

# Arduino based design of Smart energy saving system

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# Arduino based design of Smart energy saving system

*Thesis is Submitted in partial fulfillment of the requirements for the award of the degree of*

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Submitted by

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*based on research carried out  
under the supervision of*  
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## *Certificate*

Date:15-05-2016

This is to certify that the work in the thesis entitled ” **Arduino based design of Smart energy saving system**” submitted by Gopirajunaik is a record of an original research work carried out by her under my supervision and guidance in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology in Computer Science and Engineering, National Institute of Technology, Rourkela. Neither this thesis nor any part of it has been submitted for any degree or academic award elsewhere.

**Dr.Suchismita Chinara**  
(Project Guide)

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Gopirajunaik

## **Abstract**

”Now a days power management is very important. In the world different sector there are so many loss of energy. So i have design an conservation of energy system for saving the power from electricity. I have used PIR that is passive infrared sensors which used to detect presence of human being. for this managing power i have design and did a circuit which is project names ”To design and control The class room electrical appliance for multiple entry by using arduino” which detect the presence of human being and glow the particular appliances in the absence of the human being the particular appliance will switch off.” Remote sensor systems make a vast range out of ebb and flow research because of advances to empowering propels in equipment and programming. The structure and idea conduct of these systems represents a test as far as programming advancement, and requires novel programming procedures and advances. Specifically, the dynamic topology of a remote sensor system and utilization of agreeable handling for circulated programming kills established techniques for system correspondences and association. This report inspects the qualities of remote sensor systems regarding the compelling of framework prerequisites on the subsequent programming design

# Contents

<b>1</b>	<b>Problem Definition</b>	<b>1</b>
<b>2</b>	<b>Introduction</b>	<b>3</b>
2.1	Background . . . . .	4
2.2	Motivation . . . . .	5
2.3	Contribution . . . . .	6
<b>3</b>	<b>Literature Review</b>	<b>7</b>
<b>4</b>	<b>Hardware Description</b>	<b>9</b>
4.1	Block Diagram . . . . .	9
4.1.1	Block diagram description . . . . .	9
4.2	Micro controller . . . . .	11
4.3	Liquid crystal display . . . . .	13
4.3.1	LCD Screen . . . . .	14
4.4	Power Supply . . . . .	15
4.4.1	Transformer . . . . .	16
4.4.2	Rectifier . . . . .	17
4.4.3	Voltage regulator . . . . .	17
4.5	System Circuit Design . . . . .	19
4.5.1	Relay switch circuit . . . . .	20

4.5.2	Circuit Description . . . . .	20
<b>5</b>	<b>System Software Description</b>	<b>22</b>
5.1	Controlling class room devices in various form for multiple entry . . . . .	22
5.2	Flow diagram of the Algorithm . . . . .	23
5.3	Algorithm . . . . .	23
<b>6</b>	<b>Conclusion and Future Work</b>	<b>26</b>
6.1	Latest Technology . . . . .	26
6.2	Reference . . . . .	27

# List of Figures

2.1	Wireless network . . . . .	5
4.1	Block diagram of the circuit . . . . .	10
4.2	Hardware Design . . . . .	12
4.3	LCD display . . . . .	14
4.4	LCD Screen . . . . .	15
4.5	Power Supply Circuit Diagram . . . . .	16
4.6	Transformer . . . . .	16
4.7	Rectifier . . . . .	17
4.8	(a)Voltage Regulator . . . . .	18
4.9	(b)Regulator . . . . .	18
4.10	System Circuit Design . . . . .	19
4.11	Relay circuit diagram . . . . .	21
5.1	Detection movement of human being . . .	24
5.2	flow diagram . . . . .	25



