Passive Infrared-Occupancy Sensor based Lighting Control

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Abstract- **Now a day's Energy saving is the most essential thing to develop countries economy also usage of lighting system is becoming scarce in today's world due to this reason there is an need of adopting smart way of energy saving. Passive Infrared(PIR) Sensor is used to sense motion or movement of living things like Human beings, Animals and it can make automatic control by switching action. Therefore, by using occupancy sensor-based lighting system it will automatically turning on/off the lights when needed without disturbing and interrupting the normal operation of the working environment. The occupancy sensor will work in close area as well as in open areas. As occupancy sensor has efficient performance, quick response and energy saving quality it is widely used in current era in most of the residential and commercial buildings.**

Keywords-Passive Infrared, Sensor, switching, Occupancy.

I. INTRODUCTION

In India as well as in European countries, Passive Infrared-Occupancy sensor based lighting control plays an essential role in developing the country. Basically, Passive Infrared - Occupancy sensor depends on the motion or movement of the living things such as human and animals. It is the human tendency that most of the time they forgot to switch on/off the lights while entering or leaving the room or any specific area.[1] Therefore due to use of such Passive Infrared - Occupancy sensor based lighting control system we are able to control the energy consumption which is quarterly happening due action and reaction of humans. Every time it is not possible to save energy so due to these lighting control strategy we can save energy.[2]Due to linking a lighting system with occupancy sensors gives a cost-effective and easy solution for reducing lighting energy use. Due to the implementation of various sensors like Passive Infrared sensor, Daylight sensor, Vacancy sensor has been demonstrated successfully in several areas, where energy used for lighting has been reduced by between 20% and 60%, depending on the configuration, type of space and type of sensor used. However due to the use of occupancy based lighting control, The energy usage pattern is changing. Passive Infrared -Occupancy sensor is able to adjust its switching depending upon the occupancy or presence of human beings.[3] It can also automatically control the dimming of light via sensing human presence or by switching light fixtures.

II. HARDWARE USED FOR PASSIVE INFRARED-OCCUPANCY SESNOR BASED LIGHTING CONTROL

The hardware requirements of this project include:
A.   Arduino UNO
B.   Passive Infrared sensor
C.   Relay module

A. *Arduino UNO:-*

The Arduino UNO is one of the most used microcontrollers in the industry. It is very easy to handle and learn also convenient to use. This Arduino UNO is based on the microchip ATmega328P microcontroller. The coading of this microcontroller is very simple[4]. It is equipped with analog and digital input/output ports which can interact with any circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable with voltage ranges 7 to 20 volts.[5] The applications of this microcontroller involve a wide range of applications like security, home appliances, remote sensors, and industrial automation.

Figure 1: Arduino UNO

B. *Passive Infrared Sensor*

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in Passive Infrared -based motion detectors. It requires 10-40 seconds of settling time before starting its operation. It consists of pyroelectric sensor that detects motion by measuring change in the infrared levels emitted by the objects [6]. Its motion detection rang is up to 6 meters within 360-degree angle coverage area.

Figure 2: Passive Infrared Sensor

C. Relay module(Four channel)

A Relay Module is an extremely useful component as it allows Arduino, Raspberry Pi or other Microcontrollers to control major electrical loads. We have used a 4-channel Relay Module in this project but used only one relay in it. This relay module is 5V active low module.[7] It is capable to control the various electrical appliances with large current also.
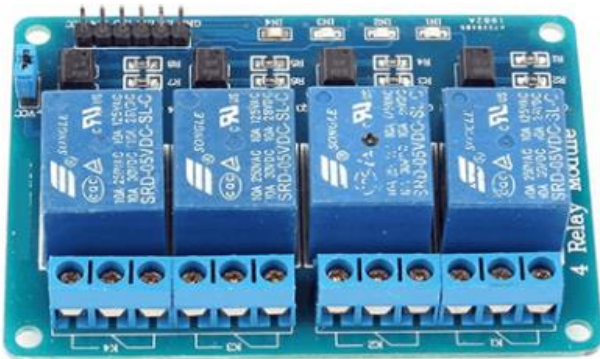

Figure 3: Four channel relay module

III. SOFTWARE USED IN PASSIVE INFRARED-OCCUPANCY SESNOR BASED LIGHTING CONTROL

The software requirements of this project include:
A.   Atmel Studio
B.   Proteus

Atmel studio 7 is used for the programming of the ATmega328 microcontroller. To load the program on to chip we have used AVRDude. PIR Sensor require 30 to 40 second warm up time so , code is written in a way that when we start the system it will wait for 40 seconds and then system starts functioning.

