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AUTOMATIC LIGHT SYSTEM USING LDR AND PIR SENSOR

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ABSTRACT

The Automatic Light system aims to create an energy-efficient lighting system that automatically activates when the surrounding light diminishes and turns off when there is sufficient light. It is engineered to automate lighting control based on surrounding light conditions and human presence, thereby enhancing energy efficiency and convenience in residential and commercial settings. This seamless process ensures that the light turns on automatically in low-light conditions with the help of LDR (Light Dependent Resistor) if the presence of human is detected using the PIR (Passive infrared) sensor, removing the requirement for manual control, the lights automatically turn on, when necessary, thus reducing energy consumption. By combining electronics and sensor technology, the Automatic Light system using LDR and PIR sensor not only adds a layer of convenience to daily life but also contributes to energy conservation. Through this project, we aim to demonstrate how simple yet effective automation solutions can be implemented using readily available components and an Arduino microcontroller, paving the way for smarter, more sustainable environments.

Keywords: Arduino, LDR (Light Dependent Resistor), PIR sensor, Automation

INTRODUCTION

In the fast-evolving world of technology today, the integration of automation into everyday life has become increasingly prevalent, aiming to enhance convenience, energy efficiency, and sustainability. Lighting systems, which are a fundamental part of residential, commercial, and industrial environments, present significant opportunities for automation. Conventional lighting systems typically depend on manual operation, which can result in wasted energy when lights remain on in empty areas or during daylight hours. To address these inefficiencies, this project proposes an Automatic Light System utilizing a combination of Light Dependent Resistor (LDR) and Passive Infrared (PIR) sensors.

The LDR sensor, sensitive to ambient light levels, enables the system to determine when artificial lighting is necessary, while the PIR sensor identifies human movement, ensuring that lights are turned on only when the space is both dark and occupied. This dual-sensor approach not only optimizes energy usage but also enhances user convenience by eliminating the need for manual intervention. The system's ability to automatically adjust to environmental conditions makes it particularly suited for applications in homes, offices, and public spaces, where efficient energy management and user comfort are priorities.

LITERATURE SURVEY

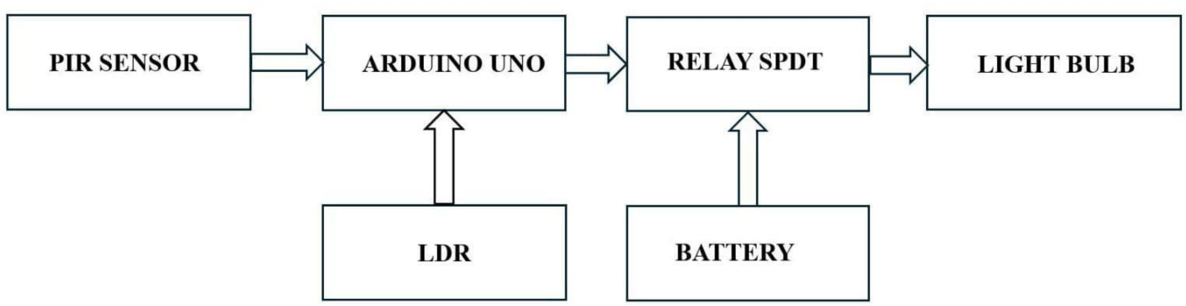
O. Urfaliglu et al. [2008] This paper explores the use of Passive Infrared (PIR) sensors for classifying human motion events. The research focuses on detecting and classifying different human activities using a modified PIR sensor system, aiming to enhance applications in environments where understanding motion dynamics is crucial. The study also addresses the challenge of differentiating between various motion types, contributing to more accurate and effective motion detection systems.

Andras Kovacs et al. [2016] This study investigates the design of a solar-powered street lighting system aimed at achieving a net positive energy balance over the year. The central focus is on the system's controller, which plays a key role in adaptive energy management by optimizing decisions regarding electricity purchase and sale, either to reduce costs or enhance profits. The research also involves testing a physical prototype consisting of 191 luminaires, demonstrating its practical effectiveness.

Nitish Kumar Jha et al. [2016] The paper suggests that the proposed system is a low-cost, efficient solution for automating street lights. The integration of renewable energy sources and advanced sensors makes it a futuristic approach to urban lighting. The system's ability to reduce energy wastage and enhance public safety through automation represents a significant step forward in smart city development.

