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DESIGN AND IMPLEMENTATION OF A SELF-RELIANT HOME AUTOMATION SYSTEM

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Abstract: We reside within the twenty-first century where automation of any type i.e. home or industrial has a vital role in human life. Once it involves industrial automation, the construct is applied to giant machines or robots that help in increasing potency in terms of production, energy, and time. Home automation on the opposite hand involves automating the social unit setting. This can be doable as a result of smartphones and the internet that we tend to use daily. Home automation is once more divided into simply dominant appliances employing a smartphone from a foreign location and another sort crammed with sensors and actuators that control the lighting, temperature, door locks, electronic gadgets, electrical appliances, etc. employing a "Smart" system. This paper introduces a hassle-free home automation system that is extensible and minimalist. The entire circuit works solely on sensors and hard-wired connections instead of WIFI/Bluetooth based approach, which can be confusing for some people especially, senior citizens.
Keywords: design implementation automation reliant home

I. INTRODUCTION

Home automation is changing into a trend day by day due to its varied benefits. This may be achieved by native networking or by remote access. We aim to style a kit that may be used for the dominant AC power supply by using Arduino as a microcontroller. Home automation can be referred as utilization of current data technology along with the help of a computer to control various home appliances (such as doors, windows, lights etc.). Such automations might extend from a control of single appliance to advanced computer or microcontroller-based networks that very with intelligence and automation. The main goal to adapt to such automation is to provide a customer/user - proficiency, safety, and energy potency.

In this project, we'll style a straightforward home automation project by using simple parts in different electrical appliances that will start or off based mostly upon the sensors. The project is predicated on Arduino and for the same; we have used Arduino UNO in the project.

II. LITERATURE REVIEW

A) Design of a Home Automation System Using Arduino

Author: Nathan David, Abafor Chima, Aronu Ugochukwu, Edoga Obinna.
Publisher: International Journal of Scientific & Engineering Research, Volume 6, Issue 6.
Date of Publication: June, 2015.
ISSN: 2229-5518
Summary: This paper presents proposes home management and observation of the environment system by utilizing an e micro-web server which is embedded in Arduino microcontroller, with a connectivity that will allow the users to access and control devices and appliances remotely. These devices are controlled through an online application or via Bluetooth Android-based Smartphone app.

The projected system doesn't need a devoted server computer when referred to already existing systems and the system also offers a completely unique protocol to communicate for observation and management of the house surroundings with quite more than just the switch components. To demonstrate the practicability and effectiveness of this technique, devices like light-weight switches, power plug, and temperature sensing element, gas sensing element and motion sensors are integrated with the projected home system.

B) Arduino Based Smart Home Automation System

Author: Naing Ma, Hlaing Ni.
Publisher: International Journal of Trend in Scientific Research and Development. Volume-3
Date of Publication: June, 2019.
DOI: 276-280. 10.31142/ijtsrd23719.

Summary: This paper presents the blueprint and a model of how the automation system with 2 Arduino Nano along with sensors is implemented. To demonstrate the effectiveness of this technique, the devices like LDR, temperature sensing element, smoke sensing element, and motion sensing element are integrated with the automation system. Additionally, the GSM and RFID modules are also used for security systems. The functions of the sensors are to watch and manage the light, the desired area's temperature, and alarms. The main goal of the using GSM as the security system is it alerts the owner by sending SMS alerts. Two Arduino Nano management sensors and relays that monitor an outlined location and take action based mostly on nominative parameters like close lightweight, temperature, etc. A microcontroller can send SMS to the owner if the sensor's sight associates abnormality. Additionally, the security related to the door lock is developed by the RFID module. During this paper, the presence of GSM module security systems builds them safer and reliable.

C) Research Paper on Home Automation Using Arduino

Author: Malav Vaibhav, Raushan Kumar Bhagat, Rahul Saini, Udit Mamodiya.
Publisher: CONVERGENCE 2019 POORNIMA INSTITUTE OF ENGINEERING & TECHNOLOGY Conference.
Date of Publication: April 2019

Summary: The world is moving rapidly towards automation. Nowadays, it gets difficult for the individuals to manage time to handle any work thus automation becomes essential which makes it easy to handle any device or machine that are required to fulfill one's needs. This paper aims to develop and style a Home automation Arduino with a Bluetooth module. Home automation systems provide easy and reliable technology with robot applications. Home appliances such as doors, lights, AC, fans can be controlled by Home automation system consisting of Arduino Uno with Bluetooth module. The paper chiefly focuses on the observation and management of good homes by phone and provides a security-based mostly good home, once the individuals don't give reception. This paper motif is controlled home appliances in good homes with user-friendly, style at a low value, easy installation.

