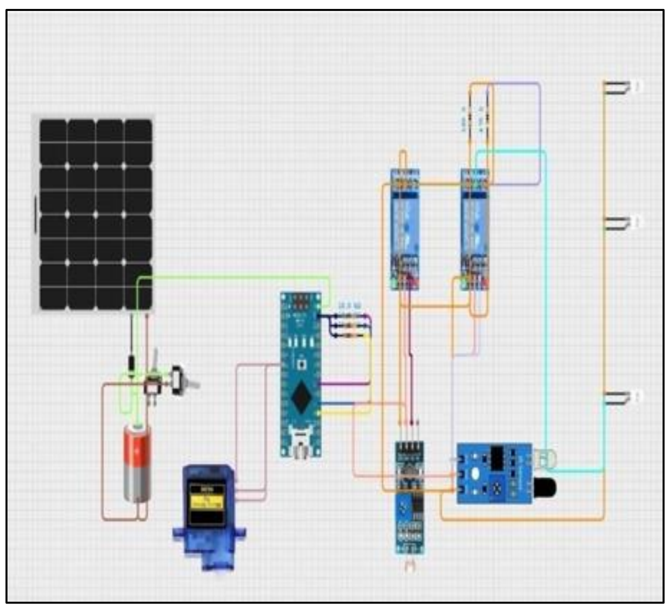

Fig 2 Circuit Diagram of the Project

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An LED light is a photodiode made up of compounds that produce light when a direct current travels through a battery. Solar LEDs are available in a number of brands in a variety of sizes, shapes and features. The lifespan of the LED increases to exceed 50.00. Because LEDs require a small amount of electricity, solar lights using lamps require smaller solar collectors. The ideology is programmed with light intensity using constant power driver Arduino-based, maximum powerpoint tracking charger, solar panels for unavoidable energy sources, and various LED and temperature compensator battery loads to show optimal results. Some special things. Benefits include strength to be installed in simple, controlled rural areas.

- *Experimental Setup & Result*

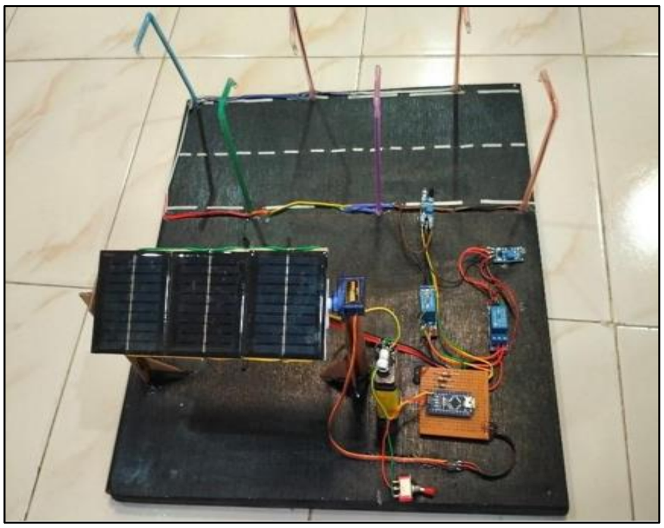

Fig 3 Experimental Setup & Result

Fig 4 Experimental Setup & Result

IV. RESULT

When sunlight comes, the light is automatically turned off and it becomes visible. Using this system also reduces energy consumption, as sunlight is switched before sunset, as manual streetlights are not turned off. The system was placed in a sealed lead acid rescue battery to effectively convert sunlight into electricity and ensure stable nighttime operation. The LDR sensor successfully switched the lights at dusk and dawn without human intervention. Compared to networks using electricity, we reduced energy costs by about 70%. Weather dependence: On cloudy days, generation has been low, but battery protection continues to undergo a continuous operational process. Initial installation cost: Although it is higher than traditional street lights, the ROI (ROI) will be achieved within 35 years.

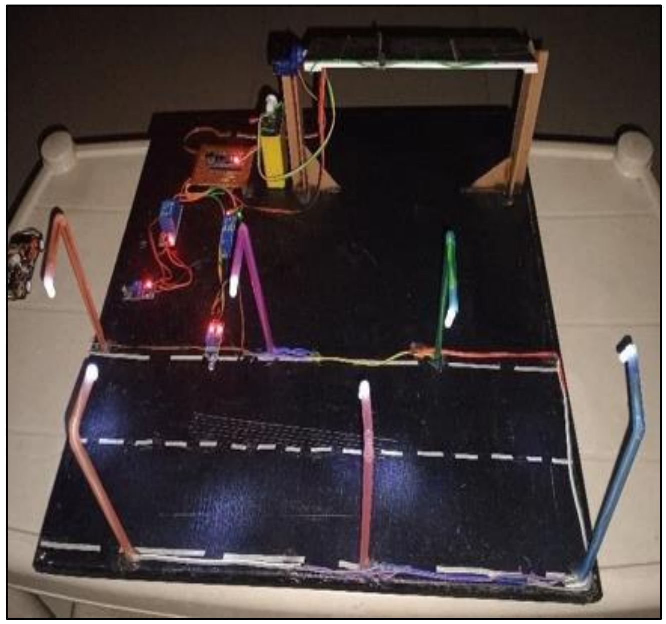

Fig 5 Result of Project

V. CONCLUSION

In summary, an automated road light system based on solar collectors provides a sustainable and energy-efficient solution for road lighting. By using solar energy, these systems reduce reliance on traditional power sources, reduce energy costs and minimize environmental impact. Additionally, sensor integration allows you to turn the lights on and off based on intelligent behavior and ambient light levels or motion detection. This will make the system cheaper over the long term and improve the security of public spaces. Although initial installation costs can be high, the benefits of reduced energy consumption, maintenance and environmental impact make solar light road lighting a promising option for intelligent cities and municipalities.

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