

Operation and Control of Human Sensible Loads

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Abstract— The infrared radiation is a form of waves coming out from human. A normal IR sensor works by sending and receiving radiation from IR transmitter and receiver. In this paper we design a system, by which the human presence or occupancy and their motion can be detected by detecting the infrared radiation coming out from the human body can be detected by using a conventional type sensor called PIR sensor (Pyroelectric sensor) and an Ultrasonic sensor is used to position the object and also to confirm the human occupancy. Here the whole process has been carried over in the ATMEGA 328 microcontroller. Along with this LM35 is used to detect the room temperature, with that room temperature can be maintained.

Key words: PIR Sensor; ATMEGA328; Ultrasonic Sensor; Digital Lamp Dimmer Circuit

I. INTRODUCTION

In the public or the private area, where people crowd gathering, in such a case a large number of electric loads like fan, lights etc. are utilized at the same time. In such a case, when the people leaving the place may hesitate or forget to switch off the electric loads. There occur a problem of wastage of large amount power in that place. This problem can be overcome by means of operating the electric according to the human presence or occupancy. The IR radiation coming out from the human body is the key factor for this system. Detection of such a kind of radiation plays a vital role in detection and sensing of human presence, occupancy and their motion. The signals from the PIR sensor does not detect the exact human presence only, but also gives the output values for the other animal body. The signal detected from the PIR and the Ultrasonic sensor combination gives the more reliable detection of the human.

The another method of using the pyroelectric infrared sensor has three different methods. Moving the sensor with motor, wearing it on the hand and masking the sensor[2]. The method of using the two PIR sensor combination at two different heights can easily differentiate the human and the animal intruder in a particular place[4]. Another new method involves a fabricated prototype infrared sensor which detects the human at different levels of radiation where recorded such that it can differentiate the intruders in the place[3].

All the methods explained above the complexity of differentiating the intruders while operating in a place of operation. In this paper we designed a new way of operating the Pyroelectric infrared sensor with the combination of ultrasonic sensor, which gives a reliable way of detecting the human presence and also enables the system to operate the electric loads according to the human presence. This combination operates together at the same field of view such that the human and the animal differentiation can be done easily, such that the operation of loads according to the human presence detection can be made feasible at a higher response. Along with this a temperature sensor is employed

to detect the room temperature, such that the temperature of the place of operating this will determine its operating surrounding temperature such that the sensor can pre determine its operating temperature and also the level of operation.

This prototype design can be made to operate in the real time application. This combination will operate more reliable on the real time operation of the electrical loads. Which gives an automatic operation. Such that the unwanted wastage of energy can be rectified in the public or private place.

II. SYSTEM ARCHITECTURE

The system architecture gives the function of all the process carried in an embedded system. By means of this representation the process flow can be tracked.

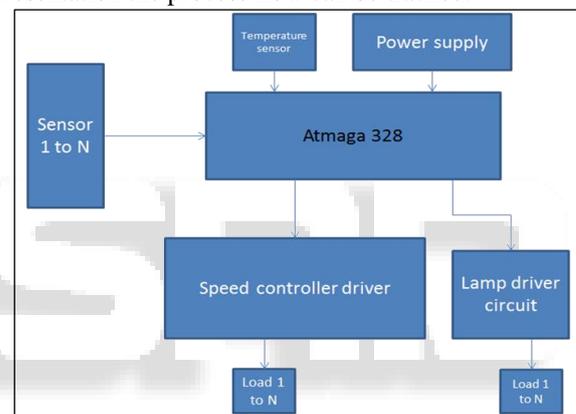


Fig. 1: overall operation architecture

In the shown fig.1 the overall operation can be explained. At the first the microcontroller send the ready command to all the sensors. The operation of the sensor are predefined in the microcontroller such that the all the function and control can be made in a systematic way. In the sensor part the Combination of both PIR and the Ultrasonic sensor will be in ready state. As the PIR sensor have two half i.e. A and B such that, if there occur any temperature difference because of detection of IR radiation from the human, the sensor will generate the output signal to the microcontroller. Though the PIR sensor is caped with the Fresnel lens, such that the scattered IR radiation from the human body can be focused in to the pyroelectric detector in the passive infrared sensor. so that the sensor can detect the slight temperature in the surroundings. On the other side the function of the ultrasonic sensor has been taken. The ultrasonic sensor is operated to detect the position and the height of the object such that the human presence or occupancy can be detected in precise manner. The combination of these two sensors gives the precise output by means detecting the human presence. The intensity of the IR radiation depends on the size and distance at which the object is located. According to the number of electric loads to be operated with the sensor system in the place the driver circuits are employed. Depending on

the area of the place it is going to operate the number of required will be determined.

III. HARDWARE DESCRIPTION

A. PIR Sensor

A conventional type PIR sensor have a Fresnel lens at the front, which covers the Pyro-electric detector. This Fresnel is designed in such away the it could focus the IR radiation coming out from the human body to the pyro-electric detector. The pyro-electric detector have two range of detection in their vertical angle namely A & B. whenever there occur a temperature difference between these two range the output is generated by the sensor.