Proteus VSM is used for the simulation of the Passive Infrared-Occupancy sensor-based lighting control system. The schematic was designed with help of Proteus inbuilt electronic component library. Proteus will directly simulate and interact with designed schematic.

IV.   SYSTEM DESIGN:

Due to the use of such smart and efficient system which helps to improve performance and reliability of the system. This system will tends to achieve energy saving.

A.   Block Diagram

As shown in below block diagram, The design clarifies the idea behind the Passive Infrared sensor-Occupancy sensor based lighting control system. These design in divided into two sections. In first section, The Passive Infrared-Occupancy sensors are used to sense presence and absence of humans. So Passive Infrared sensor senses the motion by continuously emitting its radiations in a room and this Passive infrared sensor is interfaced with Arduino UNO therefore information received from the sensor is sent to the controller[8]. In the controller block, The Arduino is programmed in such a way that when person enters/leave the room then controller performs various tasks such as comparing, time delay, occupancy in the room then observes and validate the operation and send signal to four channel relay module. As we are controlling four light fixtures so we are using four channel relay module which controls switching (on/off) of light fixture Therefore the cycle repeat itself and operation will be continuous.
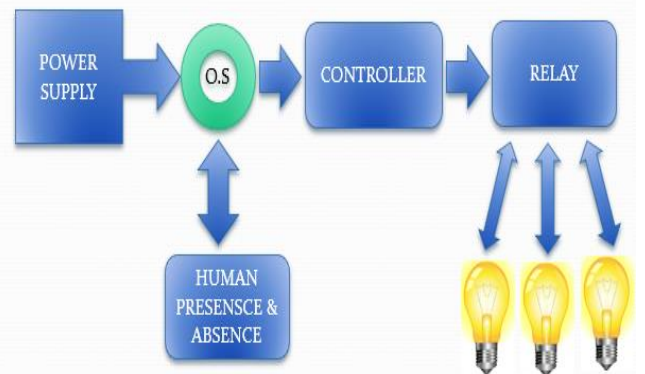

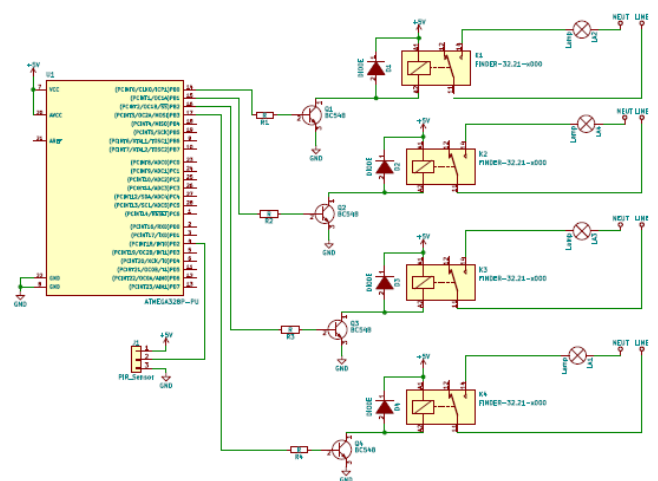Figure 4: Block diagram

V.   SCHEMATIC AND RESULT:

Figure 5: Schematic

The above schematic shows the control design of Passive Infrared-Occupancy sensor-based lighting control:

The basic power supply structure is used which includes step down transformer, Bridge rectifier, Filter, Voltage regulator LM7805 is used. These power supply circuit provides 5V supply to Arduino UNO based on ATmega328P controller. Passive Infrared sensor is connected to PD2 pin, four channel relay module is connected to PB0,PB1,PB2and PB3 along with the NPN transistor, resister and diode across each individual relay.

When Passive Infrared sensor senses the motion or any activity then it sends signal to controller. Controller follows code which we have already loaded in microchip, controller output becomes high when presence detected and becomes low when no presence is detected which then send signal to four channel relay module as per loaded program and detection. This relay operates in two modes, In first mode, If presence detected by sensor then relay switches to on condition and In second mode, If no presence is detected by sensor then relay switches to off condition. In this way cycle repeats and operation will be continuous till we off the supply of sensor.

VI. CONCLUSION AND FUTURE WORK

Due to the implementation of Passive Infrared-based occupancy lighting control, These approach is taken into account that it will automatically control the lights. Now if any person forgets to switch on/off the light while entering or leaving the room then due to this system will automatically sense motion and perform its specific task without any external instruction. We have set time in such a way that little movement of the human is detected by the sensor. This will result into energy saving. As we have designed self-decision-making control system, We can install this in museums , parking's , Homes, etc. We can also interface this system with bluetooth and alarming system.

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