# List of Tables

# Chapter 1

## Problem Definition

In many Educational Institutes and other sector there is large amount of loss of energy because of different electronics devices light,lamps,street light and other source of electronics devices.this is leads to maximum amount of electricity wastage takes place and this huge amount of energy wastage is increasing in every day in all the world.The sensor network is basically built of various sensor nodes where each nodes typically contain radio transceiver, microcontroller, battery etc. The energy efficient class room basically deals with the reduction of the energy wastage. Number of human being counting is the interset of the scenario.On condition that the original lightening system of the class room is not disturbed, the sensor nodes are installed in the entrance door and adjust the range of every sensor so as to prevent it from interference. Sensor node perceives the human signal and if the direction of the human being is inside the class room then the count of the number of human inside the class

room is increased by one and the light goes on and remains illuminating as long as all the human being does not leave the class room

# Chapter 2

## Introduction

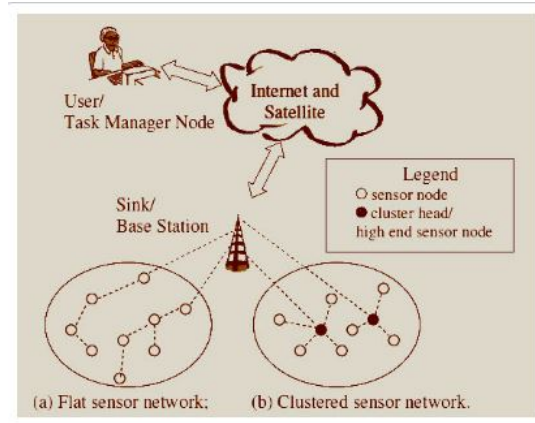
A Wireless Sensor Network is a wireless network system comprising of spatially dispersed independent gadgets utilizing sensors to screen physical or ecological conditions. It commonly takes the data from the environment are temperature, speed, wind direction, intensity, chemical concentration. The sense nodes works with each other to get some event from surroundings and the data gathered from each sensor node are transferred to the base station for further procesing in-order to process the required result. The wireless sensor is built of various sensor nodes wich is also called as Motes, basically consist of one or more radio, analog circuit, micro-controller, battery, sensor interface etc. Each motes have sensing, computing and communication capabilities

## 2.1 Background

The wireless sensors are the network in which autonomous distributed across a geo-graphical region to monitor the light, motion, pressure and ect. Recently in in Andhrapradesh they develop a World Summit on the Information Society (WSIS) 2016 in Hyderabad by Harita-Priya which detect the specific climate data from farms and give farmers personal information through SMS they use wireless sensors which detect the micro-climate information from the farms. In this project i have used 4 PIR (passive Infrared Sensor) which used to detect the motion of human beings. Like the other sensors they detect the all the objects which is passing through the infrared rays. These sensors detect the motion of persons at a distance of 10 meters with an angle of +15 and -15 degree. these sensor uses power supply 3.3v to 5v.

The convention stack utilized by the sink and all the inaccessible found remote sensor hub comprise of application layer, transport layer, network layer, data link layer, physical layer, power management plane, mobility management layer, and task management plane. The transport layer serves to keep up to ow of information. The network layer is mindful to course the information got from the transport layer. The power management plane

Figure 2.1: Wireless network



is mindful to keep up how the power is utilized by the sensor hubs i.e., the sensor hubs ought to turn after accepting the information to maintain a strategic distance from the copy the information and when the network level to any sensor hub goes down it ought to advise all its neighbor hub that it can't take an interest in the directing the information. The mobility management plane is dependable the recognize the development of the sensor hub and give the capacity to keep up the track of its neighbor hub. The task management plane balance and schedule the task of various sensor node in specific areas.

## 2.2 Motivation

For the development of the nation we should need to conserve the electricity. Every day there is lot of energy is wastage is take placing. It is common in every sector they wasting a lots of energy which is leads to decreas-

ing the energy in every day to day life. And according to the statics, in 2005 shandong university electricity fees was 10,470,000 Yuan of which, lighting accounts to 40consumed and remaining energy is wasted due to the remained un-attended. And this consumption goes on increasing yearly

### **2.3 Contribution**

In order to control energy wastage in different sectors the door is connect with the PIR sensors which is detect the human entries if any person enters into the room then the particular electrical appliance will on and the number of the count of the human being will be display on the lcd display.if the particular room is empty then the sensor which count the number of human in the room is zero and it off the particular electrical appliance in the sector.In this section i have used 4 pir sensors which is for multiple doors entry so that it detect the people in the entries it takes the input data from the sensor and gives to the output of the ariuno and it make the person count to increment and it display on the lcd.

