International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

IOT Based Solar Street Light Intensity Control System

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A B S T R A C T

This project presents the IOT based solar street light intensity control system. The Sunlight Tracker Solar Powered IOT Based Light Control System is the subject of this project's abstract. This idea aims to save energy and lessen pollution brought on by finite resources. Due to its low cost and open source nature, it is implemented using an Arduino Uno. The purpose of this system is to interact with the Arduino Uno board to control the lighting system while using IR sensors to detect human presence in the immediate area. The intelligent system operates in accordance with presence and sets up the lighting's dimmer and control system while also operating the solar tracker concurrently. By following the sun's path, the solar tracker receives sunlight more effectively than a traditional solar panel. Key words: LCD, IR emitter, and LDR.

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1. Introduction

The project involves automating lighting systems that are powered by solar trackers for effective lighting system use. The current energy crisis is a serious problem because of the rising demand for electricity. Currently, smart lighting guarantees a decrease in energy usage. The IOT-based auto sunshine tracker driven light control system encourages the use of renewable energy in addition to reducing power usage through light management. We accomplish this by continuously monitoring ambient lighting conditions and human presence using IR sensors and LDRs. Compared to a standard solar panel that is stationary, the solar tracker is 30% more efficient. Using the solar energy captured by solar panels will also help us to solve that problem.

• RELATED WORK

A. Proposed system Objective

1. The implementation of an IoT-based Automatic Street Lighting System is the primary goal of this project. As traffic gradually decreases during the late hours of the night, the intensity gradually decreases until morning in order to conserve energy; as a result, at the dusk street lights turned on and automatically turn off at dawn.

2. Solar-panel movement tracking

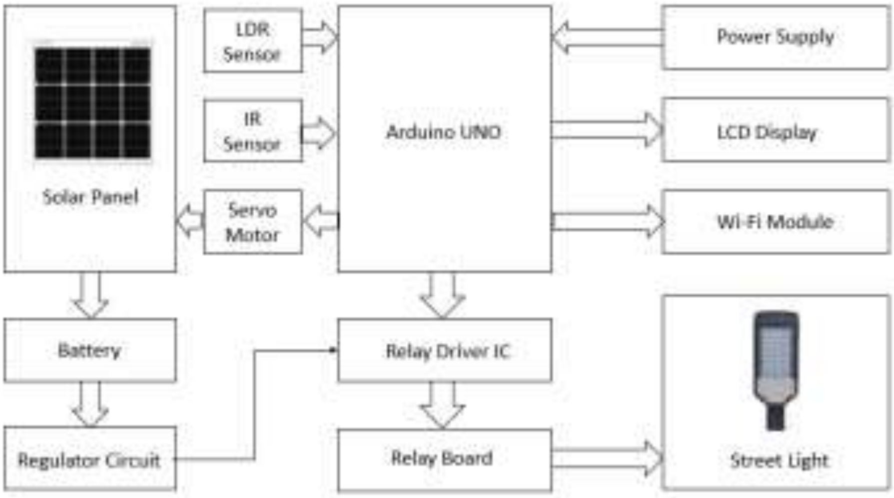
3. IOT-based device monitoring and control

4. Development of Power Saving devices.

2. Methodology

The implementation of an IoT-based Automatic Street Lighting System is the primary goal of this project. As traffic gradually decreases during the late hours of the night, the intensity gradually decreases until morning in order to conserve energy; as a result, street lights turn on at dusk and automatically turn off at dawn. Every day, the procedure is repeated. Traditional HID bulbs are replaced with White Light Emitting Diodes (LED) in the street lighting system to include a dimming capability. The high intensity discharge (HID) lamp, which is typically used in metropolitan street lights, cannot be utilised to modulate the intensity. Because of their high lifespan and minimal energy use, LED lights are the lighting of the future. Due to the ability to alter intensity, LED lights are quickly replacing traditional lighting.

B. Block Diagram of proposed methodology is given below in Fig. 1.



Block Diagram Description:

• Solar panels generate electricity during the day, which is then stored in batteries. Light sensor commands the Arduino controller from dusk to sunrise.

• When there is no motion beneath the streetlight, the programme is carried out, and the LED is turned on to 30% of its maximum intensity. Motion sensor turns on when a human or vehicle approaches a nearby streetlight, and then instructs the Arduino to increase brightness to 100%.

• If there isn't any movement after a predetermined amount of time, the intensity progressively drops to 30%. When morning comes, LDR will instruct Arduino to turn off the street light.

• Typically, streetlights run on electricity that is stored in the battery. Because of the overcast weather, if the battery is not fully charged, the streetlight will shut off automatically.

Hardware Details

• Arduino Uno

• LDR Sensor

• LED

• Solar Panel

• Battery

• Wi-Fi Module

• Relay

• LCD Display

C. Software Details

1) Arduino IDE

All software development is done in the Arduino Integrated Development Environment (IDE). The Arduino IDE is free software that makes writing code and uploading it to the device straightforward. The programming language employed is C. After the programme and required logic are complete, a compiler creates the program's hex file. The hex file is then updated on the microcontroller.