D) A Comparative Analysis on Home Automation Techniques

Author: Baig, Mirza Maqsood, Junaid Alvi, Muhammad Khan, Tamim.
Publisher: 2nd International Conference on Artificial Intelligence, Modelling, and Simulation, AIMS 2014.
Date of Publication: May, 2015.
DOI: 109-114. 10.1109/AIMS.2014.11.

Summary: Smart homes have gained a massive interest in the field of analysis recently. Such a automation of home offers the people independence to manage over their home with or without their presence with the help of a finely designed intelligent structure. In recent years all the enforced techniques haven't realized the Intelligent Homestyle all told quality aspects since each technique has its own pros and cons whether or not we tend to speak in terms of technology tailored, potency or value.

This paper presents a short comparative analysis of enforced techniques and provides a viable answer to appreciate the home automation system that constitutes Bluetooth management via automaton app development for in-house management and GSM (Global System for Mobile Communication) technology for mobile management exploitation Arduino Development Board because of the brain of our system. To implement Intelligent Home, the requirement is to adapt easily, economical and value-effective technologies, and also the answer conferred during this paper constitutes the aforementioned options

E) Smart Home Automation using Arduino

Author: A. Vinodha Krishnan, J. Indira Priyadharshini, T. Sivaranjani.
Publisher: INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY.
Date of Publication: March, 2017.
DOI: 10.5281/zenodo.376548

Summary: People tend to save electricity by switching off the appliances to reduce their electricity bill and also save energy. This could be made easier if the light is switched off on its own, doors get locked automatically etc. which would save electricity at a home and also save bills at the end of a year. Thus, there's a requirement to conserve electricity.

The goal of this research paper is to manage the light and fan by utilizing a Bluetooth module via Arduino. Today most of the energy is wasted thanks to the undo of fans and lights once it's not in use. This is often happening as a result of most of the switches being settled distant from the users. So as to steer clear from such cases this paper has presented a low-priced system which uses Bluetooth helping users to manage the fans and lights that are at a particular distance located from them.

III. METHODOLOGY

We have proposed a system design that is relatively efficient and also affordable. The advantage of our model is that the functionality of electrical and electronics devices can be controlled with ease by anyone (including those who are not much familiar with current technologies like the elderly people).

Through our model we can perform certain actions which are:

- Lights on/off by sensing motion(static/dynamic) in the room.
- Fan on/off by sensing the temperature of the room
- Opening/closing of the door
- Display current status on the LCD

Hardware/Software Requirements:

Component Name	Usage
PIR Sensor	It has been used as a motion detector to check any motion(static/dynamic) present in the room.
Ultrasonic Distance Sensor	It uses ultrasonic waves to measure distance between two objects. We have used this sensor to detect a person's distance from the door to operate the functionality of when the door is to be opened and closed.
Potentiometer	3 terminal resister which can be used as a voltage divider or as a rheostat.
DC Motor	WE have used dc motor as a fan in our project which will work on the basis of temperature sensor i.e. if the temperature of room goes up above 20 degrees Celsius then the motor would switch on and fan will start running.
LCD (16 X 2)	This apparatus has been used to display the current status of the room.
LED	It has been used as lights that would switch on when a motion is triggered in the room.
Arduino Uno R3	a microcontroller which is easy to use as a software and hardware. It is used here to take inputs from the sensors and output the result by either switching on the lights, fan etc.
Micro Servo	In this project it is used to represent doors of the house which work on the basis on sensors.
Temperature Sensor	It has been used to detect the temperature of the room.
Bread Board, Connecting Wires, Resistor	These are the components which are used to connect the above apparatus to one another.

