



## **Design and Implementation of Green Energy Based Automatic Household Gadgets Control**

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### **ABSTRACT**

By recognizing the presence of a human, an Automatic Power Control System for household gadgets using Arduino and a PIR (Passive Infrared) Sensor can be used to switch on and off the lighting system of a home automatically. This system can be utilized in garages, classrooms, and other locations like, stairwells, bathrooms, and other areas where continuous lighting is not required for a person. There is also no need to be concerned about electricity expenses because the lights turn off when the door is closed. Because there is no such thing as a human, one must pay bills according to their usage. This document proposes about an automatic power control system to regulate the lighting in the room using PIR sensor, Arduino, solar panel, inverter circuit and lead acid battery. The Arduino Uno, PIR sensor, and Relay Module are the primary components in this system. The PIR sensor, which detects human presence, is the most important component in the system's functionality. The findings of the experiments demonstrate that at using the proposed system work with renewable energy as solar energy.

**Keywords:** Automatic power control, Arduino UNO, PIR sensors, relay module, solar energy

### **1. Introduction**

Scientific advancements have provided us with luxury and convenience. Technology has become an integral element of our daily life. In the previous few years, tremendous technological progress has been made. During a couple of years Electrical energy has become an essential component of modern life. People have been affected by automation in their daily lives, and this is still true today. Human are ecstatic to lower the amount of energy consumed expenses. People have become oblivious to the importance of turning off the lights. As a result, a considerable amount of energy is expended when leaving the room. If the light is left on in the absence of a human, it will be wasted. In general, in both public and private sector businesses, offices, schools, and universities The majority of people are not interested in turning off the electronic devices while outside of the room[1]. As more consumer technology and household appliances are used, their size increases, resulting in increased power consumption in the home. Furthermore, it is unusable in the absence of a human being, power consumption occurs in both public and private sectors. Using automation to control lighting in the house or office, the usage of electricity can be comprehensively reduced using this technology, which will result in the owner saving money. Now people are anticipating automation in their daily lives and attempting to minimize human effort. Electricity waste can be decreased by adopting the suggested approach since electrical appliances will be turned on or off automatically based on the presence of a human being near the device with the help of a PIR sensor[2], there is no need to turn off the lights before leaving. There is no need to switch on any appliances or lights when you get into your cabin with appliances made of electricity. This is the most significant improvement of the system that is being planned. A system that utilises relay control, a WAGO PLC (Programmable Logic Controller), and an Arduino Uno was proposed by Vibhuti et al. [3]. The controlling and monitoring of devices via WAGO PLC and Arduino Uno, however, is challenging in this research. A smart lighting system that uses Raspberry Pi was proposed by Maslekar et al. [4]. Raspberry Pi is simultaneously keeping an eye on the fans and lighting. The system's experimental findings indicate that energy is conserved to the tune of 50%. The problem is that the Raspberry Pi costs more than the Arduino Uno. In Bluetooth module [5], a PIR sensor, and a relay are used in an automatic lighting and control system for classroom lighting. The Bluetooth light module is attached to an Arduino Uno, which uses an Android mobile application to give voice commands to turn the light ON or OFF. Using the operation of visitor counters, the disquisitions in [6] discuss an automatic room lighting system.

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When someone enters the room, the visitor counter is incremented, which causes the microcontroller software that controls the room light to switch on. A system whose control depends on an Arduino microcontroller, network connections, and the Modbus industrial protocol was proposed by Vahid et al.[7]. Through an Ethernet cable and router, the Arduino Ethernet Shield is connected to a mobile device.

## 2. Details of the proposed system module

### • Arduino

Arduino UNO (Fig. 1) is a microcontroller board based on the ATmega328P. It features 14 digital input or output pins that can be utilized as PWM (Pulse Width Modulation) outputs in addition to the 6 analogue input pins. Its own programming language is used. This microcontroller's crystal oscillator operates at a 16MHz frequency. It features a USB cable that is easily link with the ICSP (In Circuit Serial) port, the reset button, the power barrel jack, and the computer Programming). The Arduino Uno's pins are all run at 5 volts. The programming language of a microcontroller is not difficult.

