Device Control Using Smart System

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Abstract— Device Control System using Arduino and PIR (Passive Infrared) Sensor can be used to turn ON and OFF the lighting system of home automatically or any other system by detecting the presence of human. This system can be used in garages, classrooms, staircases, bathrooms, etc. where there is no need of continuous light but only when there is a human. Also, there is no need to worry about electricity bills as the lights get OFF when there is no human and hence one need to pay the bills as per use. This paper proposed as about automatic gadget control system which automatically control the room lights using Arduino and PIR sensor. The main components used in this system are Arduino Uno, PIR sensor and Relay Module. Out of these components, the operation of system mainly depends on PIR sensor which helps in detecting human presence.

Keywords—Arduino, PIR, Relay

INTRODUCTION

Nowadays without electricity we cannot imagine our daily life because electricity has become a necessity for all, without which day-to-day life chores & daily activities become stand still. Due to the depletion of non-renewable resources, conservation of mandatory and by doing so we can reduce electricity bills as well. We know that energies like wind energy, solar energy and hydro energy are called renewable energy sources which are renewable in nature. Therefore, utilization of these resources for power supply is the best possible way of producing, conserving and renewing energy, which is advantageous as it is pollution free, affordable, and free from environmental impacts. Scientific inventions have made this world worth living. They have provided us comforts and luxuries. Technology has become an important and necessary part of our lives. In last few years, there is tremendous advancement in technology. So, human life becomes more dependent on these technologies. The invention of electricity is one of the greatest of all its inventions. Electricity has become an indispensable part of human life. Electricity is considered as the soul or the life without which the entire world remains dead and dormant.

To provide more comfort to human there is a technology called as Home Automation. When there is control of all household amenities and appliances together with the use of technology then it is termed as Home Automation. As non-renewable sources are decreasing day by day, there is need of conservation of energy. Electricity is the most important to all the activities of the modern society. Hence, wise use of non-renewable energy sources is must. Home Automation gives energy efficient room by observing and controlling different devices. Now days, the issues related to energy become main problem. In this modern world people are in hurry and hence forget to turn OFF the appliances. In such a situation, this Device Control Using Arduino and Pir helps in home automation and also saves electricity. On the basis of human presence in particular area of room, the electrical appliances can be switched ON or OFF automatically. This is the main advantage of this system.In this project, we will see the Device Control using Arduino and PIR Sensor, where for demo purpose we are taking device as a light bulb and the lights in the room will automatically turn ON and OFF by detecting the presence of a human.

Such Device Control Using Arduino and PIR can be implemented in your garages, staircases, bathrooms, etc. where we do not need device to be ON continuously but only when we are present. Also, with the help of aDevice Control using Arduino and PIR Sensor you need not worry about electricity as the device get automatically off when there is no person.

I. HARDWARE AND SOFTWARE REQUIREMENTS

A.ARDUINO UNO

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing. Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike. Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide. Reprogrammed with a boot loader that allows uploading new code to it without the use of an external hardware programmer. While the Uno communicates using the original STK500 protocol it differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Table 1

Micro controller	Atmega328
Operating voltage	5V
Input Voltage(recommended)	7-12V
Input Voltage	6-20V
Digital I/O	14(of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 Ma
DC Current for 3.3V Pin	50 Ma
Flash Memory	32 KB(Atmega328 of which 0.5 KB used by bootloader)
SRAM	2 KB (ATmega32)
EEPROM	1 KB(ATmeha328)
Clock Speed	16 MHz

B.PIR SENSOR

PIR sensor detects a human being moving around within approximately 10m from the sensor. This is an average value, as the actual detection range is between 5m and 12m.PIR are fundamentally made of a pyro electric sensor, which can detect levels of infrared radiation. For numerous essential projects or items that need to discover when an individual has left or entered the area. PIR sensors are incredible, they are flat control and minimal effort, have a wide lens range, and are simple to interface with.

