

Enhancing Home Security in North-East of Nigeria using Home Automation

Dr. Karim Usman¹ and Ike Innocent²

¹Mathematics and Computer Science Department, Benue State University, Makurdi, NIGERIA

²Department of Computer Science, Nigerian Army College of Environmental Science and Technology, NASME Barracks Makurdi, Benue State, NIGERIA

¹Corresponding Author: kusman@bsum.edu.ng

ABSTRACT

Home automation plays a vital and essential role in modern era because of its usability and flexibility in using it at different places with high precision which will save cost and time by decreasing human stress. The main purpose of this technology is to control the household equipment's like, door, fan, AC, light etc. automatically. This research work has concentrated information on Home Automation and Security System using Arduino, GSM and how we can control home appliances using Android Application. Whenever a person will enter into the house then the count of the number of persons entering in the house will be incremented, in Home Automation mode appliances will be turned on whereas in security light will be turned on along with the alarm. The count of the number of persons entering the house is also outputted on the LCD screen. In Home Automation mode when the room will become empty i.e. the count of persons reduces to zero then the appliances will be turned off making the system power efficient. The owner can control his home appliances by using an android application present in his mobile phone which will reduce the human stress. At the same time if anyone enters while security mode is on a SMS will be sent to house owner's mobile phone which will indicate the presence of a person inside the house. The alarm can be turned off using SMS or Android application.

Keywords-- Home Automation, Global System for Mobile Communication (GSM), Short Message Service (SMS), Android Application, Buzzer and Arduino

android application, web pages, GSM when a person is away from home. The system helps old people by controlling home appliances with the help of their mobile phones as they do not need to go to different locations for turning the appliance on or off.

This system also alerts the person in case a burglar enters the house by sending SMS on person's mobile phone which will enable them to protect their home from burglars. The reason for this research work home automation is to save electricity and reduces stress. With this technology everyone can control the home equipment or office equipment automatically. The system is user friendly, reliable, affordable, secured and flexible. Several techniques have been employed in the implementation of home automation and security system efficiently and effectively. This research work discusses Arduino, GSM, and Android application. Home Automation and Security System based on Arduino will be built in such a way that whenever a person will enter the house then the count of number of the persons will get incremented, bulb will start glowing and alarm will start ringing. The count of the number of persons present in the room will be outputted on the LCD screen. Whenever the room gets empty i.e. the count of the person reduces to zero then the bulb will automatically stop glowing making the system power efficient. [1]

This means that whenever a person tries to enter into the house then a SMS will be sent to house owner's mobile phone indicating the presence of some person inside the house and the house owner can take some preventive and active measure in order to protect his house from the burglar. The person can also, control the home appliances using an android application present in the mobile phone which will reduce the human stress. The list of all home appliances along with Turn on and Turnoff buttons will be provided in an android application. By clicking on that particular button the person will be able to Turn On and Turn Off the home appliances using an android application.

I. INTRODUCTION

In this modern era of advancement and technological development, automation of everything is very vital. Today we are living in 21st century where automation is playing an essential role in human life. Home automation allows us to control household appliances like light, door, fan, AC etc. It also provides home security and emergency system to be activated. Home automation not only refers to reducing human efforts but also energy efficiency and time saving. The main aim of security system using home automation is to control home appliances by using different techniques like

II. RELATED WORK

The literature reports home automation system using GSM and Android Application. Home automation system because of its wide spread coverage which makes it an online system. It has also become popular due to its security feature because of which it is not possible for other people to track the information sent or received. Android application is used to control and monitor various home appliances using mobile phone. The owner can

control various appliances of his home using an android application which is present in his mobile phone even if the person is away from his home. [2]

Arduino is an open source architecture that uses Atmega2 microcontroller. For programming the microcontrollers, the Arduino platform provides an integrated development environment (IDE) based on the Processing project, which includes support for C, C++ and Java programming languages.

