

Research Article

# Presence Light: An Intelligent Lightening System for Energy Saving

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## Abstract

This paper reports on a system that can save electricity. Many times, we leave the room and hall without switching off lights and fans, thus electricity is waste. In this work, we have presented a system in which energy will be save based on number of people entering in or leaving out of the room. If there is no person in the room, then light and fan will be switch OFF. On the other hand, as soon as any person enters the room, light and fan will be switch ON. Based on the intensity of sunlight we can increase or decrease the intensity of light. Simultaneously we can vary the speed of the fan sensing the room temperature. The more temperature the more speed of the fan. A smoke sensor module is used for detecting any smoke within the room and provides safety by alarming the audio device.

**Keywords:** Energy saving; Microcontroller; Sensors; LDR (Light Dependent Sensor); PIR (Passive Infrared Sensor); Relays

## 1. Introduction

Power saving has become a necessary thing in our day-to-day life. Many conventional power saving methods such as using electrical devices which consumes very less energy or cutting off the entire power supply for a scheduled time for a particular area are not efficient and there will be a lot discomforts to the users and cost may also increase to use a low power electrical device.

Buildings are responsible for up to 40% of energy usage. Most part of this energy is use mainly for maintaining good lighting such that the workers feel comfortable. Nowadays the newly constructed modernized or automated buildings may have lighting system to improve the comfort of occupants and to save the energy. However, there are large number of old buildings, which contains the traditional lighting system. To reduce the energy consumption in those types of buildings and to help the owners of that building in terms of saving electricity bill an intelligent and an effective method is discuss in this paper.

Because of advancement in Sensor technology a very cheap and portable methods to measure our surroundings are available.

The amounts of light required to for a good environment to work comfortably in various areas are shown in table 1 which is recommended by CIBSE lighting guides.'

**Table-1** Required intensity of light for various environments

Type of place and work	Intensity required
Filing-Office work	300lux
General office (Typing and Writing)	500lux
Painting	750lux
Classrooms	300lux
Classrooms for evening class	500lux
Auditorium	500lux
Assembly (Industry)	1000lux

## 2. Existing system

This section describes about the most commonly used lighting control system used in buildings. Since this method is going to use wireless sensor network it is mandatory to know the operation of existing lighting control system. It can be decided that energy loss is occurred with a lighting system when the lighting system illuminates a light which is an area which is not being used currently at that particular time or when it illuminates a light even though sufficient lighting is available to work. The most commonly used lighting systems are explain below.

### 2.1 A Switch operated manually

In this method, a user has to switch ON and OFF the required lights. Since the user can switch on and off the lights as per their preferences, there is a chance of

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keeping the lights in on state even though it was not need during that time. This approach may first checks whether any occupants are there in the room or not. If anybody is there in that room then it checks the intensity of light, if it is enough then it will not switch on the light otherwise it switch on the light.

### 2.2 By Detecting Occupants

The lighting system with occupant detection uses Passive Infrared Sensor (PIR). This PIR sensor detects any movement is present in that particular area. If any movement is there means then this system automatically switches ON the lights. If timers are not use in this type of system means then they kept in ON state even after the user left the place. Because of this fault, also a large amount of energy can be waste.

Then another drawback about this type of system is, it will switch ON the lights when there is an occupant is present in that area, But there is a possibility of enough lighting will be there at that particular time. This system is not going to check the intensity of light before switching on the Lights. Because of this, also a large amount of energy can be lost.

### 3. Proposed system

The proposed system overcomes all the drawbacks of existing system. This system considers two things before taking any action, namely (1) human presence and (2) intensity of light. The system consists of a PIR sensor (HC-SR501) and an LDR (LM393). The PIR sensor is use to detect whether any occupants are there in that room and LDR is used to detect the intensity of light in that room. Apart from this, an algorithm can implemented in our system, which uses both the LDR and PIR sensor to decide whether to switch on the light, or not.