## Chapter 3

### Literature Review

Conservation of energy means using the sufficient energy for our needs. Every day in different ways we are wasting the energy, like in the class room, glowing of street light with high intensity and etc., so every day there is a lot of wastage of energy taking place. So the main economy of a nation depends upon the using the efficient amount of energy. Recently Coal India Limited has developed a household coal sale technology by which they can conserve the energy and there is more gain of profit to the nation. There is 20 percent of energy is wasting in the class rooms and remaining 60 percent of energy is wasting in the other sectors in the nation. To prevent these energy need to use LED light and some other new technology for minimize the amount power usage. This wasting of energy can be conserve by using better wireless sensor in different industries. These sensors detect object and they make the decision with respect to the object whether it has to make switch On or Off. So developing



these wireless sensors circuit giving the connection with the electrical devices then we can able to use the conserve the energy and it will be helpful to the next generation. By these sensors they detect the micro climate condition and other environment changes give the result to the required destination.

# Chapter 4

## Hardware Description

### 4.1 Block Diagram

#### 4.1.1 Block diagram description

1. Microcontroller : AT89S52 is used to communicate various components present in the circuit. Code which is suitable for the project is dumped in to the microcontroller

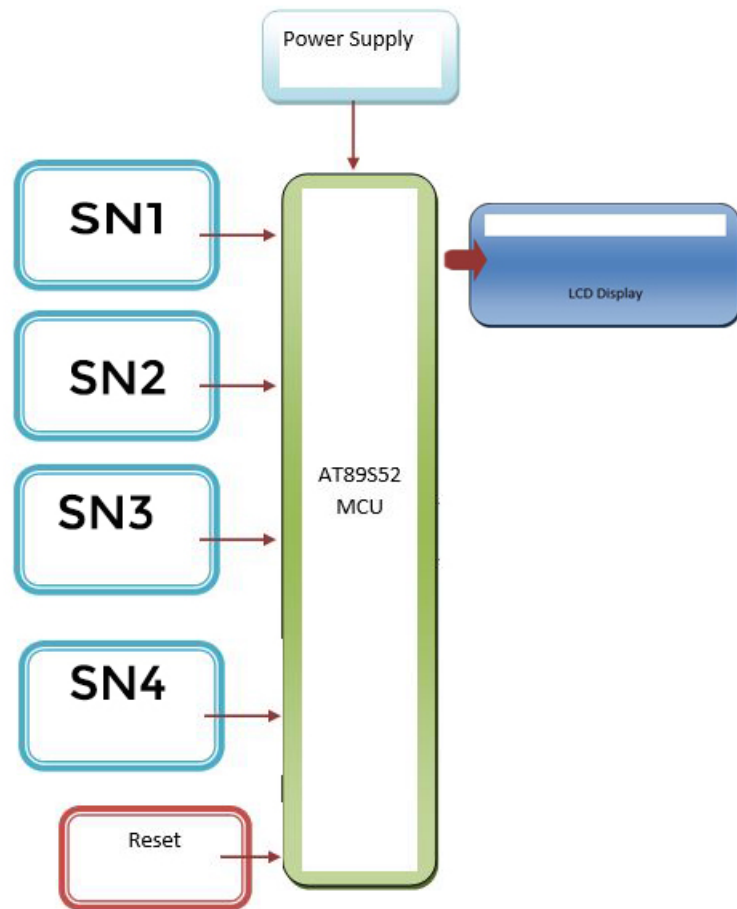
2. Power supply : All the components of the circuit require 5v of dc power supply

3. The LCD display is used to display the current state of the class room.

4. Passive Infrared Sensor (PIR): These sensors are used to detect the motion of person which is eject from infrared radiation from human beings.