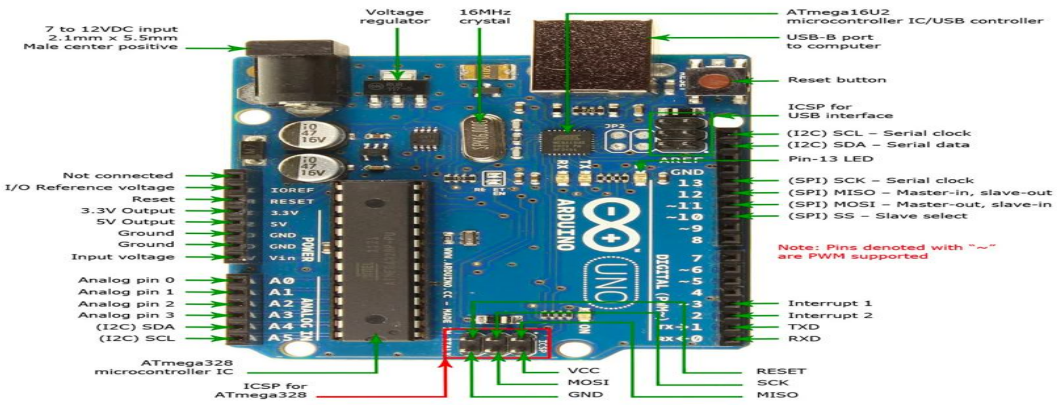

Fig 1. An Arduino Board

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IV. EXISTING SYSTEM

All the existing smart home automation projects have a functionality of controlling the home appliances with the help of Bluetooth, an android phone, Arduino and relay drivers. Its working involves stepping down of the voltage with the help of VIN pin of Arduino. A Bluetooth connection is present at the Tx and Rx pin of Arduino with the phone of the user which helps in sending the data required to the microcontroller which after reading the data send it to the relay drivers(which act as a switch).And finally these relay drivers are connected to the home appliances which helps in controlling the appliances.

Drawback/Limitations of Existing System

The major drawback of the above-mentioned system is the requirement of proper Bluetooth connection for the system to function. Thus, requiring familiarity in using phones to provide a connection. Nowadays as the technology advances there are people still who are not much familiar with it and some tend to not use it even if they are familiar with it.

For example, for the above system a person must know how to use a phone whereas there are people like the older generation who prefer not using it or some of them don't even have one because they prefer the old fashion system of switches which is convenient for the to use. This is where our project comes into action or has an advantage as we provide the functionality which can be used by ease by anyone and one does not have to learn any new gadget for the same as working our project is purely based on sensors.

V. IMPLEMENTATION

Our model focusses on 4 aspects on which our home automation system is built:

- Lights on/off by sensing motion(static/dynamic) in the room by the PIR sensor.
- Fan on/off by sensing the temperature of the room by the TEMP sensor
- Opening/closing of the door sensing he distance from the door by the Ultra Sonic Distance Sensor.
- Displaying current status on the LCD.

Apart from three sensors namely PIR sensor, TEMP sensor, Ultrasonic Distance sensor, our project includes components like LEDs, SERVO motor, DC motor, ARDUINO which help in the overall working of our automation system. Using the Arduino UNO, which is powered by the USB, it is connected through 13 digital pins and 6 analog pins of its to other hardware components as shown in the circuit diagram below. This helps in plugging in the real word data from sensors. The real time working of sensors with the help of Arduino UNO makes our project reliable and efficient.

Circuit Diagram:

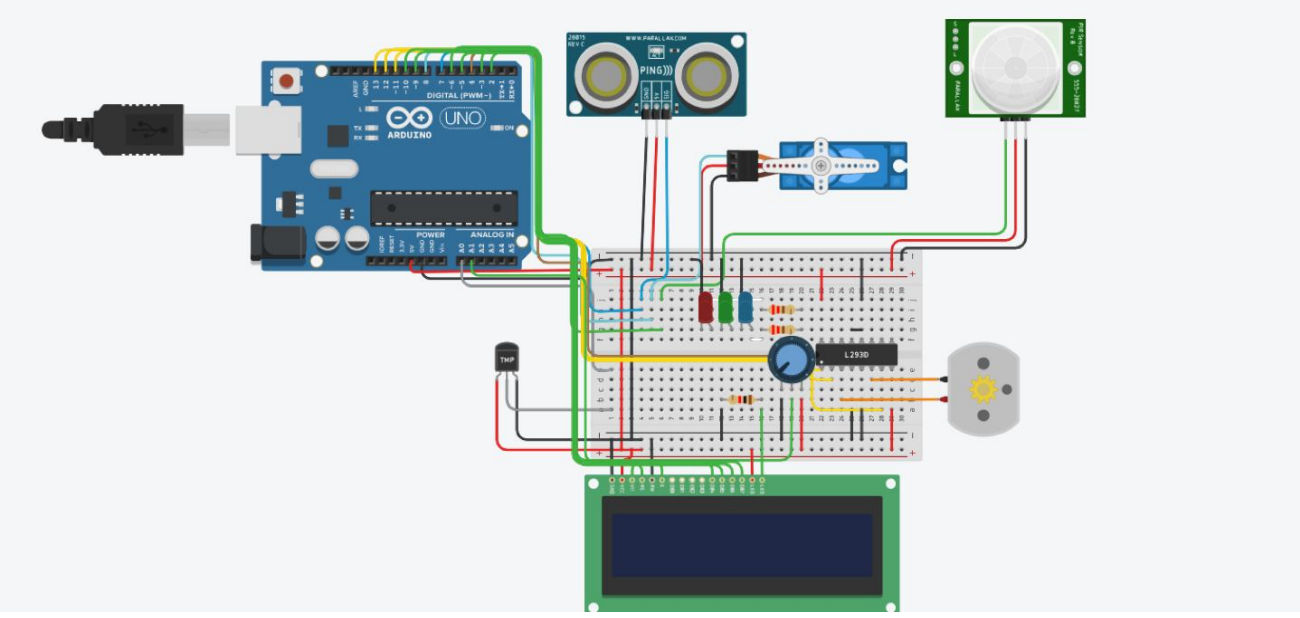

Fig 2. Circuit Diagram

Code:

```
#include<Servo.h>
#include<LiquidCrystal.h>
LiquidCrystal lcd(A1,10,9,6,5,3);  // LiquidCrystal(rs, enable, d4, d5, d6, d7)
float value;
int tmp = A0;
const int pingPin = 7;
int servoPin = 8;
Servo servo1;
void setup()
{
Serial.begin(9600); //Serial.begin(speed) bits per second
servo1.attach(servoPin);
lcd.begin(16, 2); //16 X 2 LCD
pinMode(2,INPUT);
pinMode(4,OUTPUT);
pinMode(11,OUTPUT);
pinMode(12,OUTPUT);
pinMode(13,OUTPUT);
pinMode(A0,INPUT);
digitalWrite(2,LOW);
digitalWrite(11,HIGH);
}
void loop()
{
long duration, inches, cm;
pinMode(pingPin, OUTPUT);
digitalWrite(pingPin, LOW);
delayMicroseconds(2);
digitalWrite(pingPin, HIGH);
delayMicroseconds(5);
digitalWrite(pingPin, LOW);
pinMode(pingPin, INPUT);
duration = pulseIn(pingPin, HIGH);
inches = microsecondsToInches(duration);
cm = microsecondsToCentimeters(duration);
//Serial.print(inches);
//Serial.print("in, ");
//Serial.print(cm);
//Serial.print("cm");
//Serial.println();
//delay(100);
servo1.write(0);
if(cm < 40)
{
servo1.write(90);
lcd.setCursor(0,1);
lcd.print("Door:OPEN");
}
else
{
servo1.write(0);
lcd.setCursor(0,1);
lcd.print("Door:CLOSED");
}
 int pir = digitalRead(2); //pin 2
if(pir == HIGH)
```



```
{
digitalWrite(4,HIGH);
lcd.setCursor(10,0);
lcd.print("LED:ON");
// delay(500);
}
else if(pir == LOW)
{
lcd.setCursor(12,0);
lcd.print("OFF");
digitalWrite(4,LOW);
}
value = analogRead(tmp)*0.004882814;
value = (value - 0.5) * 100.0;
lcd.setCursor(0,0);
lcd.print("Tmp:");
lcd.print(value);
delay(1000);
Serial.println("temperature");
Serial.println(value);
if(value > 20)
{
digitalWrite(12,HIGH);
digitalWrite(13,LOW);
}
else
{
digitalWrite(12,LOW);
digitalWrite(13,LOW);
}
lcd.clear();
}
long microsecondsToInches(long microseconds) {
 return microseconds / 74 / 2;
 }
 long microsecondsToCentimeters(long microseconds) {
 return microseconds / 29 / 2;
}
```

Explanation:

```
#include<Servo.h>
#include<LiquidCrystal.h>
LiquidCrystal lcd(A1,10,9,6,5,3);  // LiquidCrystal(rs, enable, d4, d5, d6, d7)
float value;
int tmp = A0;
const int pingPin = 7;
int servoPin = 8;
```

This above explains the libraries that Arduino board controls, for e.g. servo motors, LCD. It also gives us an idea of the Arduino pins (A0,7,8) that are connected to sensors TMP, PingPin and the servo motor.

```
 void setup()
        {
        Serial.begin(9600); //Serial.begin(speed) bits per second
        servo1.attach(servoPin);
        lcd.begin(16, 2); //16 X 2 LCD
                pinMode(2,INPUT);
        pinMode(4,OUTPUT);
                pinMode(11,OUTPUT);
```



```
pinMode(12,OUTPUT);
pinMode(13,OUTPUT);
pinMode(A0,INPUT);
digitalWrite(2,LOW);
digitalWrite(11,HIGH);
}
```

void setup() is a pre-setting function executed only a single time when the code is executed several times. This function is used for setting up few functions and meanings that are not supposed to change while the code is being executed. We essentially use it to define pin function once program starts. For eg certains pins like 2, A0 are assigned as input pins.