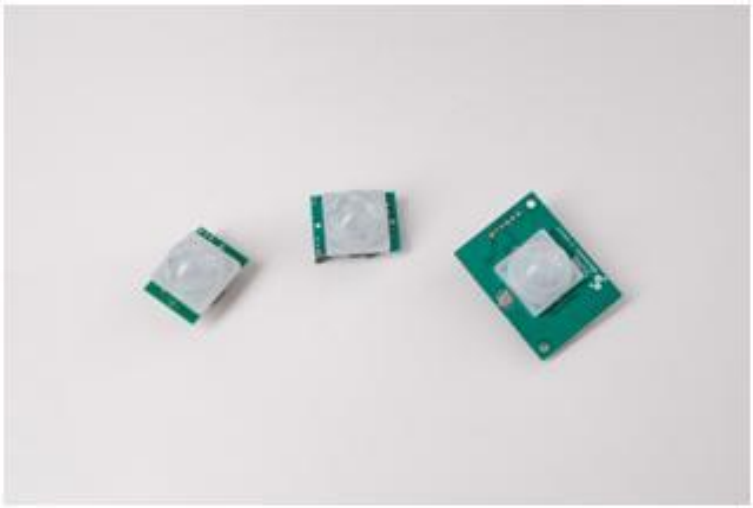

Fig 1.PIR Sensor

Most PIR sensors have a 3-pin connection at the side or bottom. One pin will be ground, another will be signal and the last pin will be power. Power is usually up to 5V. Sometimes bigger modules don't have direct output and instead just operate a relay which case there is ground, power and the two switch associations. Interfacing PIR with microcontroller is very easy and simple. The PIR acts as a digital output so all you need to do is listening for the pin to flip high or low. The motion can be detected by checking for a high signal on a single I/O pin. Once the sensor warms up the output will remain low until there is motion, at which time the output will swing high for a couple of seconds, then return low. If motion continues the output will cycle in this manner until the sensors line of sight of still again. The PIR sensor needs a warm-up time with a specific end goal to capacity fittingly. This is because of the settling time included in studying nature's domain. This could be anyplace from 10-60 seconds

II. WORKING

Arduino is a microcontroller which provides open source platform to perform software and hardware operations. This is an advantageous project as Arduino Uno and PIR Sensor is used thereby lights in the room will turn ON automatically by detecting a human motion and stay turned ON as long as the person remain present in the room. At the beginning, when no human is present in the room, the PIR Sensor's OUT pin is in the LOW mode. Hence, light of the room is OFF. The output of the PIR Sensor goes HIGH as the person enters the room. PIR Sensor detects the Infrared (IR) radiation in the room. The Digital pin 8 of Arduino Uno is used to connect the Data OUT pin of PIR Sensor. When this becomes HIGH, the activation of relay takes place by Arduino Uno. So that relay pin is in the LOW mode; because relay is an active LOW device. Now, the lights will turn ON. This light maintains its state as ON as far as there is motion in the room. If the person exits the room or takes a nap, the motion in front of sensor stops and there will be no changes in the IR radiations. Therefore, Data OUT pin of PIR sensor will be in LOW mode. This leads to turn OFF the relay. So, relay now is in the HIGH mode. Hence, room light will be turned OFF.