Figure 4.1 represent the total block diagram of the system and the internet shield is connect with the ATMEGA

Figure 4.1: Block diagram of the circuit

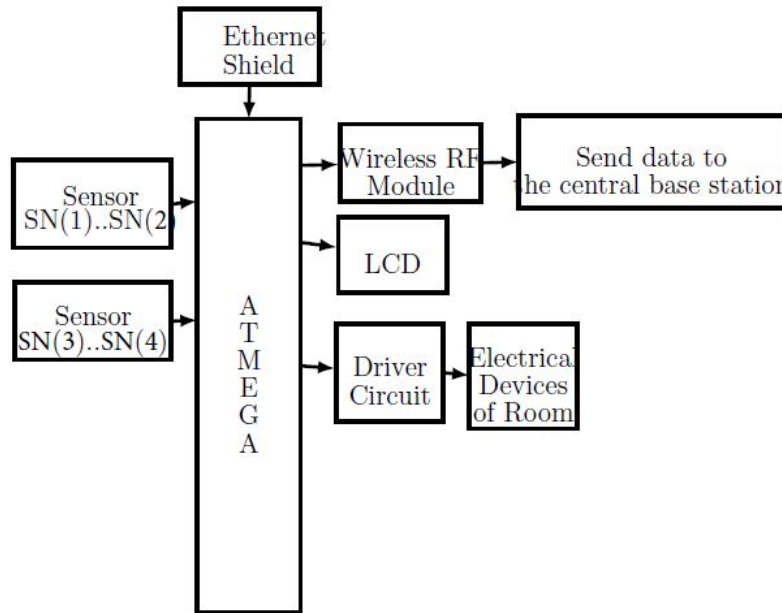


to facilitate at web server.it this we user the four sensors which is represented as SN1,SN2,SN3 and SN4.The lcd is connet with the arduino which connect the input pins with the arduino which takes the input from the arduino and it display on the screen and it print the out put of the data.The PIR sensors used as human detection which detect the presence of human and here i have used the step down transformer which use to step down the 5v from the source and the entire circuit is working with the 5v power supply. if a human being pass from sensors then they detect the presence and it count the number of persons enter into the room.In this the sensor(SN1) which detect the presence of human being and it wait for some time to detect the second sensor(SN2) and it display the the number human beings enter into the class room and then particular electrical appliance switch on.if the person cross from sensor SN(2) to sensor SN(1) then it decrease the count in the number and which display the out put on the LCD display.

## **4.2 Micro controller**

Here, we are using Arduino Uno as the microcontroller which belongs to the ATMEGA328P. The system provides the set of analog & digital input and out-

Figure 4.2: Hardware Design



put pin though which can be used for interfacing with different circuits or another boards. It has 16 digital input/output pins out of which 6 pins can be used for pulse width modulation (PWM) at about 500Hz frequency, 6 analog input and output pins, a 16 MHz crystal oscillator, a USB connection for burning the command from Arduino GUI software to Arduino board, a power jack, a circuit serial programming header provides the ability to logical device, micro-controller, or other embedded devices to be programmed while installed in the computer system and provides the ability of easily burning the command from computer system to Arduino microcontroller, and reset button which is used to refresh or erase the memory. Its operating voltage is 5V. Arduino

uno has a 32KB of ash memory to store the command, 2 KB SRAM, 1KB EEPROM.