B. Ultrasonic Sensor

Ultrasonic are the waves of sound. Fig.2. shows the pictorial view of this sensor. This sensor have two parts namely transmitter and receiver. The transmitter transmits the ultrasonic waves and the detector detects the reflected waves comes back. The difference in the time between the transmitted and received signal gives the information about the distance of the object. The wave is transmitted in a straight direction

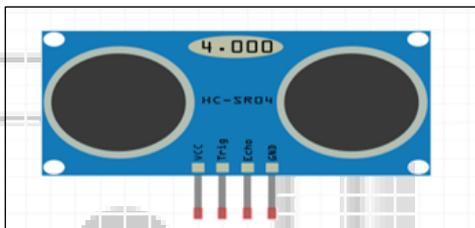
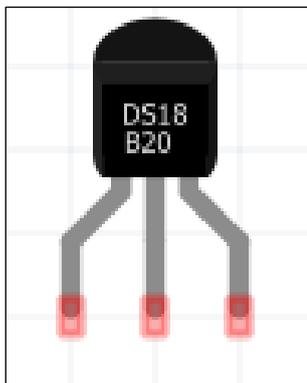


Fig. 2: Pictorial view of ultrasonic sensor
Distance of the object = $\frac{\text{TIME} \times \text{SPEED OF SOUND}}{2}$

Time =time between transmission and reception of wave.
Speed of sound=341 meter per second.

Division by 2 denotes the wave travelled by two times.

C.DS18B20(Thermal sensor)DS18B20 is digital temperature sensor that can be used to measure the temperature of a place or Home with an electric output comparative to the temperature in Celsius.It has the output voltage of this sensor is proportional to the Celsius and it does not need any temperature calibration and maintenance.It is used to detect the precise centigrade temperature .however its output changes shows its linearity.It can measure temperatures from -55C (-67F) to +125C (257F), which is perfect for general usage at home.



Vin data GND

Fig. 3: pictorial view of DS18B20 temperature sensor from fritzing for the embedded system. Here it is connected to all the sensor explained before such that the processing and controlling operation can be done easily.

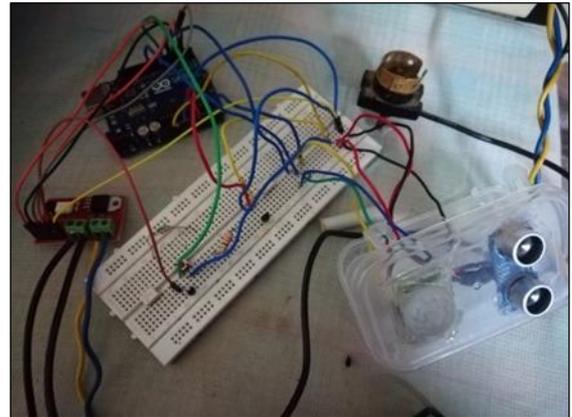


Fig. 4: PIR and Ultrasonic sensor combination, with driver circuit

The function of DS18B20 is to detect the temperature of the surroundings, with the help of this the electric loads can be controlled in easy way. This method gives a systematic control.

The shown flow chart gives the process involved in the overall operation of this system. First the sensors are in the ON state, it continuously check the intrusion of any IR radiation from the surroundings. If there is any detection, then it send signal to the microcontroller. Then the microcontroller immediately check the ultrasonic sensor condition and their limits. If both the sensor are in the limits, then the microcontroller switch on the relay. The electric loads are connected to the relay, such that the loads can be operated. This process continuous until the limits set in the microcontroller fails. The function of this process can be changed according to the program encoded in the microcontroller. Once the process set to the desired output the microcontroller continuously runs the process at infinite number of times. Which means the process in the microcontroller is a continuous work. If there is any interruption in this process may give wrong output.

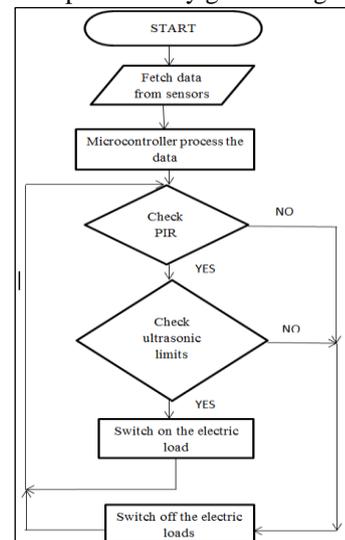


Fig. 5: flow chart of the operation involved in the sensors combination.

IV. RESULT AND DESCRIPTION

As the output obtained in the separate simulation of these sensor had been noted. The prototype model of the sensor combination senses the human presence at the range of 7 metre length and 4 metre width and it operates the load according to the human presence in their field of view. The accuracy may varies at the length of 10 to 50 centimetres.

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V. CONCLUSION

This method gives an easy way of detecting the human presence. By means of this project the unnecessary power loss can be avoided, particularly in the people gathering in the large area. Further most this method can be used for security and surveillance purpose. In addition to this novel sensor can be added, such that thermal radiation of different can be extracted for simplified output.

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