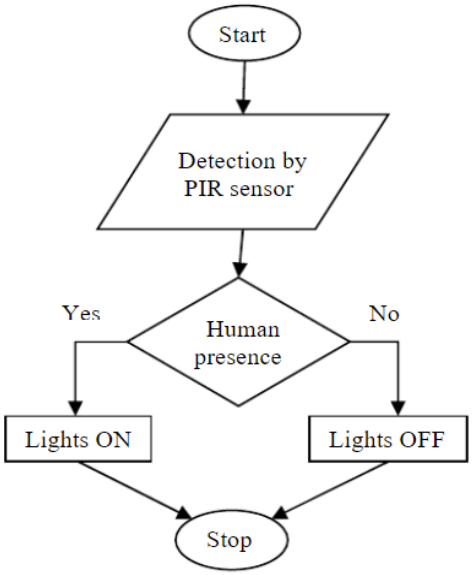

Fig 2.Flowchart of Device Control using Arduino and PIR sensor

PIR sensors are more complicated than many of the other sensors explained in these tutorials (like photocells, FSRs and tilt switches) because there are multiple variables that affect the sensors input and output. To begin explaining how a basic sensor works, we'll use this rather nice diagram. The PIR sensor itself has two slots in it, each slot is made of a special material that is sensitive to IR. The lens used here is not really doing much and so we see that the two slots can 'see' out past some distance (basically the sensitivity of the sensor). When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a *positive differential* change between the two halves. When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change. These change pulses are what is detected. In the detection area, the infrared radiation energy of the human body through the clothing is received by the lens of the detector and focused on the pyroelectric sensor. When the human body (intruder) moves in this surveillance mode, it enters a certain field of view in sequence and then walks out of the field of view. The piezoelectric sensor sees the moving human body for a while and then does not see it, so the human body. The infrared radiation constantly changes the temperature of the pyroelectric material so that it outputs a corresponding signal, which is the alarm signal.

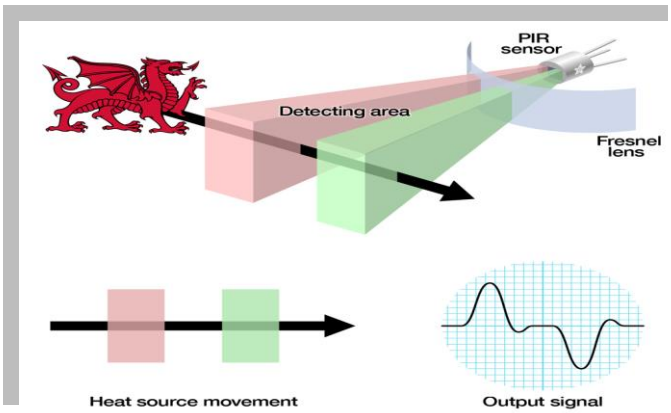

Fig 3 Working of PIR Sensor

PIR sensors are rather generic and for the most part vary only in price and sensitivity. Most of the real magic happens with the optics. This is a pretty good idea for manufacturing: the PIR sensor and circuitry is fixed and costs a few dollars. The lens costs only a few cents and can change the breadth, range, sensing pattern, very easily. The lens is just a piece of plastic, but that means that the detection area is just two rectangles. Usually we'd like to have a detection area that is much larger. To do that, we use a simple lens such as those found in a camera: they condenses a large area (such as a landscape) into a small one (on film or a CCD sensor). For reasons that will be apparent soon, we would like to make the PIR lenses small and thin and mouldable from cheap plastic, even though it may add distortion. For this reason the sensors are actually Fresnel lenses