### **4.3 Liquid crystal display**

LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons

- 1.The declining prices of LCDs

- 2.The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters

- 3.Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data

- 4.Ease of programming for characters and graphics. These components are specialized for being used with the micro-controllers, which means that they cannot be activated by standard IC circuits. They are used for writing different messages on a miniature LCD

A model described here is for its low price and great possibilities most frequently used in practice. It is based on the HD44780 microcontroller (Hitachi) and can display

Figure 4.3: LCD display

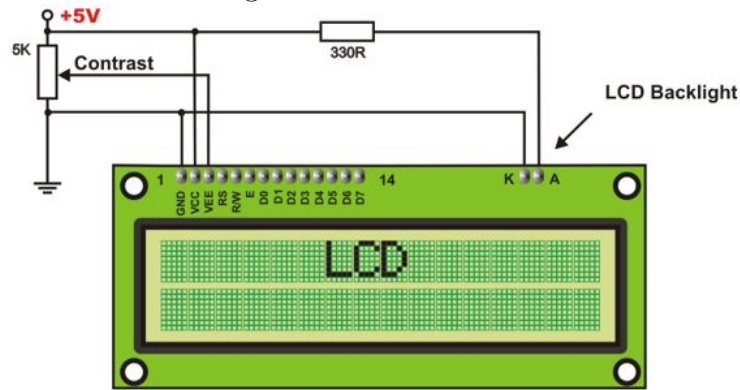


messages in two lines with 16 characters each. It displays all the alphabets, Greek letters, punctuation marks, mathematical symbols etc. In addition, it is possible to display symbols that user makes up on its own. Automatic shifting message on display (shift left and right), appearance of the pointer, backlight etc. are considered as useful characteristics.

#### 4.3.1 LCD Screen

LCD screen consists of two lines with 16 characters each. Each character consists of 5x7 dot matrix. Contrast on display depends on the power supply voltage and whether messages are displayed in one or two lines. For that reason, variable voltage 0-V<sub>dd</sub> is applied on pin marked as V<sub>ee</sub>. Trimmer potentiometer is usually used for that purpose. Some versions of displays have built in backlight (blue or green diodes). When used during operating, a resistor for current limitation should be used (like with any LE diode)

Figure 4.4: LCD Screen



## 4.4 Power Supply

### Power Supply Circuit

In fig 4.4 the circuit consist of step down transformer ,Bridge rectifier,Capacitor,Voltage regulator,Resistor,and diode.

- 1.Initially from source there is 230v of power supply into a primary winding it step down the voltage into 12v in the secondary winding.
- 2.The power is passes through bridge rectifier and it convert the ac voltage into dc voltage.
- 3.its input and output are connect with the capacitor for storing electrical charge.
- 4.Voltage regulator connect with the capacitor which regulate steady voltage to 5v in the circuit.
- 5.the output of the voltage regulator is connect with the input of the sensors.



