TITLE: COMPETENT LIGHTING SYSTEM BASED ON MOTION DETECTION

ABSTRACT

Motion detection has become one of the great areas of research in the world. Many activities are carried out in the presence of motion. One of the research focus has been the use of Arduino Uno microcontroller, Ultrasonic sensor, passive infrared sensor and many others to sense and measure distances. The goal is to measure and monitor human activity remotely, and using less manpower as much as possible. This study aimed at designing a sensor that can easily measure how far the object is, monitor change of distances as the object approach and display the results in the serial monitor of arduino, and turn on the light. The hardware utilized included the Arduino Uno on a bread board interfaced with Ultrasonic sensor. The program to run the circuit was developed using Arduino IDE and stored at the memory of the Arduino microcontroller. The study demonstrated that the designed sensor could be used to accurately determine the position of an approaching object and display the distance readings on the serial monitor. Thus, this method of distance sensing and measurement is efficient and assures measurements of small distances precisely. This distance sensing and measurement system can get wide applications where proximity detection is required e.g. in industries and traffic departments.

I. INTRODUCTON AND PROBLEM STATEMENT

As population is increasing day by day, demand for electricity is also being rapidly increased. It is very important to reduce the wastage of power which is spending unnecessarily. It is high time we needed to look forward to reduce energy waste as wasting of electricity can make drastic effect on energy infrastructure. As more and more consumer electronic and home appliances are used, the size of them is becoming large; power consumption in home area tends to grow. Moreover, unusable power consumption occurs in the absence of human being in public and private sectors.

Using the automation in switching the home or office lighting system, the consumption of electricity can be comprehensively reduce which will in turn save the money of the owner. Now the people are looking forward for automation in their daily life. The people are trying to reduce human efforts.

By using suggested system wastage of electricity can be reduced as electrical appliance will be automatically turned ON or OFF based on the presence of the human being with the help of ultrasonic sensor, while departure no need to turn off the appliances or while arriving in your cabin no need to turn on the electrical appliances. This is the main enhancement of the projected system.