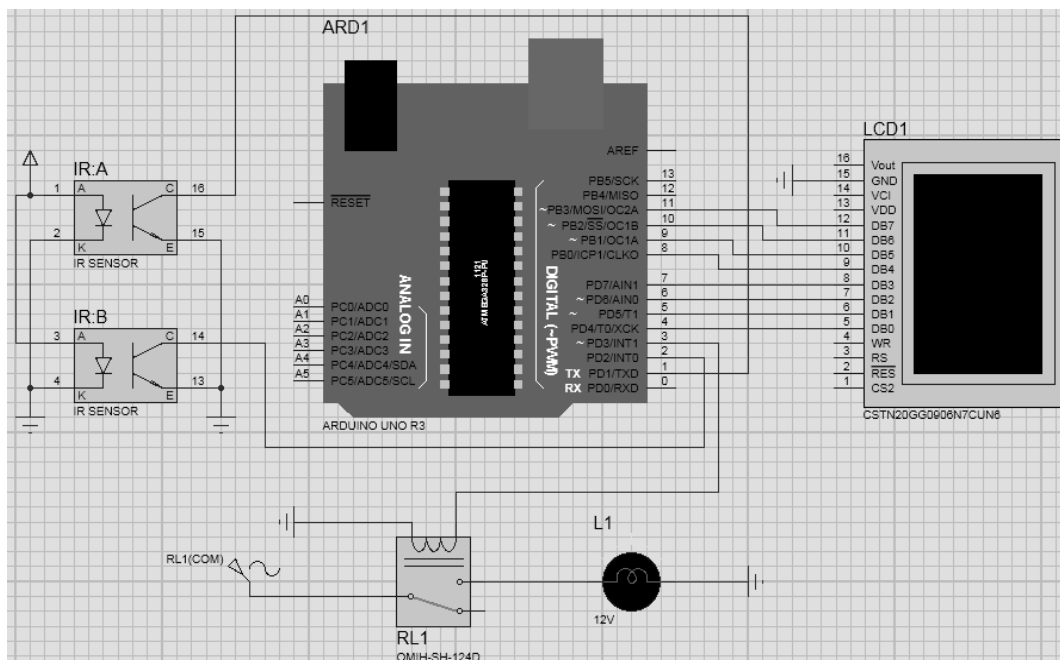
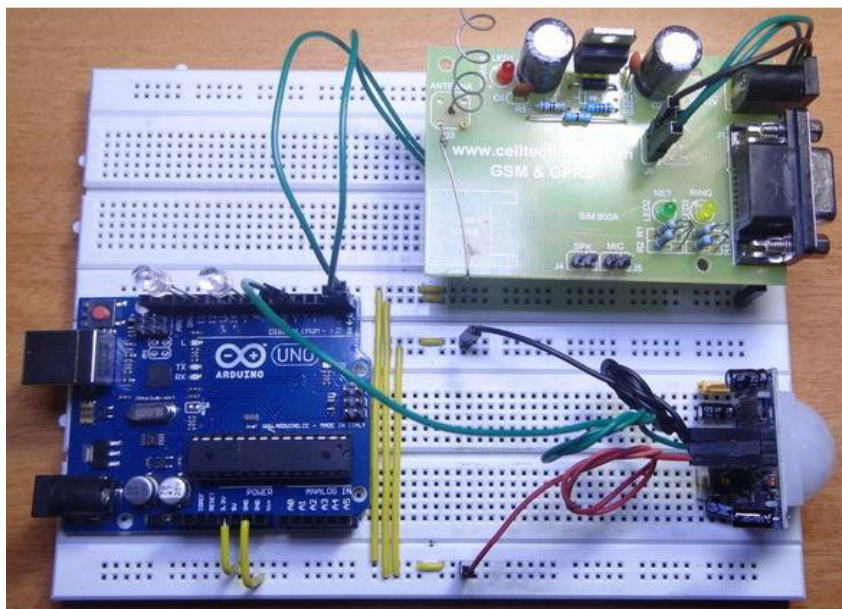


Figure 1: Design of Arduino based home automation system

Arduino has two variants Arduino Uno and Arduino Mega, Arduino Uno has 20 pins that can be used for both input and output whereas Arduino Mega has 80 pins for input and output, so it can connect number of home equipment's. It's ARM (Advanced RISC Machine) based processor also speeds up the processing. [3]

It will count the number of people present in the room with the help of IR sensor. When both the sensors will sense the person then only the count will be incremented. The count of number of people present in the room will be displayed on the LCD screen. If timer of second sensor is higher than timer of first sensor then this

condition will indicate that the person is entering the room. If timer of first sensor is higher than timer of second sensor then this condition will indicate that the person is leaving the room. Bulb in the room will start glowing as soon as the person enters the room and the bulb stops glowing when the room is empty. Therefore the system is power saving as the light bulb will automatically get switched off when the room is empty. The system provides a security based feature as the alarm will start ringing whenever a person will enter into the room. Piezo buzzer is used for the alarm in the system. [4].