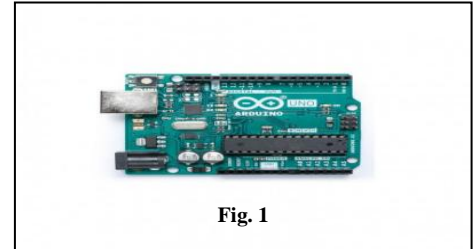


Fig. 1

### • PIR Sensor

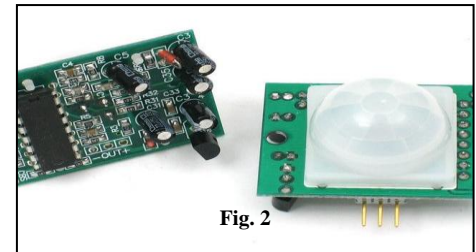


Fig. 2

### • Relay or controlling unit

A relay (Fig. 3) is a switch that is able to manage currents and voltages that are significantly higher. Power protection is done by this gadget extensively. This device has the advantages of being compact, stable, and long-lasting, and it may be utilized with both ac and dc systems. The three Relay the common terminal, the typically open terminal, and the normally closed terminal. It has three pins: input signal, GND, and VCC. Here a 5v relay is used in automatic control circuit.

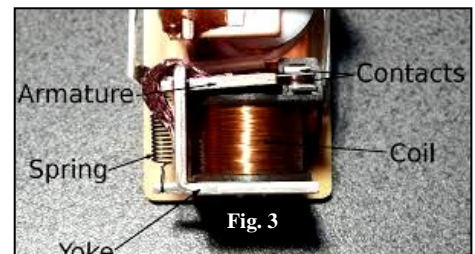


Fig. 3

### • Solar Panel

Solar panels (Fig. 4) collect clean renewable energy in the form of sunlight and convert that light into electricity which can then be used to provide power for electrical loads. Solar panels are



Fig. 4

comprised of several individual solar cells which are themselves composed of layers of silicon, phosphorous (which provides the negative charge), and boron (which provides the positive charge). Solar panels absorb the photons and in doing so initiate an electric current. The resulting energy generated from photons striking the surface of the solar panel allows electrons to be knocked out of their atomic orbits and released into the electric field generated by the solar cells which then pull these free electrons into a directional current. This entire process is known as the Photovoltaic Effect. Two 12V, 10W polycrystalline solar panels are used here.

### • Inverter circuit

A typical power inverter device (Fig. 5) or circuit requires a stable DC power source capable of supplying enough current for the intended power demands of the system. The input voltage depends on the design and purpose of the inverter. Examples include: 12 V DC, for smaller consumer and commercial inverters that typically run from a rechargeable 12 V lead acid battery or automotive electrical outlet.

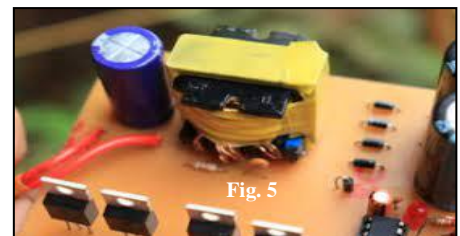


Fig. 5

### • Lead acid battery

A 12V sealed lead acid batteries with 1.2AH is use here.

### • Software used

Any piece of programming board requires software for the development environment. Generally, the software is used as a bridge to build communication between the board and the IDE. For programmable boards to perform a specific command or task, the software — more commonly known as Integrated Development Environment (IDE), is required. It functions to write programs to the boards. So as the Arduino, an IDE (software for Arduino) is a must for programming on board.

### 3. Working Principle of the proposed circuit

Here solar panel is used to charge the battery through charging circuit and inverter circuit is applied to convert that dc voltage to 230V ac supply to give the supply to adpoter. The adpoter gives power supply to the Aurdino, PIR sensor and relay circuit. PIR sensor works on the principle of heat changing. If heat change is detected by the PIR sensor then relay will be operated to ON or OFF the household gadgets. Here Fig. 7, Fig. 8 define simulation circuit and Fig. 9 define proposed circuit model.