The main parts of the proposed system are Arduino, ultrasonic Sensor and the Relay Module. This system can be considered as a major application of ultrasonic sensors.
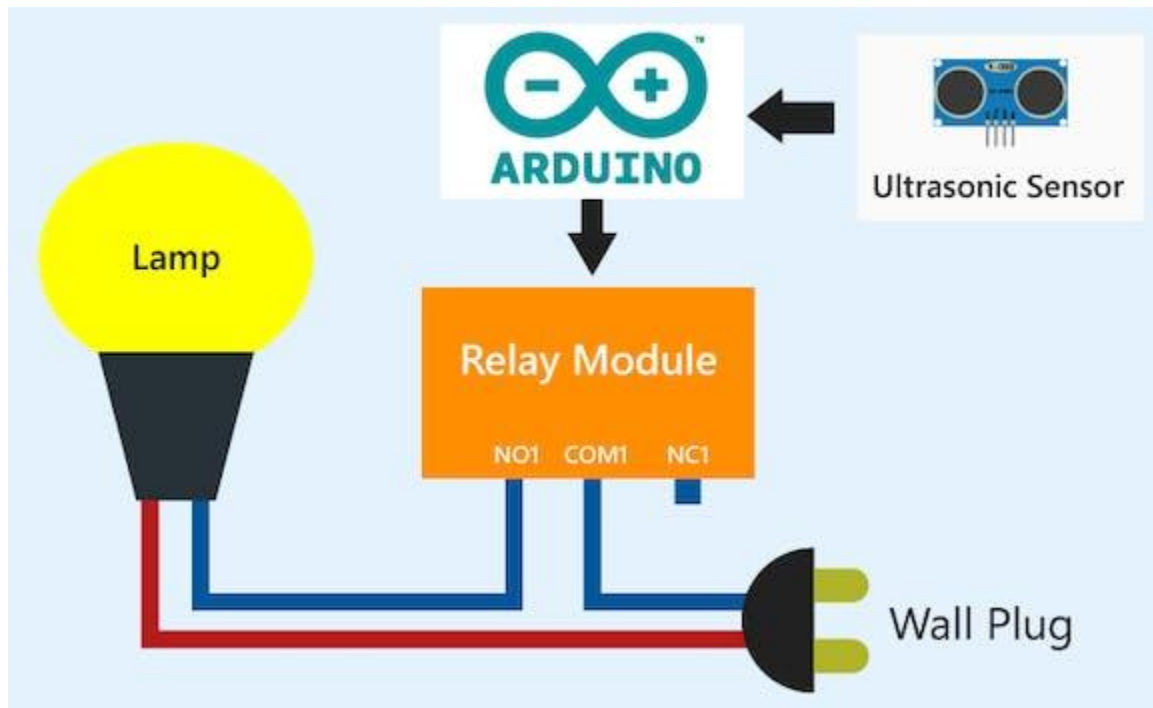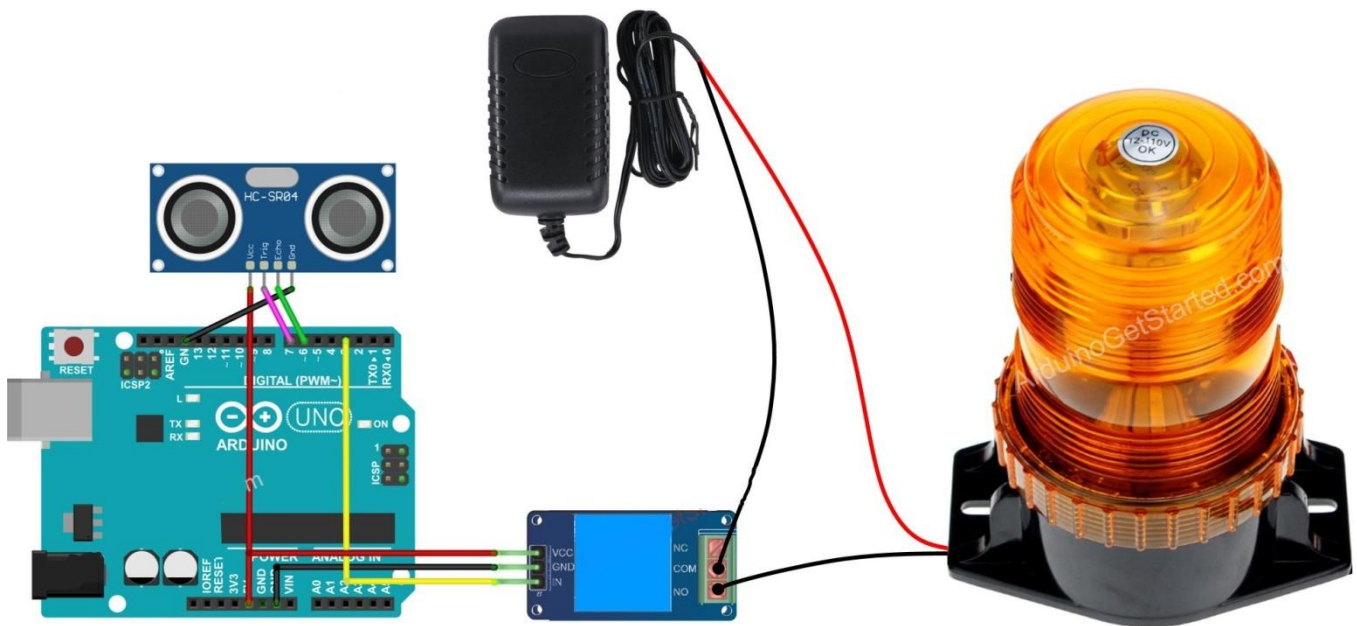
II. BLOCK DIAGRAM

Fig 2.1 Block Diagram

Fig 2.2 Flow of circuit

ARDUINO UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PW output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano.

Fig 2.3 Arduino Uno

The Uno board is the first in a series of USB-based Arduino boards; it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. The ATmega328 on the board comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.

Arduino Uno microcontroller is full set containing the memory and the I/O serial ports which are used in interfacing it with other devices like relay module, LCD, LEDs, Buzzer and many others. Once the program is made in the computer, it is transferred to the Arduino chip using the USB cable. The circuit to be interfaced with the microcontroller is connected to it. Arduino Uno in the circuit controls all the functioning of the attached device and make them operate as per the program.