2) Blynk App

Blynk is a platform that allows users to operate devices like Arduino, Raspberry Pi, and others remotely via iOS and Android apps. By simply dragging and dropping widgets, you may create a graphic interface for your project on a digital dashboard. You can start fiddling in less than 5 minutes after setting everything up because it's so simple. There is no board or shield that Blynk is bound to. Instead, it's your preferred supporting hardware. Blynk will get you online and prepared for the Internet of Things whether your Arduino or Raspberry Pi is connected to the Internet by Wi-Fi, Ethernet, or this new ESP8266 chip.

D. Algorithm

1. The sun tracker's primary sensors are LDRs. The structure holding the solar panel rotates thanks to the coordination of two servo motors. The Arduino IDE is used to upload the Arduino programme to the microcontroller.

2. LDRs can detect how much sunshine is shining on them. The top, bottom, left, and right LDRs are identified.

3. For vertical tracking, two top LDRs and two bottom LDRs' analogue values are compared, and the vertical servo will move upward if the top LDRs get more light.

4. If the bottom LDRs show more occurrence light, the servo travels in that direction.

5. The analogue qualities from two left LDRs and two right LDRs are for the angular deflection of the solar board.

6. The servo motors are configured to move in the proper direction using the Arduino if the right LDRs have lighter incidence on them.

7. The vertically and horizontally positioned servo motors work together to orient the solar panel so that it faces the direction where the sun shines with the most intensity.

8. The solar panel's output is then sent to the light management system, which is primarily designed to automatically regulate a street's light intensity based on activity and switch off the lights when the street has enough natural light.

9. To determine whether the roadway has enough natural light, we employ LDRs.

10. If there is enough light, the lights stay on.

11. In this research, infrared sensors are employed to detect human movement.

12. The lights use the least amount of energy when the roadway is empty, yet they still shine brightly enough for pedestrian visibility.

