Smart Lightning and Security System

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Abstract- As Electric Power is one of the major concerns, so the concept of the automatic lighting and security system saves the electrical energy. By using the automatic lightning, the consumption of electrical power can be minimized to a greater extent and for that sensors and microcontrollers can be designed in such a manner such that lights get ON/OFF based on motion in a room. The various sensors used for sensing the motion in an area are PIR motion sensor, IR Motion Sensor. An IR sensor senses the heat of an object and detects its motion within some range as it emits infrared radiations and this complete process can be controlled by microcontroller. Along with that security system can be applied in this concept by programming the microcontroller in such a way that if there is some movement in an area then lights must get ON/OFF automatically or any alarm must start. This chapter proposes the framework for the smart lightning with security systems in a building so that electrical power can be utilized efficiently and secures the building.

Keywords: IR sensors, IR radiations, microcontrollers.

NOMENCLATURE

IR: Infrared sensor
GSM: Global System for Mobile SONAR:
SOund NAvigation and Ranging PIR:
Passive Infrared Sensor

I. INTRODUCTION

As far as the industry is moving towards reducing man work with the help of automation. Hence, automation is playing a vital role in the growth of the economy and also helpful in normal day to day life. The main idea is to utilize the energy in an efficient way.

Automation System is a concept brought forward for smart cities buildings where the lightning system is automated i.e., when there is no movement in the room then the lights get switched off automatically and as soon as the human movement is involved the lights will get switch on by sensing the motion in a room. As there is loss of electrical energy in the homes when we leave the switches on while leaving the room. This emerging technology improves quality of living and provides them with automated secure system.

When the electrical equipments in room are plugged in there is a flow of electricity and while it is not in use then it may cause accidents such as blaze from short circuit. Users forgot to switch off the electrical devices most of time when they leave the room. So to avoid these types of incidents , smart home technology can be considered as accurate solution. With the advancement in the technology, many smart home solutions have been considered and implemented to enable security and improving quality of living. A Smart home can be said as technology which is used to make all the electronic equipment around the home act smartly i.e. automated that is highly advanced automatic system for temperature balancing, security and many other functions.

II. HARDWARE SPECIFICATIONS

3.1 PRIMARY COMPONENTS

3.1.1 Aurdino Mega2560

A small computer on a single integrated circuit can be referred as Microcontroller. It consists of one or more processors with memory and programmable input- output peripherals embedded. The Aurdino Mega is a micro-controller board which is consists of analog and digital input-output pins that may be interfaced to other circuits and cables. It consists of has 54 digital input/output pins out of which 14 are used as PWM outputs, 4 UARTs (i.e. hardware serial ports) and 16 analog inputs, a USB connection a power jack, an ICSP header, a 16 MHz crystal oscillator and a reset button. It consists of whatever is required to support microcontroller. It simply just connects to the computer along with the USB cable with AC-to-DC adapter and battery to get started. The operating voltage is 5 V with input voltage of 7-12 V. The SRAM is 8 KB and EEPROM is 4 KB. The pins can be defined as :

Table 1

S.NO.	RX PIN NO.	TX PIN NO.
0	0	1
1	19	18
2	17	16
3	15	14

Table 2

EXTERNAL INTERRUPTS	PIN NO.
0	2
1	3
2	21
3	20
4	19
5	18

Table 3

SPI PINS	PIN NO.
MOSI	51
MISO	50
SCK	52
SS	53
SDA	20
SCL	21

Figure 1

3.1.2 Sensors

For a smart lighting system Sensors are the major part and hence, power can be generated by combining the suitable sensors with the microcontroller. Infrared and Ultrasonic sensors are used for smart lightening. Infrared sensors are the electronic devices which sense the surrounding's characteristics which include the measuring of heat which is being emitted by any object in its range and also can detect the motion using infrared radiations. Ultrasonic sensors are devices which measures the distance to an object by using sound wave i.e. the sensors will detect the object by sending an echo. Distance between emitting short ultrasonic burst which will reflect back the sensor which will be controlled by micro controller can be measured by sensors. The ultrasonic sensors emits the short burst of 40 KHz which will travel through the medium of air and when it will hit the object it bounces back again to sensor.