Figure 4.5: Power Supply Circuit Diagram

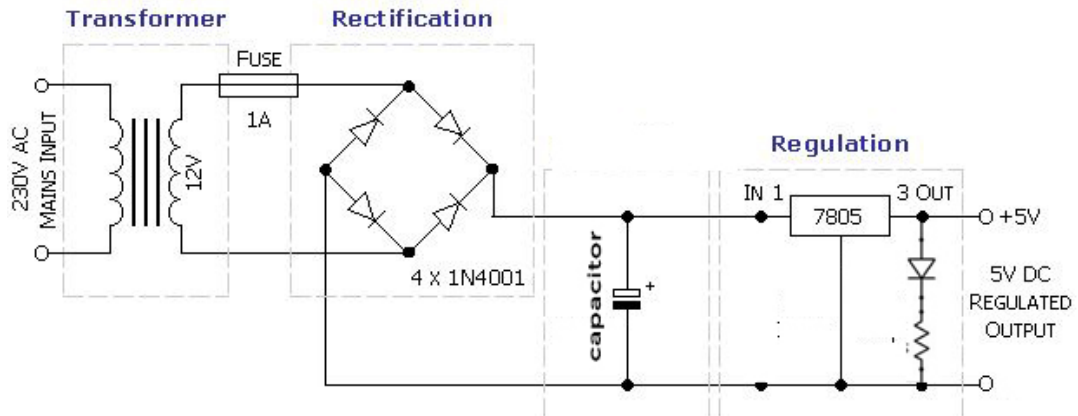


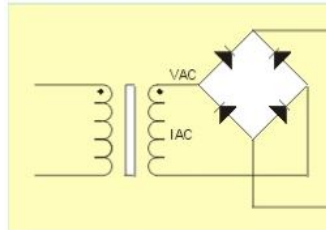
Figure 4.6: Transformer



#### 4.4.1 Transformer

In fig the transformer is connect with the bridge rectifier. In primary winding it passes 230v of power supply and it gives output to the secondary winding 12v with 500mA current to the rectifier. Usually in our circuit the transformer is with 0-12v of power supply

Figure 4.7: Rectifier



#### 4.4.2 Rectifier

In fig 4.4.2 the rectifier is connect with the step down transformer with passes 12v of power into the rectifier. Bridge rectifier is consist of 4 diodes. Two diodes conduct during the negative cycle while other two will conduct during the positive cycle. Rectifier is an electrical device which convert AC into DC current which can give only one direction with complete process in the circuit.

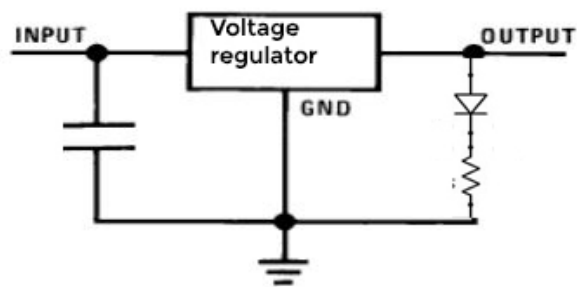
#### 4.4.3 Voltage regulator

In fig 4.4.3(b) the voltage regulator has three pins In, Out and Ground. The input pin is connect with the positive node and its ground is connect with the negative node of the capacitor. Initially 12v of DC power is passes to the regulator and it regulate the voltage in 5v of power with steady 5v power supply in the circuit.

Figure 4.8: (a) Voltage Regulator



Figure 4.9: (b) Regulator





### 4.5.1 Relay switch circuit

In fig 4.5.1 Relay is act as switch to the circuit.It takes 5v of power from the circuit and it gives output 230v of power to the bulb for glowing in the circuit.

### 4.5.2 Circuit Description

In this circuit the LCD is connect to the Arduino with different pins are:

LCD RS pin to Digital pin 12

LCD Enable pin to Digital pin 11

LCD D4 pin to Digital pin 5

LCD D5 pin to Digital pin 4

LCD D6 pin to Digital pin 3

LCD D7 pin to Digital pin 2

and the other 4 sensors have given input data with the sensors.They connect with the arduino board are:

*Pir sensor<sub>1</sub> with Digital pin 9*

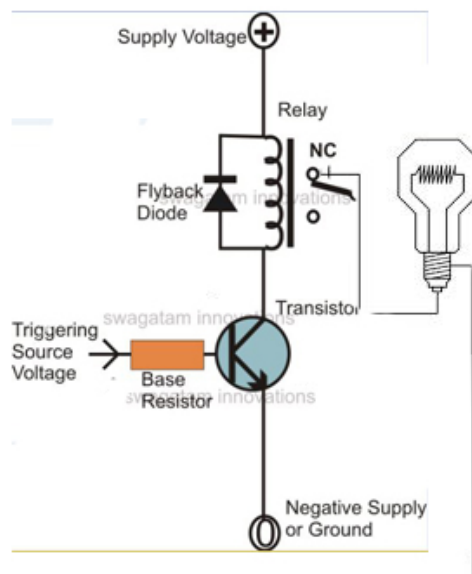
*Pir sensor<sub>2</sub> with Digital pin 10*