ULTRASONIC SENSOR

The HC-SR04 ultrasonic sensor uses SONAR to determine the distance of an object just like the bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package from 2 cm to 400 cm or 1 to 13 feet. The operation is not affected by sunlight or black material, although acoustically, soft materials like cloth can be difficult to detect. It comes complete with ultrasonic transmitter and receiver module.

Fig 2.4 Ultrasonic Sensor

Here are its main specifications:

Specifications

- Power Supply: DC 5V
- Working Current: 15mA
- Working Frequency: 40Hz
- Ranging Distance : 2cm – 400cm/4m
- Resolution : 0.3 cm
- Measuring Angle: 15 degree
- Trigger Input Pulse width: 10uS
- Dimension: 45mm x 20mm x 15mm

The ultrasonic sensor uses the reflection of sound in obtaining the time between the wave sent and the wave received. It usually sent a wave at the transmission terminal and receives the reflected waves. The time taken is used together with the normal speed of sound in air (340ms-1) to determine the distance between the sensor and the obstacle. The Ultrasonic sensor has been used by several researchers to sense the movements of the objects as they approach it.

RELAY MODULE (5V)

Relay is one kind of <u>electro-mechanical component</u> that functions as a switch. The relay coil is energized by DC so that contact switches can be opened or closed. A single channel 5V relay module generally includes a coil, and two contacts like normally open (NO) and normally closed (NC).

A 5v relay is an automatic <u>switch</u> that is commonly used in an automatic control circuit and to control a high-current using a low-current signal. The input voltage of the relay signal ranges from 0 to 5V.

Fig 2.5 Relay Module

Normally Open (NO): This pin is normally open unless we provide a signal to the relay modules signal pin. So, the common contact pin smashes its link through the NC pin to make a connection through the NO pin

Common Contact: This pin is used to connect through the load that we desire to switch by using the module.

Normally Closed (NC): This NC pin is connected through the COM pin to form a closed circuit. However, this NC connection will break once the relay is switched through providing an active high/low signal toward the signal pin from a microcontroller.

Signal Pin: The signal pin is mainly used for controlling the relay. This pin works in two cases like active low otherwise active high. So, in active low case, the relay activates once we provide an active low signal toward the signal pin, whereas, in an active high case, the relay will trigger once we provide a high signal toward the signal pin.

However, these modules generally work on an active high signal which will strengthen the relay coil to make contact with the common terminal with the normally open terminal.

5V VCC: This pin needs 5V DC to work. So 5V DC power supply is provided to this pin.

Ground: This pin connects the GND terminal of the power supply.

BREADBOARD

Breadboards are temporary work boards for electronic circuits. The general shape of a breadboard is shown in Fig 2.6. Compatible with most breadboards, 24-gauge wire is used to connect circuits; solid wire, not stranded. Sometimes, kits may be available with various colors of fixed lengths to specifically fit breadboards. These are a nice convenience.

Fig 2.6 Bread Board

A bare board already has some connections. The horizontal rows are connected throughout the row and may make a complete row with the addition of a simple jumper at the center point.

Similarly, the vertical columns are connected vertically down half the width of the board. A jumper may be inserted at the middle location to connect the full width of the breadboard.

BULB (9W)

The electronic bulb is the simplest electrical lamp that was invented for illumination more than a century ago. It was the small and simplest light that brightened the dark space. The electronic bulb is also known as an incandescent lamp, incandescent light globe or incandescent light bulb. Bulb comes in different sizes and light output and operates with a voltage range from 1.5 Volts to about 300 Volts.

Fig 2.7 Bulb

LED light bulbs are a more environmentally-friendly alternative to incandescent bulbs. LED bulbs use a semiconductor device that emits visible light when an electric current passes through it. That property is known as electroluminescence. Compact fluorescents, the most common alternative to incandescent bulbs, use

electricity to excite mercury gas until it emits ultraviolet (UV) light. That light is then passed through a phosphor, which causes it to emit more visible light.