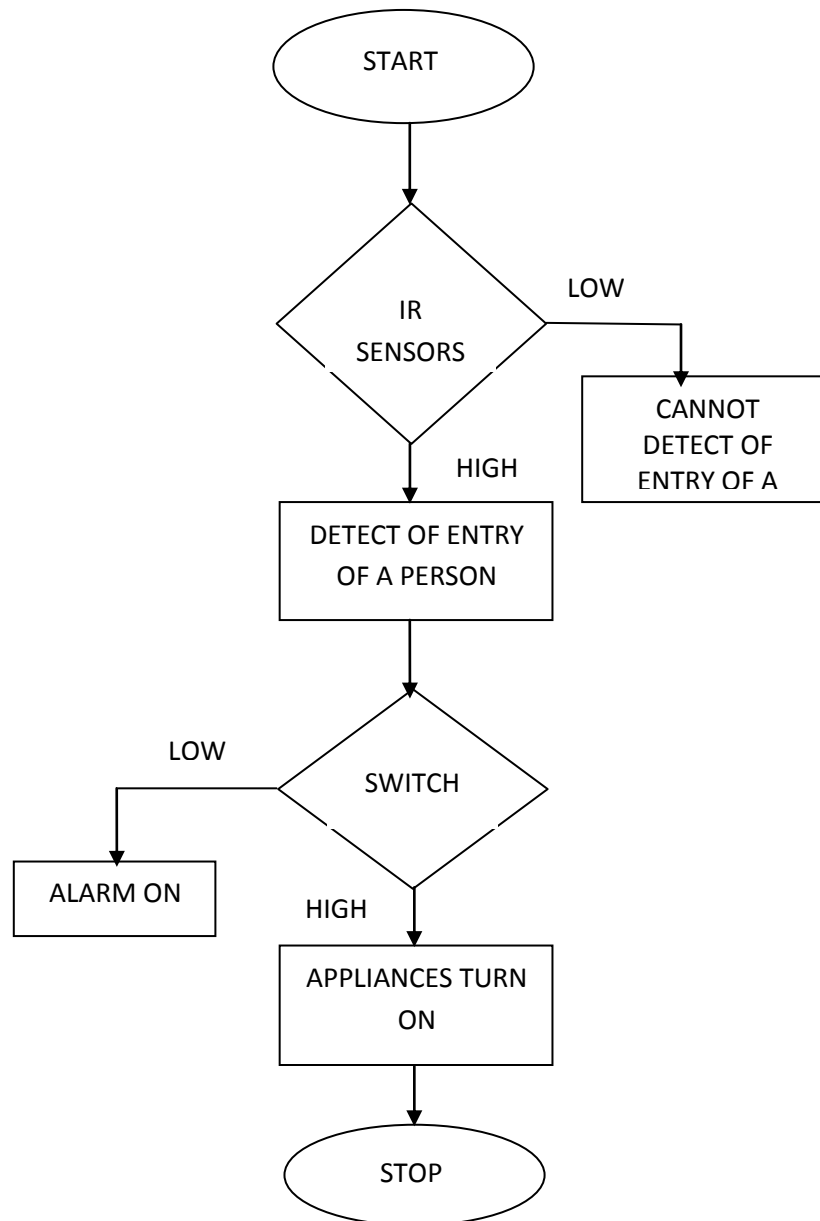


Figure 2: Flowchart of Arduino based home automation system

Android application is used to control various home appliances using mobile phone. A person can control various appliances of his home using an android application which is present in his mobile phone even if the person is away from his home.

The design of the GSM and Android application based home automation and security system is given in Fig. 3.

System can perform communication by two methods-

- 1. Global System for Mobile Communication (GSM).
- 2. Android Application

SMS communication is possible using GSM module (ELEMENTZ SIM900A UART). SMS communication is used majorly during Security mode when connectivity and security is essential for the system. Whenever a burglar tries to enter the house then SMS is sent on the house owner's mobile phone in order to inform the house owner about the presence of some person inside the house when the owner is away from his home. Then the house owner

can call the police or his friend in order to protect his house from burglar. Moreover the alarm will also start ringing when a burglar enters a house when the system is operating in secured mode.

Android Application is employed for changing the setting of the room. Android application will contain the list of various home appliances that needs to be controlled using mobile phone. When we will select a particular appliance from the list then the action will be performed on that appliance only. Two actions will be performed on that appliance. The action will be either to turn on or off the appliance. Whenever we will choose to turn on the home appliance, the appliance will be turned on by clicking on the 'TURN ON' button present in the android application and when we want to turn off the home appliance, the same will be turned off by clicking on the 'TURN OFF' button provided in the android application. The alarm can also be turned off using Android application present in the mobile phone. [5].