3.2

3.2.1.1 Ultrasonic Sensors

It works on the principle of reflection of sound and for that it uses SONAR (SOund NAvigation and RAnging) technique which works on propagation of sound. The sensors are controlled by the microcontroller and on supplying the current by micro controller the sensors emits an echo which when strike by the object , the distance of object will be detected. That echo will reflect back to sensors and sensors will record all the readings through that. The Operating voltage for these sensors is 5 V with current of 15 mA. The effectual angle for the sensors is less than 15 and it can cover range 2 cm – 400 cm or 1'' to 13 '' feet. The total numbers of pins are 4 which are as follows:

Pin – echo for receiving input sensor (output) Pin –
   trig for sending ultrasonic signal (input) Pin – vcc
   power input
   Pin – gnd ground

3.2.2 Relay Module

The Relay module in smart lightning system controls the high voltage electronic devices by turning the current on or off, letting to go through it or not. This is a switch which actually operates with the help of electromagnet. When the electromagnet starts with low voltage, say 5 volts from aurdino microcontroller, it pulls contact to make or either break a high voltage circuit. The trigger voltage is 5v DC with the current of 70mA. The maximum AC load is 10A (250/125v AC) and the DC load is 10A (30/28v DC). The maximum switching it can operate on is 300 operating/minute. The relay module has 5 pins which are described as:

PIN NUMBER	PIN NAME
1	COIL END 1
2	COIL END 2
3	COMMON (COM)
4	NORMALLY CLOSE(NC)
5	NORMALLY OPEN(NO)

Table 4

Figure 2

3.2.3   Light Dependent Resistors

The Light Dependent Resistor also called LDR or photo resistor can be defined as device whose function is to resist incident electromagnetic radiation. This consists of semiconductor material with high resistance. The LDRs works on the theory

Figure 3

of photo conductivity in which the conductivity of material is increased whenever the light is being absorbed by material. When the light falls on the material the electrons in its valence band of semiconductor material got excited to conduction band. Through this process more current start passes through the device.

3.2.4   Connecting Wires

The Connecting wires used in home automation are of two types. These are Jumper wire or DuPont Wire. They are the electrical wires which is grouped in a cable, with a pin or connector at each end. The operating voltage is 5 - 12 V. These are considered as best in end to end connections with peripherals. There are three types of connecting wires which are as follows:

1. Male – Male
2. Male – Female
3. Female – Female

Figure 4

4. Proposed Framework

It works on principle of sound in the room i.e. sensors will sense the object by emitting the ultrasonic burst in the room and when the echo gets detected by the object, the sensor will measure the readings from that. Whenever there is little bit of heat is produced by the object or, can say that when human being enters into the room, it will have some temperature and when the echo sense that it will respond it back to sensors. Light Detecting Resistors act as insulator and it exhibits high resistance while in darkness it has low resistance and

allows the current to pass through for flow of electricity.

The Light Detecting Resistors operate in the course of sensors and then these got activate underneath with lowest illumination condition and then controlled by the Amega micro-controller.

The circuit of Aurdino microporocessor has low power whereas the high performance micro controller is being programmed and this is done through embedded assembly programming laguage to implement the tasks. This program is operated and stored by storage devices which are EPROM.

1. Pin no. 1 of LDR is being attached to A0 port of Ardino mega- 2560 processor board.

2. All the IR sensors are attached to port no. 2, 3, 4, 5 and 6 (digital), which is the input signal to the micro processor board.

3. Connect it to the ground of sensors which are there to the GND port.

4. The LED's are connected to the output signals, to port no. 8, 9, 10, 11 and 12.

5. Then again the ground of all the sensors are connected to the GND port.

6. Power is then passed to the Arduino (7 - 12 V).

Figure 5

Sensors

Connecting Wires

Microcontroller

Relay Module
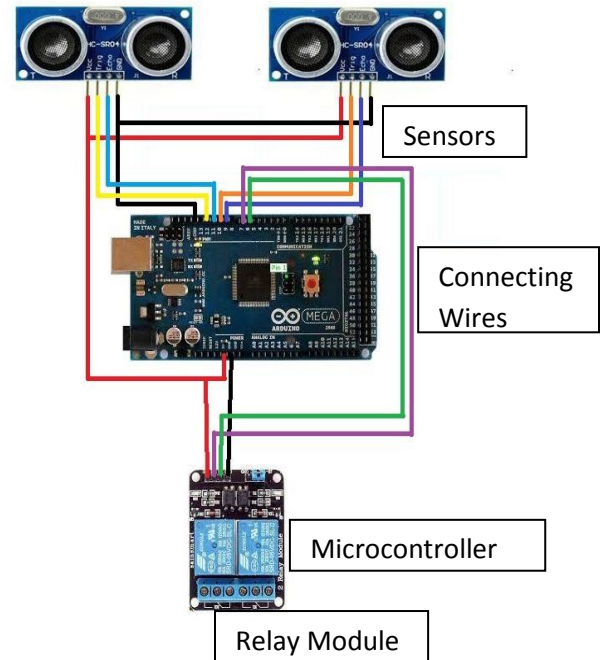
CONCLUSION

This chapter proposed a framework for smart lightening with security systems in a smart building. The main purpose to propose this framework is to save the electrical energy. By the use of automatic lightning, the electrical power consumption can be minimized and for that sensors and microcontrollers can be designed in such a manner such that lights get ON/OFF based on the motion in a room. Along with that security system can be applied in this concept by programming the microcontroller in such a way that if there is some movement in an area then lights must get ON/OFF automatically or any alarm must start.

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