Pins 4, 11, 12, 13 are assigned as output pins. Serial.begin(9600) is used for getting the Arduino ready so that exchanging messages is made possible with the Serial Monitor which has a data rate of 9600 bits per second.

```
void loop()
        {
        long duration, inches, cm;
        pinMode(pingPin, OUTPUT);
        digitalWrite(pingPin, LOW);
        delayMicroseconds(2);
        digitalWrite(pingPin, HIGH);
        delayMicroseconds(5);
        digitalWrite(pingPin, LOW);
        pinMode(pingPin, INPUT);
        duration = pulseIn(pingPin, HIGH);
        inches = microsecondsToInches(duration);
        cm = microsecondsToCentimeters(duration);
        //Serial.print(inches);
        //Serial.print("in, ");
        //Serial.print(cm);
        //Serial.print("cm");
        //Serial.println();
        //delay(100);
        servo1.write(0);
        if(cm < 40)
        {
        servo1.write(90);
        lcd.setCursor(0,1);
        lcd.print("Door:OPEN");
        }
        else
        {
        servo1.write(0);
        lcd.setCursor(0,1);
        lcd.print("Door:CLOSED");
        }
```

Unlike to void setup() function, the void loop() function doesn't execute only once. It repeats over and over, restarting after each end, as it run infinitely. This is where bulk of the Arduino sketch is programmed and executed.

The present block explains the working of the Ultrasonic Distance sensor and the servo motor that is attached. The PingPin ie the Ultrasonic sensor sends an output wave comprising of high and lows and waits for it to return as an input signal after it has hit the obstacle. In our case any person near the door.

PingPin is configured to receive an input signal after which the time duration is converted into inches and cm. If distance is less than 40 cm then Ultrasonic sensor commands the servo motor to open thus making a right angle else the door (servo motor) remains closed as shown in the code.

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```
int pir = digitalRead(2); //pin 2
        if(pir == HIGH)
        {
        digitalWrite(4,HIGH);
        lcd.setCursor(10,0);
        lcd.print("LED:ON");
        // delay(500);
        }
        else if(pir == LOW)
        {
        lcd.setCursor(12,0);
        lcd.print("OFF");
        digitalWrite(4,LOW);
        }
```

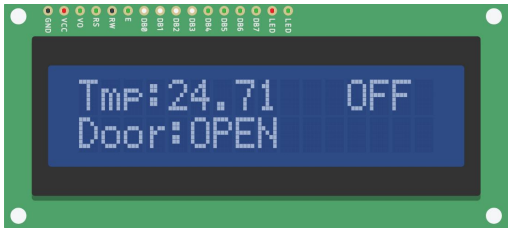
This part of the Arduino code explains the working of the PIR sensor, ie the motion sensor. When the environment is dynamic then PIR sensor gives an output high, indicating there is some motion in the room and the lights needs to be switched on. LCDs in such case will show the output LERD:ON. If the environment is static, LEDs will remain switched off and LCD will show the output OFF.