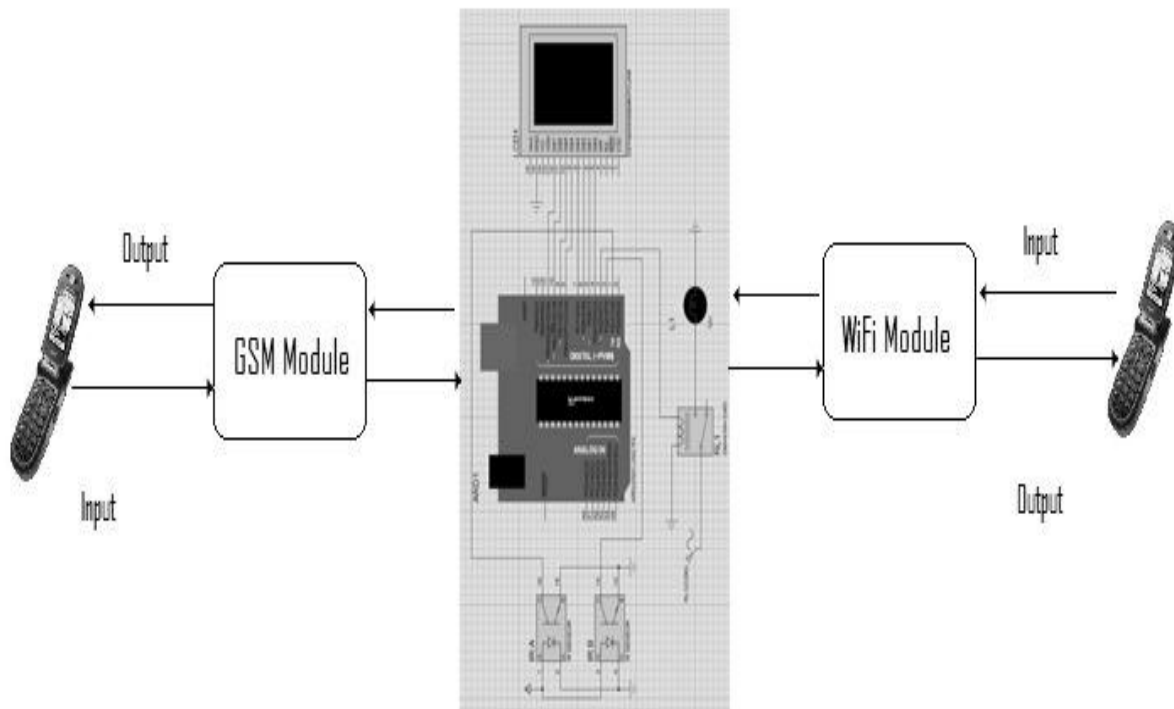


Figure 3: Design of GSM and Android application based home automation system

Two type of communication is discussed:

- 1. Input
- 2. Output

For Input communication user sends new configuration to the system using SMS or an Android App. The input communication is used for the secured mode. Whenever a person enters into the house, SMS is sent to

the user in this communication. Figure 4. Flowchart for input communication

The output communication usually occur in two modes:

- 1. SMS (via GSM module).
- 2. Android application.

In output communication system sends an alert message to the user about a burglar using GSM module. The GSM module will send SMS on user’s mobile phone indicating the presence of burglar inside the home. The output communication is also used to change the setting of the room as the system will continuously monitor the input. If any change is detected in the settings then the settings of the room are changed accordingly. Home appliances can be controlled easily using android application. They can be turned on and off using android application present in their mobile phones. Figure 4. Flowchart for input communication.

When the sensor detects the motion of any intruder it sets the output has high. The connectivity is provided based on the Arduino controller and then communicates with global system mobile (GSM) module via through the network. The sensor which generates the electrical signals converts to global system mobile (GSM) module with using Arduino microcontroller. The network module is an important module as the transmission of the sensor rays is sent using the connectivity of the internet. The delay of time is important aspect regarding the message to user device should be of fixed delay that is implemented through the Arduino programming code. [6]