### Advantages

- Low Cost.
- Easy to use.



Fig.1 Working System

### 4. Block Diagram

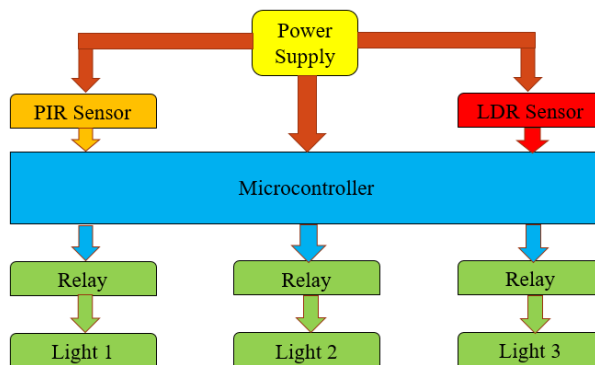


Fig.2 Block Diagram for Proposed System

### 5. Description

This system uses Microcontroller (Arduino UNO R3), LDR, PIR sensor and the lights can be control by relays. The LDR sensor will keep on sensing the intensity of light and sends it to the microcontroller. The PIR sensor will send a signal to the microcontroller if there is any occupant in the room. If anybody is present in the room then the microcontroller compares the sensed motion in the room and give signal to the microcontroller. If the intensity value is less than the value stored in the microcontroller then the light will switched on by connecting the relay.

### Hardware used

**A. PIR sensor:** A PIR detector is a motion detector that senses the heat emitted by a living body. This sensor used as a security control lights so that they will switch on automatically if approached. They are very effective in enhancing home security systems. The sensor is passive because, instead of emitting a beam of light or microwave energy that must be interrupt by a passing person in order to sense that person, the PIR is simply sensitive to the infrared energy emitted by every living thing.

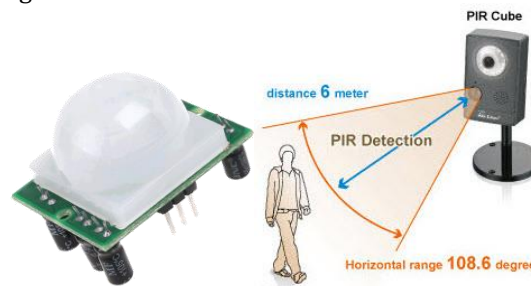


Fig.3 PIR Sensor + Working principle

**B. LDR sensor** LDR's or Light Dependent Resistors are very useful especially in light/dark sensor circuits. These help in automatically switching ON /OFF the street lights etc., normally the resistance of an LDR is very high, sometimes as high as 1000000 ohms, but when they illuminate with light then resistance drop

drastically. Electro-optical sensors are the devices that alter their electrical characteristics, in the presence of visible or invisible light. The best-known devices of these types are the light dependent resistor (LDR), the photo diode and the phototransistors.

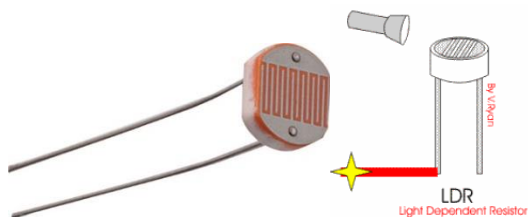


Fig.4 LDR Sensor + Working Principle

**C. Microcontroller** a microcontroller is a computer present in a single integrated circuit, which dedicated to perform one task and execute one specific application. It contains memory, programmable input/output peripherals as well a processor. Microcontrollers are mostly design for embedded applications and are heavily use in automatically controlled electronic devices such as cellphones, cameras, microwave ovens, washing machines, etc.



Fig.5 LDR Sensor + Working Principle

**D. Relay** A relay is usually an electromechanical device that actuated by an electrical current. The current flowing in one circuit causes the opening or closing of another circuit. Relays are like remote control switches, and are use in many applications because of their relative simplicity, example circuit using a relay to power a 120v load long life, and proven high reliability. Relays used in a wide variety of applications throughout industry, such as in telephone exchanges, digital computers and automation systems.