*Pir sensor<sub>3</sub> with Digital pin 6*

*Pir sensor<sub>4</sub> with Digital pin 7*

*the transformer is used as power supply for complete circuit and if any*

Figure 4.11: Relay circuit diagram



# Chapter 5

## System Software Description

### 5.1 Controlling class room devices in various form for multiple entry

The PIR Sensors are use to detect the motion of human beings. Like the other sensors IR they detect any object which passes from its radiations. In PIR sensors they radiate the rays in return they take the reflection and detect the presence of the human. These sensors are kept in a class room which used to detect the presence of the human being and it count the present state of the class room. Here i have used 4 sensors for detect the motion of human beings for multiple entry in a class room. If the count of the sensor is one then the particular appliance need to switch On. If the count of the student is decreases it become zero then the particular appliance switch Off. Here the current state of the class room will be display on the LCD display. Here the sensors SN1, SN2 are the doors entry for the first door and Sensors SN3

and SN4 are the doors for the second class room entry. If a person crosses from SN1 to sensor SN2 then there will be an increment in the current state of the class room and the particular appliance should be glow. If the person entry from sensor SN3 to SN4 then also there will be the increase in the current state of the class room will be take place and it is display on the LCD display. If the class room is empty and he cross from sensor SN2 to SN1 then there will be the decrease in the current state of the class room then the particular appliance should be switch off. u may can see in the fig below diagram.

## **5.2 Flow diagram of the Algorithm**

### **5.3 Algorithm**

Algorithm for controlling the electronic Device

1. Initially the sensors are placed and there is no entry so count==0;
2. Calibrate the timing of the sensors for few seconds
3. If any person cross from any of the sensor the first the sensor receive the data sink and wait for other data will