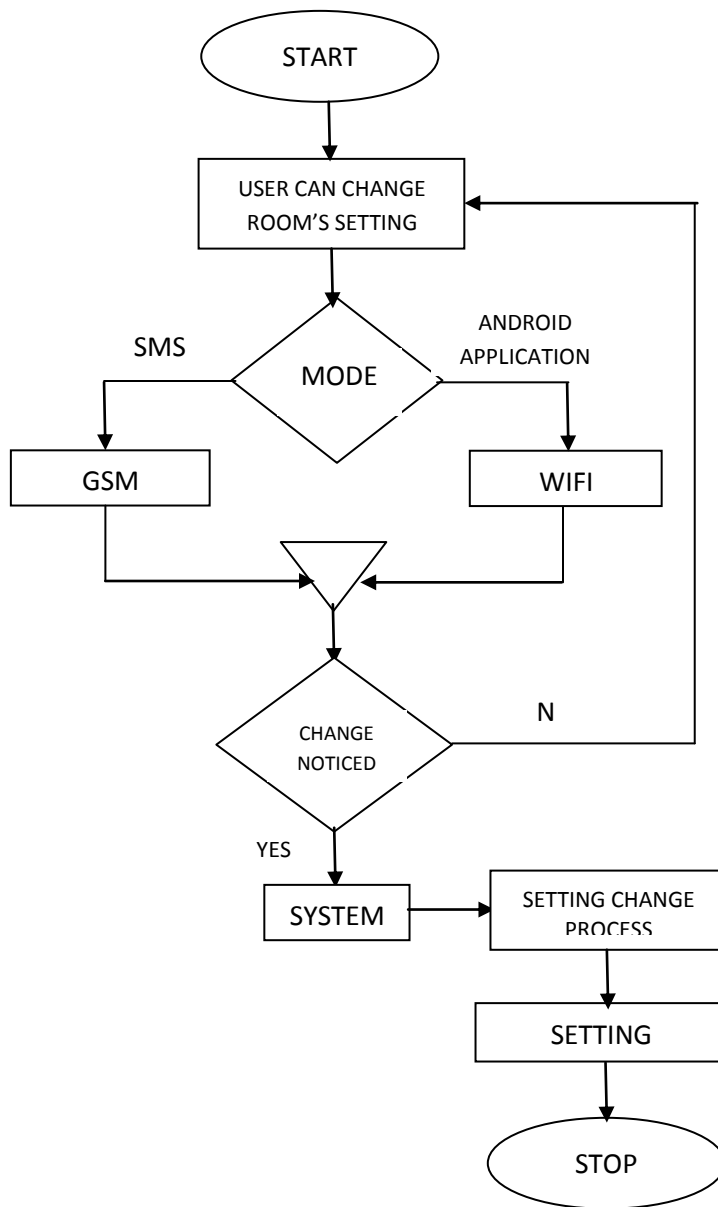


Figure 4: Flowchart for input communication

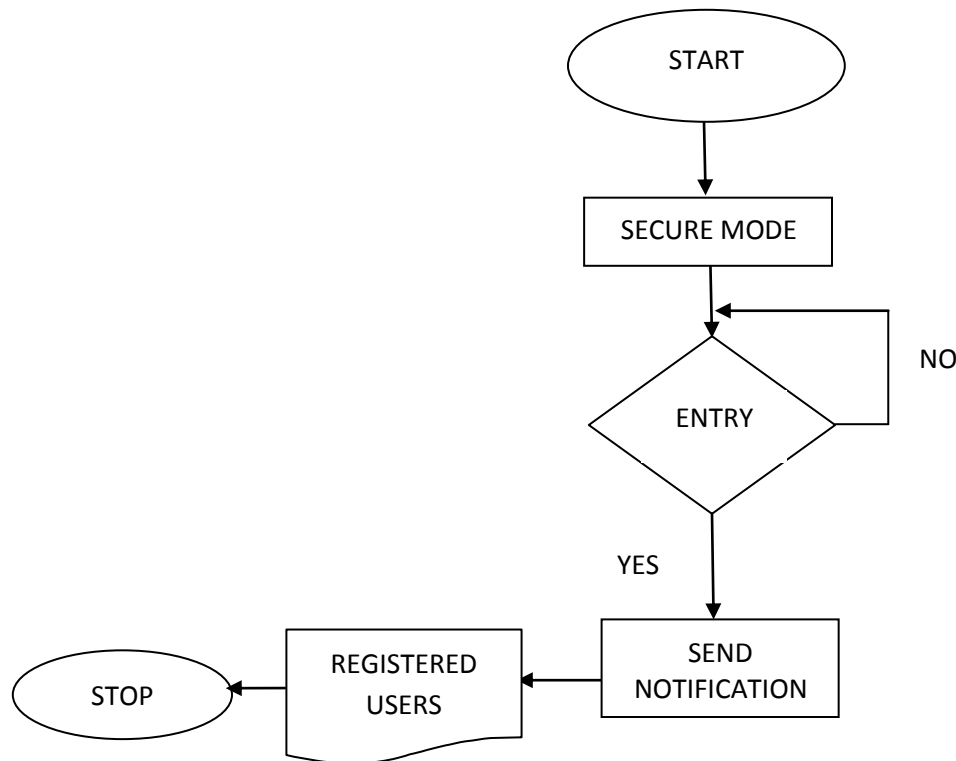


Figure 5: Flowchart for output communication

Component Description

- (i) Global System Mobile (GSM) Module
- (ii) Arduino Controller
- (iii) Buzzer
- (iv) Mobile Phone.
- (v) Passive Infrared Sensor (PIR) sensor

PIR Motion Detection Sensor

Passive Infra-Red or PIR Sensor is a Pyroelectric device that detects motion. Hence, it is also called as motion detection sensor. It detects motion by sensing the changes in infrared levels emitted by nearby objects.

GSM Module (SIM 900A)

SIM 900A is the GSM/GPRS module with built in RS232 interface. It has dual band GSM/GPRS system that works on 900/1800MHz frequencies. With the help of RS232, the modem can be connected to PC or microcontroller via serial cable. Voice calls, SMS and internet access are possible with this module. There are on board connections for microphone and headphones with which we can make or receive calls.

Arduino UNO

It is the main controller used in this project. It detects the signals from PIR sensor and sends commands to GSM Module accordingly. The serial pins of the Arduino are used in this project to communicate with GSM module. [7]

III. CONCLUSION AND FUTURE WORK

Conclusively, it is observed that all the home automation system techniques uses wireless technology. Arduino, GSM and Android based home automation techniques have been implemented in order to offer flexibility to the people in order to control their home appliances with ease.

This paper addressed Different home automation techniques using Arduino, GSM, Android and are given with their design, implementation and flowcharts which gives the comprehensive layout of their strengths and weaknesses

This system also helps the user to protect their homes from burglars when they are away from the home by using alarm as the alarm will start ringing whenever a burglar tries to gain access to the house and the owner will receive a message on his mobile phone whenever some other person will try to enter the owner’s house. This system is also used to display the count of number of persons entering the house on LCD screen. It is also Simple home intrusion system