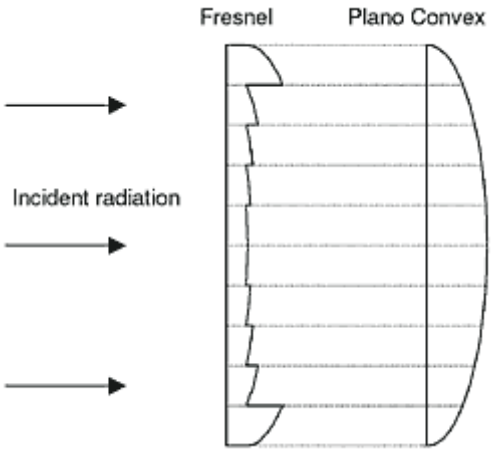

Fig 3.5 Fresnel lens

The Fresnel lens condenses light, providing a larger range of IR to the sensor

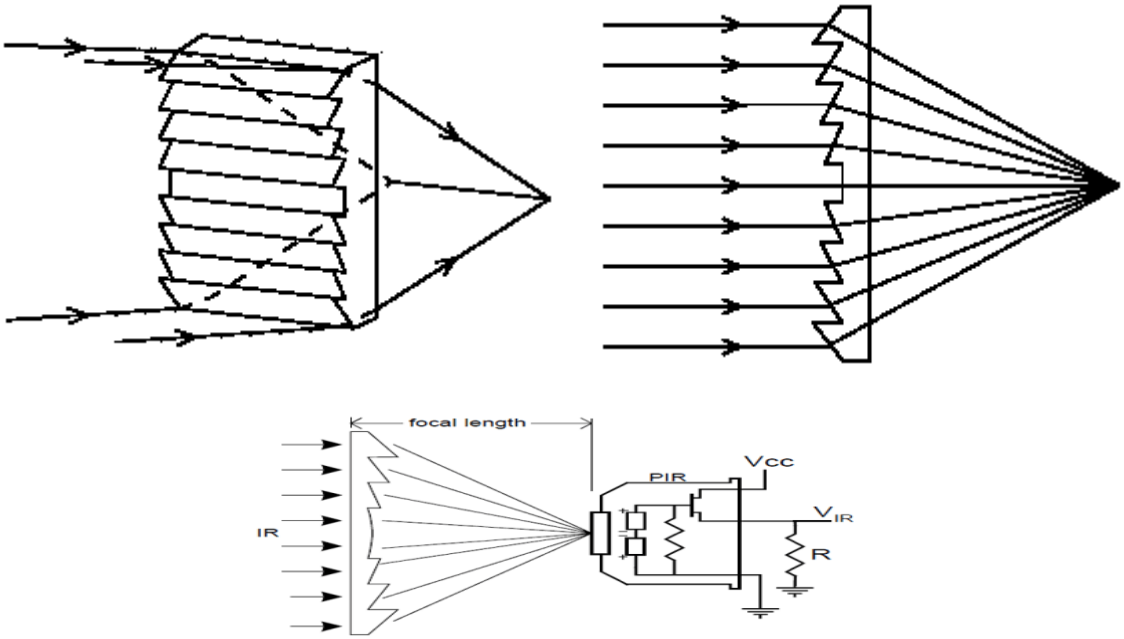

Fig .5 Incident Radiation on Fresnel Lens

We actually have two sensors, and more importantly we don’t want two really big sensing-area rectangles, but rather a scattering of multiple small areas. So, what we do is split up the lens into multiple sections, each section of which is a Fresnel lens. The different faceting and sub-lenses create a range of detection areas, interleaved with each other. That's why the lens canters in the facets above are 'inconsistent' - every other one points to a different half of the PIR sensing element

Fig 6. Multi Facet-Sections of Fresnel Lens

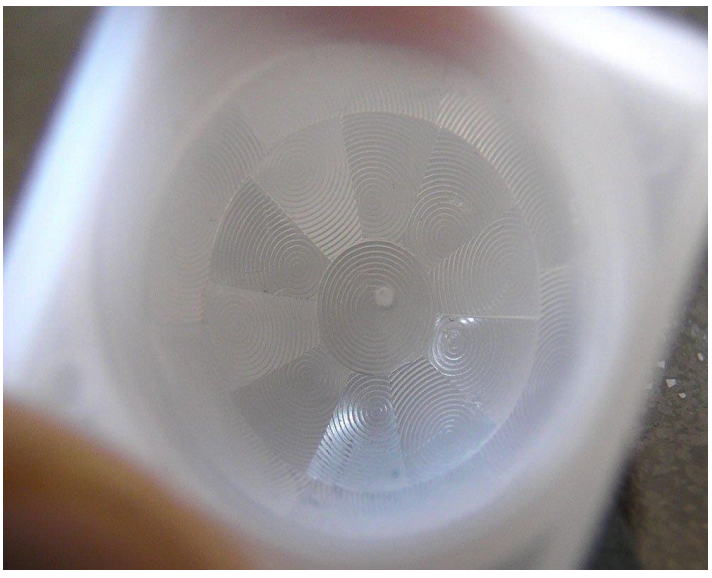

Fig 7. Different Fresnel Lenses in each Facet

The different faceting and sub-lenses create a range of detection areas, interleaved with each other. That's why the lens canters in the facets above are 'inconsistent' - every other one points to a different half of the PIR sensing element.