Figure 5.1: Detection movement of human being

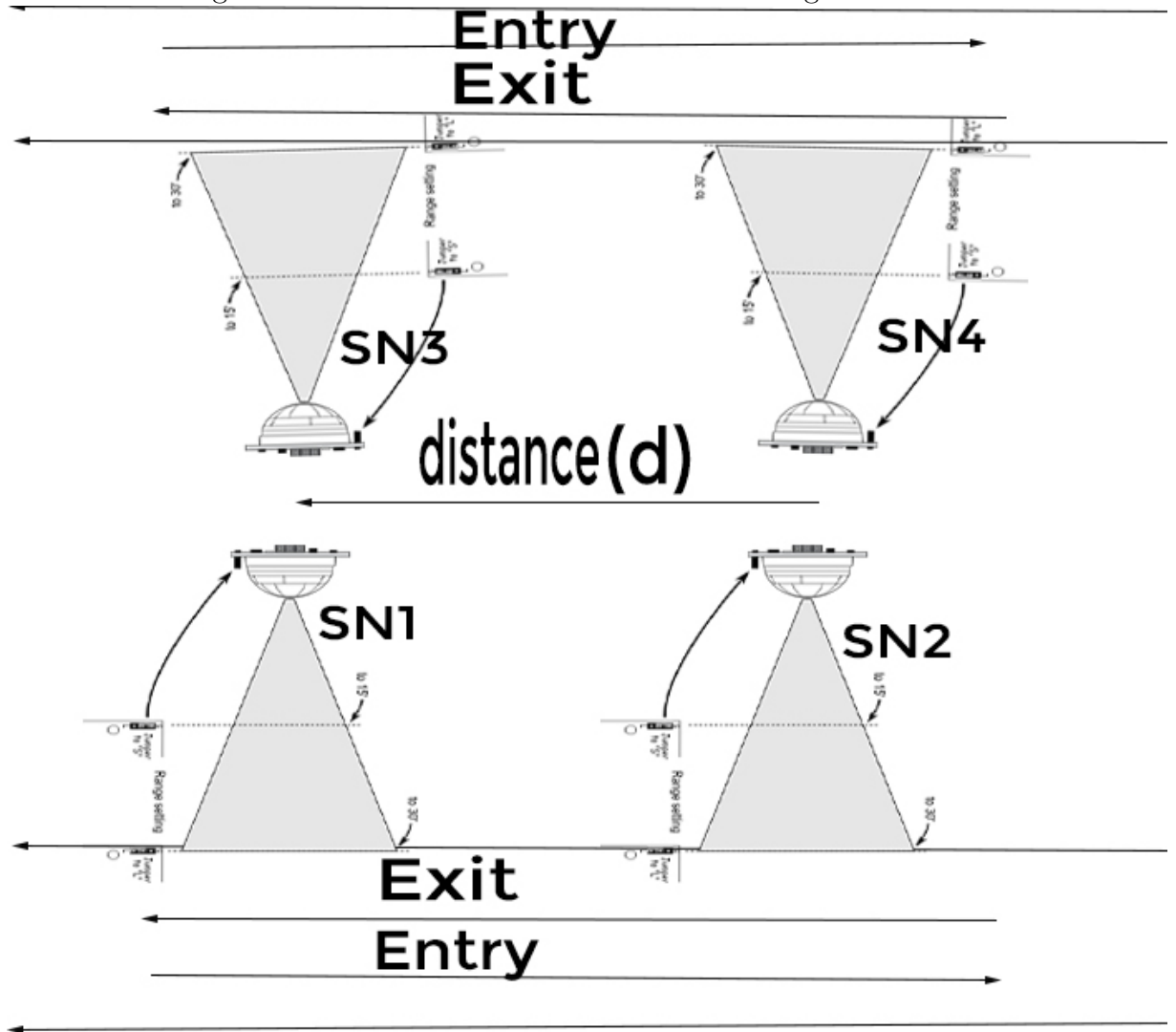
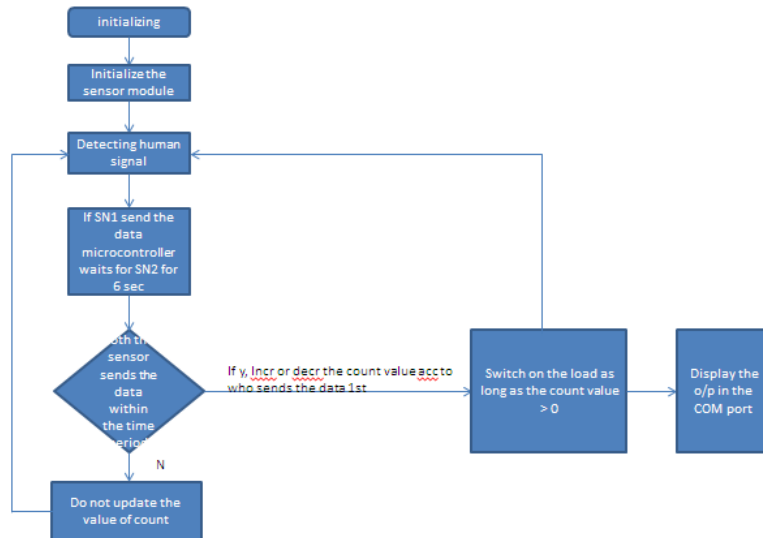


Figure 5.2: flow diagram



be communicate within fraction of second

4.If the sensor is entry type then the count value of the current state of the class room is set to increase one

5.Then the particular bulb is On

6.If the sensor is exit type then the sensor is decrease to once and if the sensor count==0 the

7.The particular bulb is switch to Off.

## **Chapter 6**

### **Conclusion and Future Work**

In this project i did work on sensors and it used for the conservation of energy efficient. These sensors detect the presence of the human being who is transfer from the sensors and it gives the data to the arduino and the arduino gives its input to the particular electrical appliance then it turn to On. If the person is not present in the particular rum them the sensor detect the persons movement and he transfer from the sensor then it gives the empty of the current state of the class room and it turn to Off. These type of designing circuit are used to conservation of the the energy sources in the nation

#### **6.1 Latest Technology**

Recently a new technology which is developed in the state of Andhrapradesh using wireless sensors which is called "World Summit on the Information Society(WSIS)" 2016 this technology which collect very specific climate data

from farms and give farmers personalised information through SMS.

## 6.2 Reference

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