```
value = analogRead(tmp)*0.004882814;
        value = (value - 0.5) * 100.0;
        lcd.setCursor(0,0);
        lcd.print("Tmp:");
        lcd.print(value);
        delay(1000);
        Serial.println("temperature");
        Serial.println(value);
        if(value > 20)
        {
        digitalWrite(12,HIGH);
        digitalWrite(13,LOW);
        }
        else
        {
        digitalWrite(12,LOW);
        digitalWrite(13,LOW);
        }
        lcd.clear();
        }
```

The temperature sensor detects the temperature of the room. If the value exceeds more than 20, then the output pin 12 gives an output high, indicating the DC motor is running. This explains as the temperature is high in the room, fans are switched on. Else fans are switched off when the temperature is less than 20.

VI. RESULTS

After connecting the the sensors and components to the respective pins and configuring them, we ran the simulation. In the first case, it can be observed in the simulation that door opens once a person comes closer than 40 centimetres and the door closes again once the person passes through the door.



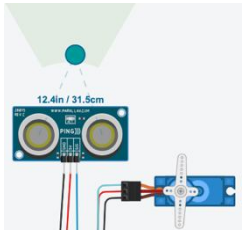


Fig 3. Ultrasonic Distance Sensor Response

Now if the motion sensor detects movement in its range, the LED's which signify bulbs in the room light up.

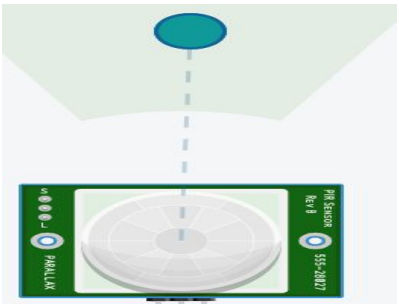
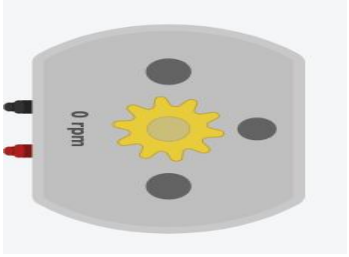


Fig 4. PIR Sensor Response

The circuit also has a temperature sensor which continuously detects the temperature of the ambience. In the simulation it can be observed that if the temperature reduces below 20 degree Celsius, the attached DC Motor (Fan) stops spinning.



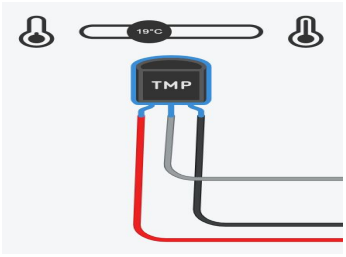


Fig 5. Temperature Sensor Response

VII. CONCLUSION

We have successfully implemented a home automation system which is not only very simple but also extensible. More sensors could be added to the circuit to further extend the feature set of the system. We have implemented a simplified form a home automation system which is self-reliant and hence needs no wireless connection such as Bluetooth or Wi-Fi network. This feature gives the user peace of mind especially to the people who belong to the older generation. We believe that the future of home automation is sensor based hard wired configurations, rather than IOT configurations due to sheer simplicity and minimalism.

REFERENCES

1. Design of a Home Automation System Using Arduino, Nathan David, Abafor Chima, Aronu Ugochukwu, Edoga Obinna, International Journal of Scientific & Engineering Research, Volume 6, Issue 6.
2. Arduino Based Smart Home Automation System, Naing Ma, Hlaing Ni, International Journal of Trend in Scientific Research and Development. Volume-3.
3. Research Paper On Home Automation Using Arduino, Malav Vaibhav, Raushan Kumar Bhagat, Rahul Saini, Udit Mamodiya, Convergence 2019 Poornima Institute of Engineering & Technology Conference.
4. A Comparative Analysis on Home Automation Techniques, Baig, Mirza Maqsood, Junaid Alvi, Muhammad Khan, Tamim, 2nd International Conference on Artificial Intelligence, Modelling, and Simulation, AIMS 2014.
5. Smart Home Automation System Using Arduino, A. Vinodha Krishnan, J. Indira Priyadharshini, T. Sivaranjani, International Journal of Engineering Sciences & Research Technology.
6. R. J. C. Nunes, "Home Automation - A Step Towards Better Energy Management," [Online]. Available: http://www.icrepq.com/pdfs/CALEIRA416.PDF
7. Carl J. Debono and Kurt Abela, "Implementation of a Home Automation System through a Central FPGA Controller", 16th Electro-technical Conference (MELECON), IEEE, pp. 641-644, 25-28 Mar. 2012.
8. E. M. C. Wong, "A phone-based remote controller for home and office automation," IEEE Transactions on Consumer Electronics, vol. 40, no. 1, pp. 28-34, Feb. 1994.
9. Nausheen Belim, Harshada Bhambure, Priyanka Kumbhar, Simranjit Tuteja, "Automate and Secure Your Home Using Zigbee Technology," International Journal of Innovative Research in Computer and Communication Engineering, vol. 1, no. 1, pp. 63-66, Mar. 2013.
10. Vini Madan and S.R.N Reddy, "GSM-Bluetooth based Remote Monitoring and Control System with Automatic Light Controller," International Journal of Computer Applications, vol. 46, no. 1, pp. 20– 28, May 2012.