This work can be extended by including; an embedded system seems to be the direction in which electronics technology is headed. We recommend smart

systems should be incorporated in the design and Better microcontrollers are being produced all the time. We recommend the use of the latest microcontrollers and embedded microcontroller technology.

REFERENCES

- [1] A. Alheraish. (2004). Design and implementation of home automation system. *IEEE Transactions on Consumer Electronics*, 50(4), pp. 1087-1092.
- [2] Bader M. O. Al-thobaiti, Iman I. M. Abosolaiman, Mahdi H. M. Alzaharani, Sami H., Almalki & Mohamed S. Soliman. (2014). Design and implementation of a reliable wireless real-time home automation system based on arduino uno single-board microcontroller. *International Journal of Control, Automation and Systems*, 3(3), 11 - 15.
- [3] Arnab Waheed Ahmad, Naeem Jan, Asaeed Iqbal, Chankil Lee & Ansan Korea. (2011). Implementation of ZigBee- GSM based home security monitoring and remote control system. *IEEE Symposium on Circuits and Systems (MWSCAS), Seoul*, pp. 1-4.
- [4] Faisal Baig, Saira Beg & Muhammad Fahad Khan. (2013). ZigBee based home appliances controlling through spoken commands using handheld devices. *International Journal of Smart Home*, 7(1), 19 -26.
- [5] Baris Yuksekkaya, A. Alper Kayalar, M. Bilgehan Tosun, M. Kaan Ozcan & Ali Ziya Alkar. (2006). A GSM, internet and speech controlled wireless interactive home automation system. *IEEE Transactions on Consumer Electronics*, 52(3), pp. 837-843.
- [6] Mahesh.N. Jivani. (2014). GSM based home automation system using app-inventor for android mobile phone. *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering*, 3(9), 12121-12128.
- [7] Pooja S Chinchansure & Charudatta V Kulkarni. (2014). Home automation system based on FPGA and GSM. *International Conference on Computer Communication and Informatics (ICCCI), Coimbatore, India*, pp. 1-5.