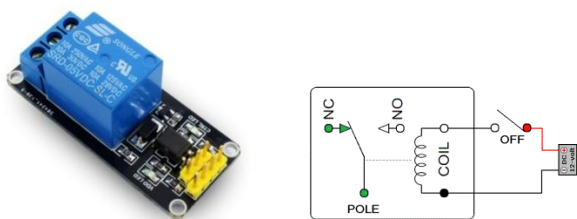


Fig.6 Relay + Working Principle

5. Flowchart

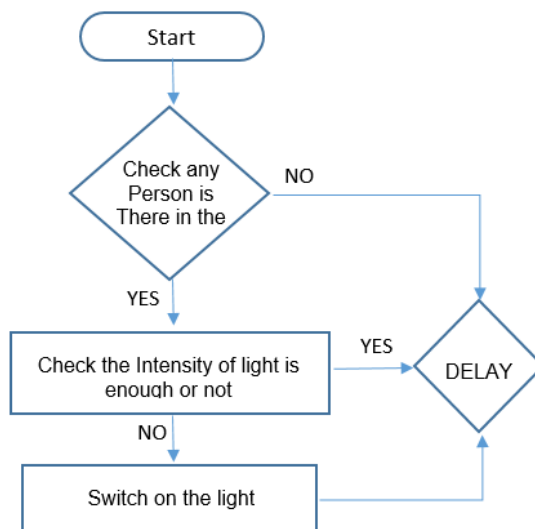
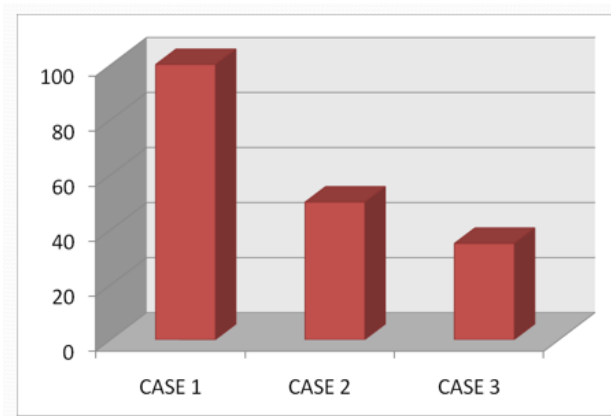


Fig.7 Flowchart

6. Results



CASE 1- Present System without Automation  
 CASE 2- Old Buildings with Automation  
 CASE 3- New Construct With Automation

Fig.8 Energy Consumption Graph

7. Future work/scope:

- In this system, the number of persons present in the room (Person counter) can be included.
- The system can be upgrade to allow the users to configure the intensity of light in real time.
- By using this concept, we can implement various applications Such as fans, tube lights.
- This can be originate with wireless such that we can put different sensors in different places.
- This sensor will turn on the micro controller with the signals instead of using wires.
- We can send this data to a distant location using mobile or internet.
- Voice alarm system can be included to indicate that the room is full & persons cannot enter inside.

- This system can also be applied to various loads like pressure, force etc. by increasing the number of ports of the micro controller.

## Conclusion

- In this digital world, Technology is very advanced and we prefer things to be done automatically without any human efforts. This project also helps to reduce human efforts. In addition, it is very useful to conserve resources. It is very useful in Schools, hospitals, malls, offices, auditoriums
- Home automation with considering Energy Saving System is not limited for any particular purpose, it can be used anywhere in a developing industry with little modifications in software coding according to the necessities. This concept is use in many developing countries in order to save their limited power. It ensures that our work will not only be usable in the future but also provides the flexibility to adapt and extend, as needs change.
- In our scheme, we associated all the sensors to microcontroller with the wires.

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