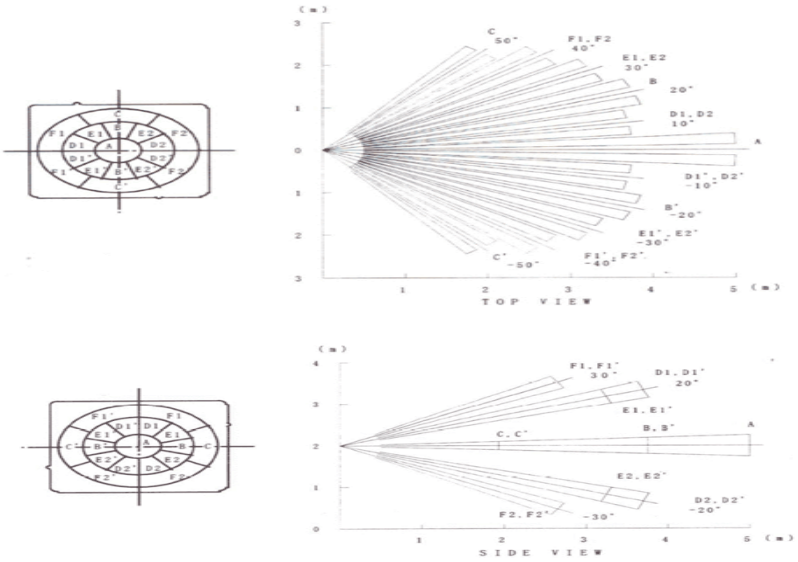

Fig 8.Top and Side view of each Facet in a PIR Sensor

Table.2

Arduino Pro IDE	
Developer(s)	Arduino Software
Preview release	v0.0.2 / 28 October 2019; 7 days ago[7]
Repository	github.com/arduino/Arduino
Written in	Java, C, C++
Operating system	Windows, macOS, Linux
Platform	IA-32, x86-64, ARM
Type	Integrated development environment
License	LGPL or GPL license
Website	blog.arduino.cc/2019/10/18/arduino-pro-ide-alpha-preview-with-advanced-features/