LEDs themselves have been around for some time, but only recently have improvements in efficiency, cost and output made them viable for the larger-scale lighting used in households, businesses and other environments. Due to the rapid progress in LED technologies, products exist with wide ranges of efficiencies and life spans.

The bulbs can work for 50000 hours, if not run outside of the specified temperature range. They use about 8-11 watts of power to replace a 60-<u>watt</u> incandescent with at least 806 lumen and 9.5 watts for a 75-watt equivalent. This capacity provides an efficiency gain of up to 80% over incandescent bulbs.

<u>JUMPER WIRES</u>

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with [breadboards](#) and other prototyping tools in order to make it easy to change a circuit as needed.
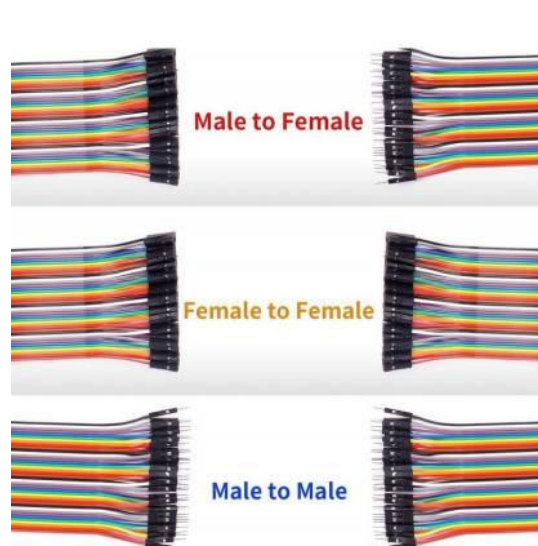

Fig 2.8 Jumper Wires

Jumper wires come in three versions-

- Male-to-male jumper
- Male-to-female jumper
- Female-to-female jumper

The difference between each is in the endpoint of the wire. Male ends have a pin protruding and can plug into things, while female ends do not but are also used for plugging.

Moreover, a male connector is referred to as a plug and has a solid pin for centre conduction. Meanwhile, a female connector is referred to as a jack and has a centre conductor with a hole in it to accept the male pin.

Male-to-male jumper wires are the most common and what you will likely use most often. For instance, when connecting two ports on a breadboard, a male-to-male wire is what you will need.

III. WORKING PRINCIPLE

The proposed system design is divided into 3 parts, Arduino consisting microcontroller circuit for controlling the entire system, ultrasonic sensor which detect the presence of human or object kept at or smaller than a specific distance in cm and the relay module for automatic switching.
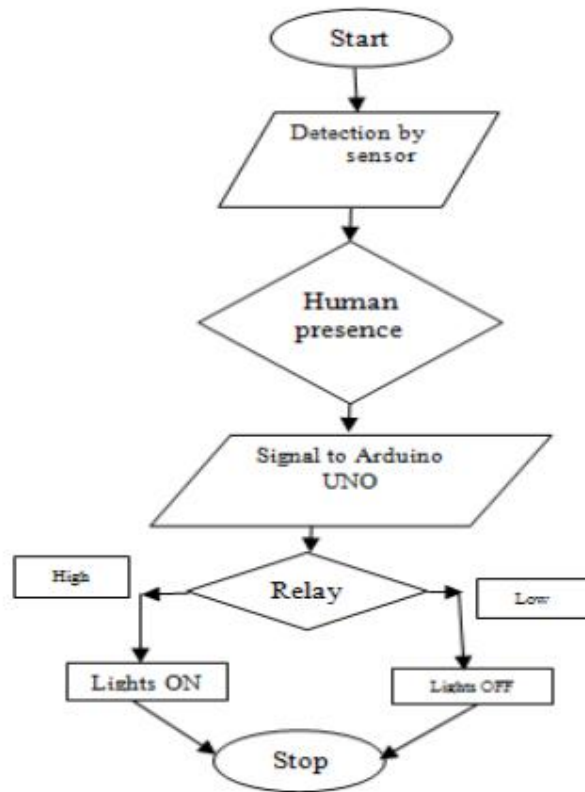