13. The lights around the IR sensor will become brighter as the IR detects the presence of humans.

14. We are using energy from solar panels to power the lights.

15. IOT can be used to check fuse condition and notify concerned parties.

16. The microprocessor receives the battery's stored energy, and the lighting system receives the remainder.

RESULT AND DISCUSSION

E. Circuit Diagram

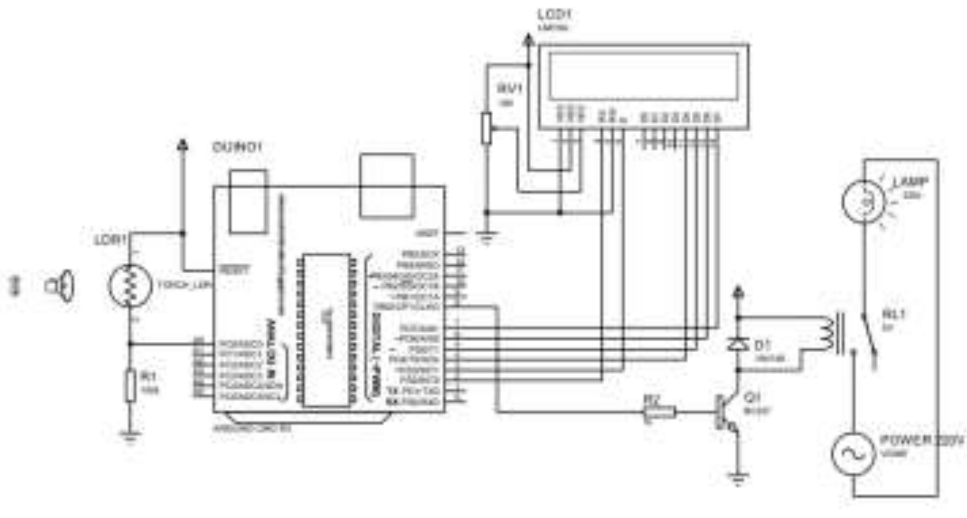


Fig 3 Circuit Diagram

F. Simulation Result

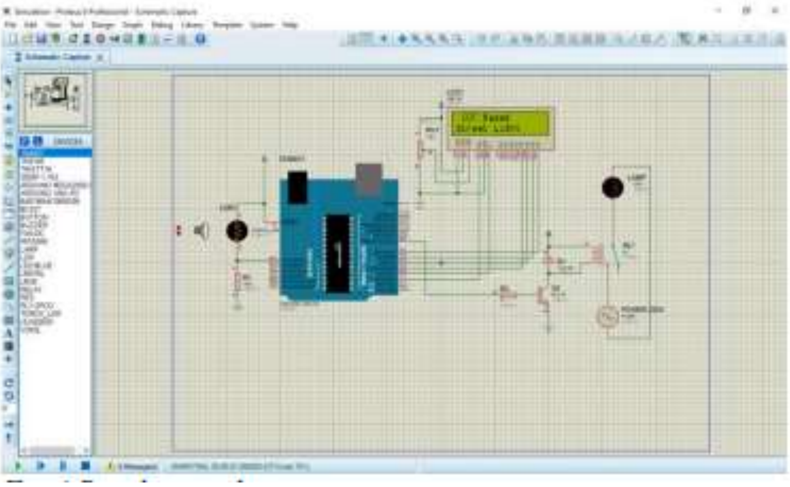


Fig 4 Result snapshot

G. Applications

1. On Highway
2. On society road line
3. At hospital
4. At School
5. At Industry.

Table 1: External Brightness vs Led intensity

External Brightness	*LED Intensity*
62	514
54	534
51	542
210	119
211	117

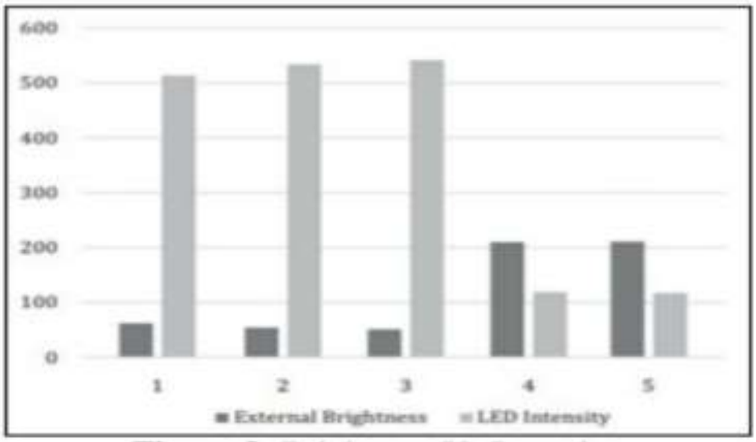


Fig 4 Brightness Vs Intensity.

H. Advantages

1. Solar street lighting is grid independent, which lowers running costs.
2. Maintenance costs are significantly lower than for traditional street lights.
3. LED brightness can be effectively adjusted without affecting the colour of the light.
4. Accident risk is extremely minimal.

5. It has no harmful emissions and is environmentally friendly.

6. A longer lifespan than regular street lights.

7. Power usage is significantly reduced.

8. LDRs are sensitive, affordable, and easily accessible gadgets. They can handle good power and voltage levels, comparable to those of a standard resistor. 9. They are utilized all around the world as a foundational component in many electrical systems and are small enough to fit into almost any electronic gadget.

10. Photo resistors are independent of external forces and transform light into electricity.

11. Since photo resistors are composed of readily available materials and have a straightforward design, they may be manufactured in the hundreds of thousands each year.

12. When soldering, no additional care are needed and an LDR can be connected either way.

Overall Result

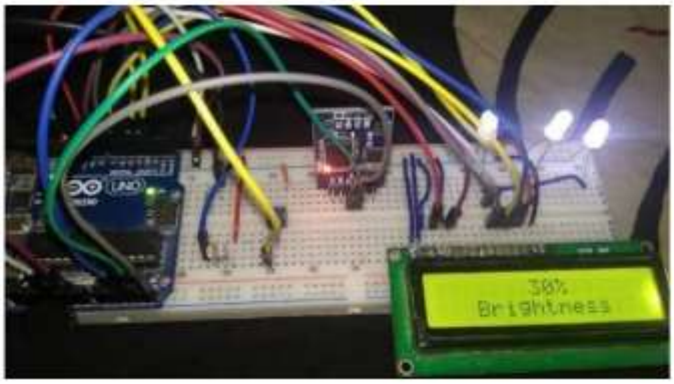


Fig.7. Overall System Implementation

CONCLUSIONS

With the advancement of automation technology, life is becoming more manageable from all angles. Automatic systems are becoming more popular than manual ones these days. IoT is the most recent and emerging web innovation, and due to the increased use of the exhaustible resources, conservation of such natural resources has become the need of the hour. The rapid growth in the number of internet users over the previous decade has made Internet a passionate part of life. With this project, we hope to preserve these resources and improve the environment. In order to increase productivity and save energy resources, automation technologies must be implemented in today's infrastructure projects. Solar tracking systems work by detecting the sun's position and connecting the panel to sunlight in the opposite direction. It increased the yield of solar panels compared to ordinary solar panels and added a greatest power point regulator for a soft switching multi-input converter to the solar energy system. The controller has proven to be able to monitor power point slides with the highest degree of accuracy. Planning and executing an automatic tracking of sunlight electricity to solar panels is the project's main goal. The knowledge and data may also serve as a foundation for the development of a different application in the future. This project shows a framework for intelligent road lighting that makes use of LEDs powered by solar energy and has a control system for efficient management.

ACKNOWLEDGMENT

We would like thank our guide Prof. M.A. Natu for his guidance.

We would also like to thank Head of the Department Prof. S. P. Jagtap for his constant motivation and Support. We would also like to thank our principal Dr. N.G. Narve who encourage us.

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