METHODOLOGY

Block Diagram



The Automatic Light System using an LDR and a PIR sensor is designed to control lighting based on ambient light conditions and motion detection. This system enhances energy efficiency by ensuring lights are only on, when necessary, which is particularly useful in areas where manual control of lighting is impractical or inefficient. In this system Arduino UNO is used which is a microcontroller board used for creating and prototyping electronics projects. It's based on the ATmega328P, heart of the Arduino Uno and being simple and user-friendliness. It is a small computer chip that executes code and controls other components. There are 14 digital i/o pins, of which 6 can be used as PWM outputs. These pins are used to read digital signals (high/low) or to send digital signals. There are 6 analog input pins that can read varying voltage levels and convert them into digital values. They are used for sensors and other analog devices. It has a built-in voltage regulator to ensure it operates within a stable voltage range. The board has built-in LEDs for power and pin status, and a specific LED (connected to pin 13) that can be controlled via code for basic testing. To program the Arduino Uno the Arduino IDE is used which is a software a tool that enables you to write code in C/C++ with an easier syntax, upload it to an Arduino board, and observe the results. A Light Dependent Resistor, commonly referred to as a photoresistor, is a type of resistor whose resistance decreases as the amount of light it is exposed to increases. When light falls on the LDR, the material inside the LDR (often cadmium sulfide) changes its resistance. In low light or darkness, the resistance of the sensor increases, while in bright light, the resistance decreases. The resistance of a Light Dependent Resistor changes significantly with varying light levels. LDRs generally have a slower response time compared to other types of light sensors. A Passive Infrared sensor senses motion by monitoring variations in infrared radiation that objects emit within its viewing range. PIR sensors are frequently utilized in security systems, motion-sensitive lighting, and other significant applications that require detecting movement. A PIR sensor's primary element is the pyroelectric sensor, which responds to variations in infrared radiation. These sensors commonly incorporate lenses, like Fresnel lenses, to concentrate infrared light onto the pyroelectric sensor. The PIR sensor includes a signal processing circuit that converts the raw signal from the pyroelectric sensor into a digital signal that can be interpreted by a microcontroller or other electronics. For the simulation we are using tinker cad software which is user-friendly, web-based software application developed by Autodesk. The relay SPDT is connected with the light bulb, power supply i.e. battery and also to the Arduino. The Arduino is powered via its power jack or USB connection. The below mentioned code is uploaded through the Arduino IDE to the microcontroller board.

Code

```
const int ldrPin = A0;
const int acLamp = 12;
const int pirPin = 2;
 void setup()
{
Serial.begin(9600);
pinMode(ldrPin, INPUT);
pinMode(pirPin, INPUT);
pinMode(acLamp, OUTPUT);
}
void loop()
int ldrValue = analogRead(ldrPin);
int pirValue = digitalRead(pirPin);
Serial.println(ldrValue);
Serial.println(pirValue);
if((ldrValue < 500) && (pirValue == HIGH))
{
digitalWrite(acLamp, 1);
delay(5000);
}
Else
{
digitalWrite(acLamp, 0);
```