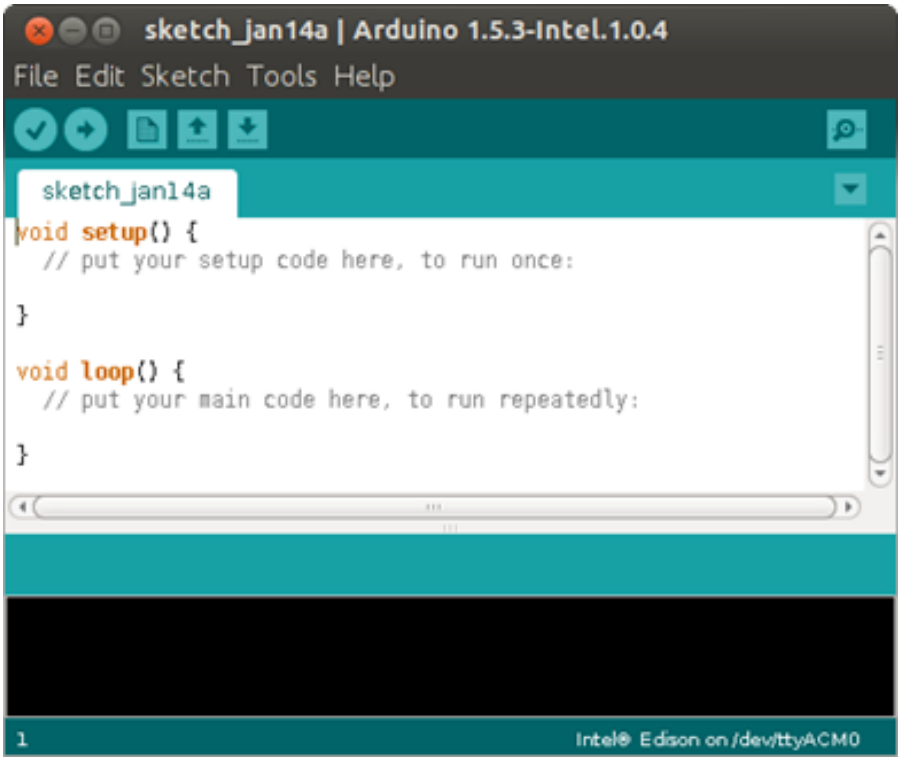

Fig. 9. Arduino interfacing screen

III. RESULTS

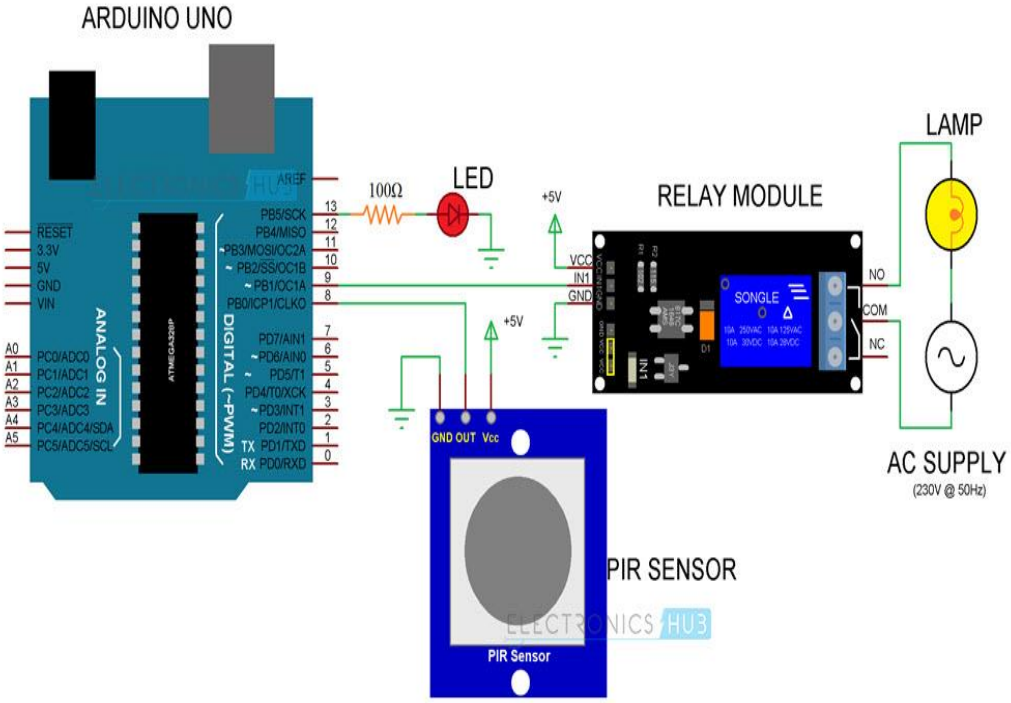

Fig. 10 Circuit diagram (2) of Device Control Using Arduino and PIR Sensor

The design of device control system is used to turn ON and OFF the room lights or any other system automatically by detecting the human presence in the room. There is no need to press the button every time when person enters in the room

IV. CONCLUSIONS

In this project we have developed a real time model that can automatically switch on or off a device based on the presence of the human being. Now-a-days in our world non-renewable resources are depleting at a rapid rate due to excess human consumption. This project is not only useful for saving time and money of the user but also contributes in the saving of the earth's resources and to a bright future. It is low cost and also low power consumption. This project will help us for reducing the time and money of the user not only that it will also help in conserving the non-renewable resources of the world. This project is so informative and useful project through which we learnt the working of Arduino and PIR Sensor as well as about relays.

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