Fig 3.1Flow Chart

Functioning of this project is very simple and is explained here. Initially, when there is no human movement, the ultrasonic sensor doesn't detect any individual and it's OUT pin stays LOW. As the individual enters the room, the sensor detects the object or body through ultrasonic waves whose distance is less than 30cm (chosen by us). As a result, the output of the ultrasonic sensor becomes HIGH. Since the Data OUT of the ultrasonic sensor is connected to Digital Pin 8 of Arduino, whenever it develops HIGH, Arduino will trigger the relay by making the relay pin LOW (as the relay module is an active LOW module). This will turn the Light ON. The light stays turned ON as long as there is movement in front of the sensor. If the person leaves the room, the distance between the sensor and the object increases from 30cm and will become stable (there will be no change) and hence, the Data OUT of the ultrasonic sensor will become LOW. This in turn will make the Arduino to turn OFF the relay (make the relay pin HIGH) and the bulb light will be turned OFF. The distance

between the ultrasonic sensor and object is displayed on the serial monitor along with the variations in the distances between the sensor and the body.

IV. HARDWARE IMPLEMENTATION AND RESULTS

In this study, a tool to detect motion of objects, display the recorded distances on the serial monitor screen and produce light. The circuit was successfully connected and the program was sent to the Arduino microcontroller chip to run the circuit. The ultrasonic sensor was able to send the ultrasonic sound waves to the approaching object The limit set for the ultrasonic sensor at the distance lesser than 30cm. The results were correct since for the distance equal or greater than 30cm, the bulb did not turn ON. The serial monitor was also expected to display the variation of distances as the object approaches the ultrasonic sensor. When the power was connected to the set-up, there were values recorded in the serial monitor screen indicating that the connection was right. Fig 4.1 shows the proposed system of light control.
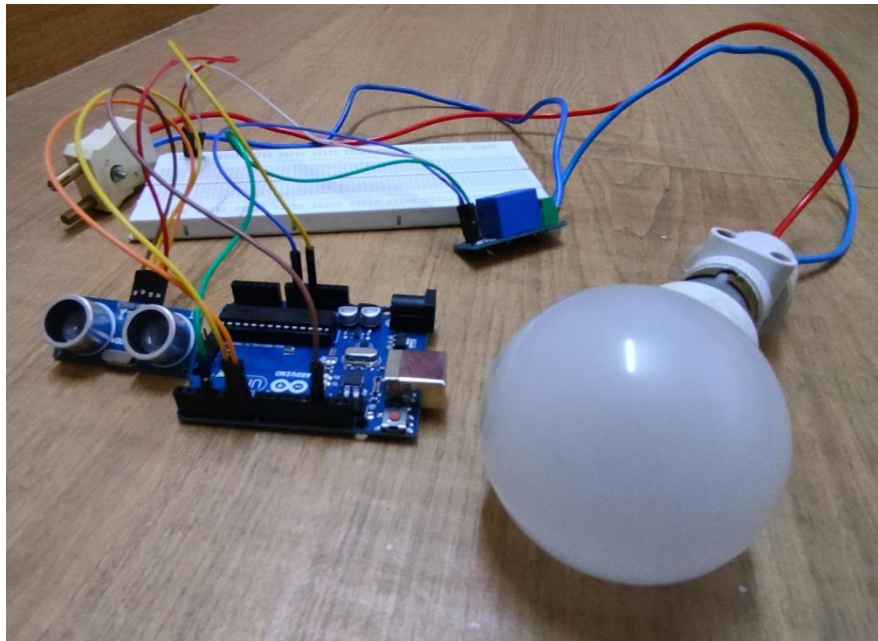

Fig 4.1Hardware implementation of the project

V. CONCLUSION AND FUTURE SCOPE

The proposed light control system is a cost effective and the safest way to reduce power consumption. When it senses, the light will glow brightly for the set amount of time. This work shows automatic light control using ultrasonic sensor as a result of which power is saved to an extent.

From this we can conclude that an approach is taken to control the lights using various devices, as nowadays enormous amount of energy is wasted in daily life. With the help of this system the energy wastage can be preserved and can be contribute to large amount of power saving. The total effective cost of system is very less.