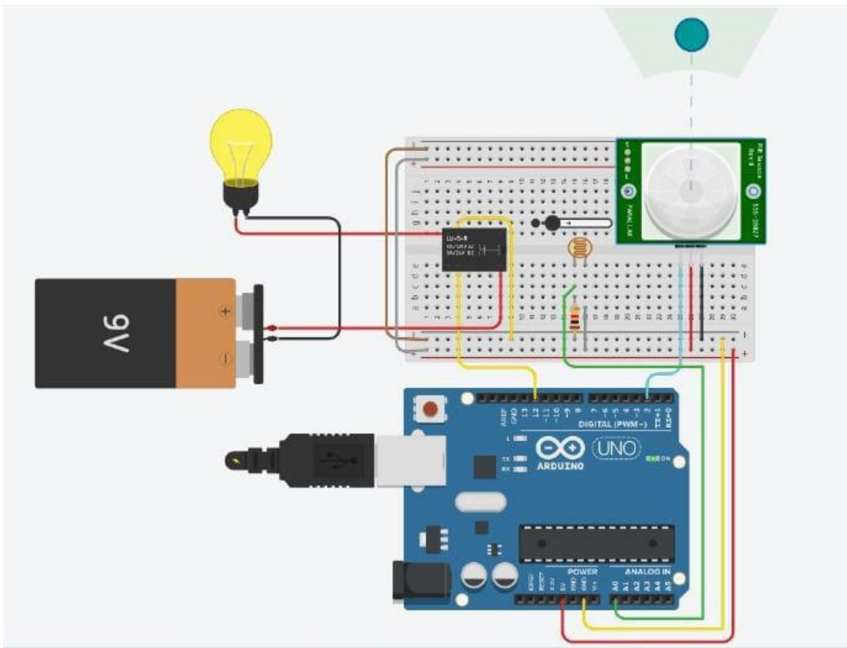
```
}

}
```

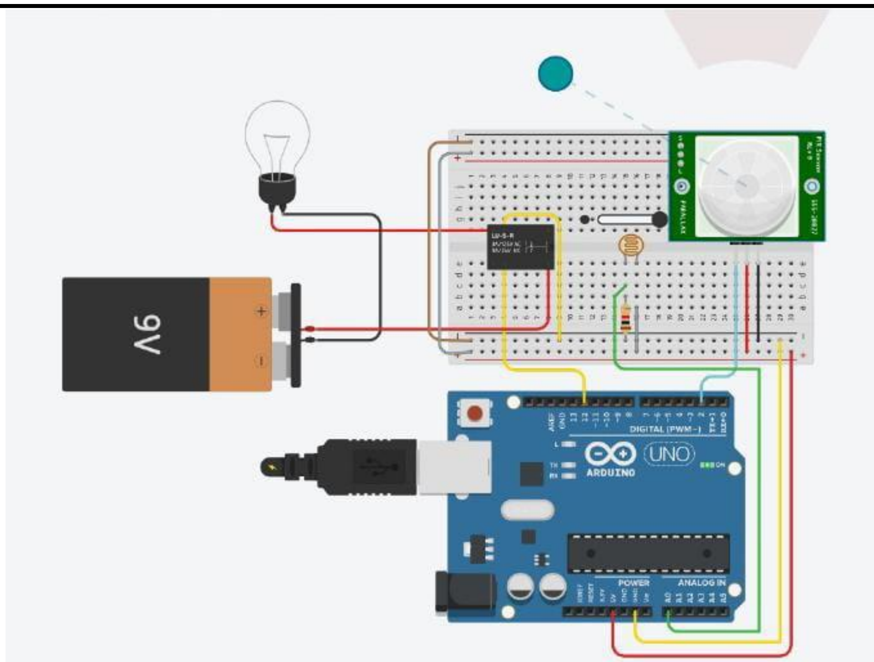
RESULTS

The implementation of the Automatic Light System using an LDR and PIR sensor successfully demonstrated its intended functionality across various test scenarios. The system efficiently used the LDR to monitor surrounding light levels and the PIR sensor to sense human movement, automatically controlling the system based on these inputs.

1. The system ensured the light turned on whenever the surrounding light level decreased past the predefined level and the PIR sensor consistently detected motion within its specified range.



2. The light was quickly deactivated when no motion was detected and the surrounding light fell below the preset levels.



CONCLUSION

The Automatic Light System with an LDR offers an effective and energy-saving approach for managing lighting automatically. The system is energy-efficient, cost-effective, and reliable, providing a practical solution for automatic lighting control. This System effectively combines ambient light measurement and motion detection to automate lighting. This design improves convenience and supports energy savings by minimizing unnecessary lighting. Adjustments and enhancements can further refine the system to meet specific requirements. The flexibility of the Arduino platform allowed for easy customization and potential for further enhancements. Overall, this project exemplifies the synergy between electronics and sensor technology, contributing to convenience and energy conservation in everyday life. This project not only demonstrates fundamental principles of electronics and programming but also underscores the importance of integrating technology to create intelligent, responsive systems. Future enhancements could include features such as adjustable light thresholds, remote control capabilities, or integration with smart home systems to further enhance the system's adaptability and capabilities.

REFERENCES

[1] O. Urfaliglu, Emin B. Soyer, B. Ugur Toreyin, and A. Enis Cetin presented a study titled 'PIR-sensor based human motion event classification' at the 2008 IEEE 16th Signal Processing, Communication and Applications Conference.

[2] Andras Kovacs, Roland Batai, Balazs Csanad Csaji, Peter Dudas, Borbala Hay, Gianfranco Pedona, Tibor Revesz, and Ozsef Vancza authored a paper titled 'Intelligent Control for Energy-Positive Street Lighting,' which was published in Energy (Volume 114, 2016, Pages 40-51) by Elsevier Ltd.

[3] YM Jagadeesh and S Akilesh presented their work on 'Intelligent Street Lights' at the SMART GRID Technologies conference held from August 6-8, 2015.

[4] Anif Jamaluddina, Anafi Nur Ainia, Egy Adhitamaa, and Agus Purwanto conducted an assessment of LiFePO4 battery performance in a standalone photovoltaic street light system, as presented at the Engineering Physics International Conference (EPIC) in 2016.

[5] "Nallapaneni Manoj Kumar, Anup Kumar Singh, and K. Vinay Kumar Reddy presented a sustainable technical design for street lighting in Fugar City, Nigeria, which transitions from fossil fuels to solar power. Their work was featured at the 6th International Conference on Advances in Computing & Communications (ICACC 2016), held from September 6-8, 2016, in Cochin, India.

[6] In January 2016, Nitish Kumar Jha and Anustup Biswal published an article titled "Advanced Street Lights" in the International Journal of Engineering Research & Technology (IJERT), Vol. 5, Issue 01, which is indexed under ISSN: 2278-0181

[7] Michael Mango and Luca Benini present a cost-effective and highly scalable solution for wireless sensor networks aimed at enabling smart LED light control in green buildings. Their work is detailed in the IEEE Sensors Journal, Volume 15, Issue 5, published in May 2015.

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