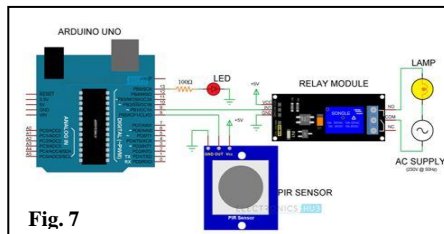


Fig. 7

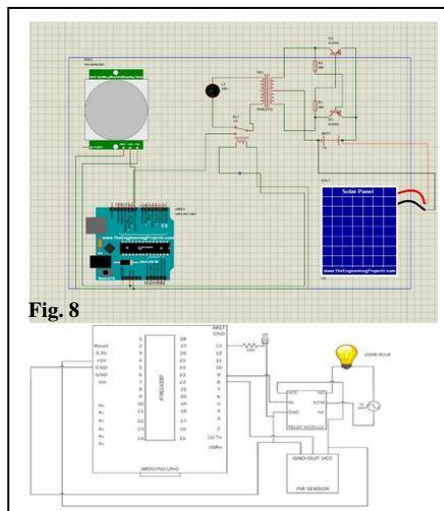


Fig. 8

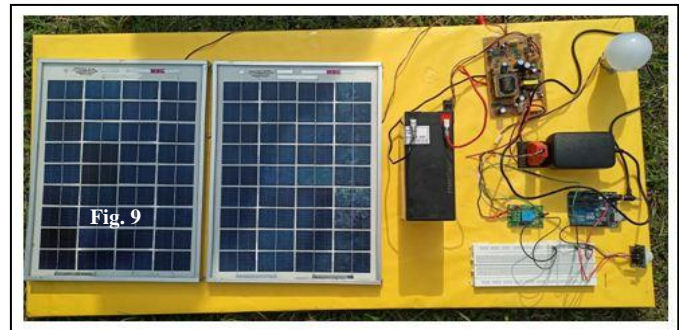


Fig. 9

### 4. Results

The automatic gadget control system is used to automatically turn ON and OFF the room lights by sensing the presence of people in the space. When a person enters the room, there is no need to touch the button each time. To successfully complete the operation an energy meter attached to the system was used with this system to measure the before and after the system installation, power use. For monitoring purposes, a 7W bulb is used. The units consumed over 4 days are displayed in Table..1

Table.1

Status	Date	Hours	Opening readings	Closing readings	Units consumed per hour
Before Installation	15/05/2022	1	2798.2	2798.4	0.2
	16/05/2022	1	2798.4	2798.6	0.2
After installation	17/05/2022	1	2798.6	2798.7	0.1
	18/05/2022	1	2798.7	2798.8	0.1

### 5. Future Scope

There are many technologies that can be used in automatic lighting systems to make the system more accurate. To make the system more professional GSM (Global System for Mobile) module can be used to get notifications. There are some sensors that can be used to control and secure the home. For example, a pressure sensor used to detect the occupancy which will be placed outside the door. Image processing can also be used to detect a person's presence by using a digital camera. In the proposed system decisions are taken based on the presence of humans but here we can also interface LDR (Light Dependent Resistor) along with PIR sensor for better working of the system. This system can also be interfaced with the Bluetooth module so the whole system can be controlled from the mobile by just a single click.

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## 6. Conclusion

From the proposed system we can conclude that an approach is taken to control the room lights using this topology. As nowadays enormous amounts of energy is wasted in daily life. With the help of this system the energy wastage can be preserved and can contribute to large amounts of power saving. This paper has introduced the idea of automated homes and proposed a method which saves power consumption by system. This Automated Gadget Control System has the interconnections between the home appliances and sensors for controlling and monitoring the device. Automated home is a vast system that has multiple technologies and its applications that can be used to provide control and security of the homes easily.

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