

Efficient Home Automation and Security

Abhinav Gupta*, Komal Tomar**

* Mechanical Engineering, Vellore Institute of technology

** Electrical and Electrical Engineering, Vellore Institute Of technology

Abstract- To design and implement a flexible and powerful home yet cost effective security system using the GSM technology is the main aim of this research. This novel idea came to our mind while participating in schneider go green challenge .In this growing world nothing is left untouched by technology, so for occupant's convenience and safety a mobile based home security system is needed. The system is can detect burglary, leakage of cooking gas; smoke caused due to accidents effectively and after detecting such activity it sends a message to the owner number. Android cell phone application is used to control the whole process. The user can control all the features and systems remotely (outside) thorough the app. With the additional control for home appliance switching activating and deactivating the alarm system is also provided. Within the GSM covered region a person can be assured of complete safety of his/her house anywhere in this world.

Index Terms- Remote appliance control, GSM, Home automation, Home security system.

I. INTRODUCTION

Process of improving the quality of a person life by facilitating flexible, comfortable and a secure control over house-holds is called Home automation. With advancement of technology and internet connectivity Internet based home automation systems are one of the most popular system. Controlling and monitoring of a house using internet from a remote place requires a laptop /computer which is bulky. So as efficient and consumer friendly alternate can, mobile phone with Operating system on it can be used for remote monitoring and controlling of a house. A mobile phone can be easily handled and carried all day long so it is feasible to use a mobile phone rather than a laptop or a computer. Prior to this systems were dependent on telephone line, using a communication line based remote controller. In general four significant challenges the home automation faces are:

The WSN (Wireless Sensor Network) technology has an advantage that it ensures remote monitoring with fast and secure network establishment with budget of a common man. The key difference between WSN and GSM is it's the covering area which facilitates very long distance communication.

Being battery powered wide area coverage even in remote rural area are the main advantage of GSM network. The user can get a theft/ intrusion alarm without any lag instantly. User needs to activate the alarm system through the application by pressing the button to get the alarm message each time before leaving the house from the security system installed in the user's premises. To prevent any misuse of the alarm activation system the user has to log on to the system with a specific credentials to activate and deactivate the alarm system. Users can turn that off the

application unexpectedly left in running condition. This saves a lots of energy waste and further reduces bill payable. User need not to be an expert to run the application in his/her mobile it is completely user friendly. As per requirement of the user and safety needs the designed system has choices for further addition of more sensors. To get more control over appliances the user also can add more relays if he/she feels so. So in short the system is a modern intelligent home security system which give us all features with trust about safety of the house.

II. SYSTEM ARCHITECTURE AND WORKING PRINCIPLE

A. System overview:

The available GSM communication options are:

(1)Using voice call feature- It intimates the polices/ fire station on triggering of the alarm..

(2)By sending a SMS- Appliances can be turned on/off the by simply sending a SMS. This will also generates a alarm if there is an intrusion or fire hazard by sending a SMS to the owner.

(3)By use of Internet- By using this feature we can control the device from anywhere in the world where there is a internet connection.

In this paper we are using a SMS based communication. The whole system is controlled using an android mobile application. The application takes care of all the short messages to be sent to monitor the device status remotely and control the appliances.

Features of the system:

1) Low cost: 8-bit low cost microcontroller are used to build the system are. The sensors too are pretty inexpensive. The sensors are connected to the board via low resistance wires.

2) User friendly interface: Anyone with a little knowledge in android usage can manage the system as it very user friendly and can use it to ensure the safety of his/her house and control the home appliances and can. The application starts with just one touch and wants the username and password to ensure that it's in the hand of the proper user.

3) Small size: total package is very lightweight and small in size. It can be easily put into a 8 to 10 inch square box for commercial purpose.

4) Alarm in case of emergency: Whenever the system detects an certain hazardous event, system sounds a noisy alarm instantaneously alongside sending a message to the user it

5) Short response time: To ensure proper safety the users need to get notified about any sort

incidents like fire hazards or unexpected intruder within a very short time. It takes the system less than a second to send a message to the user describing the incident.

6) **Wide area coverage:** Every area in connection with GSM can help the user to connect and control the system.

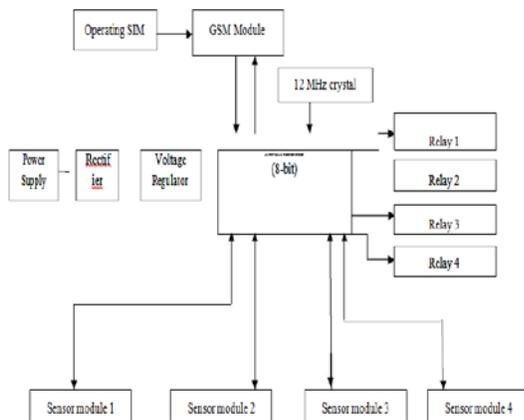


Fig. 1: Block diagram of the system

C. Reason for choosing such a system:

As stated 4 main challenges faced by home automation are: high cost of ownership, difficult to manage, poor flexibility, and difficulty in achieving security. Android mobiles are now available low cost everywhere. For the flexibility of use the Android operating system are becoming more and more popular which is one of the prime reason of using this operating system to control the whole device.

D. Security in GSM communication:

The security mechanisms of GSM are implemented in three different system elements namely SIM card, handset and the GSM network. The SIM contains the IMSI, authentication key for each individual subscriber, the ciphering key generating algorithm, the authentication algorithm, as well as a PIN. The ciphering algorithm is also contained in GSM handset. The encryption algorithms are present in the GSM network as well. A database is used identification and authentication information for subscribers which is maintained by Authentication Center (AUC) which a part of the Operation and Maintenance Subsystem. For each user an information folder is maintained this information consists of the IMSI, the TMSI, the Location Area Identity (LAI), and the individual subscriber authentication key (Ki). In order for the authentication and security mechanisms to function, all three elements (SIM, handset, and GSM network) are required.

E. The system:

The block diagram of the system is shown in Fig.1. The system that resides in the home is actually shown here. In 8 bit ATmega328 microcontroller readings of the sensor are taken as an input. The microcontroller according to the data transferred by the sensors and threshold value then computes and decides between sounding of an alarm and sending the alert message to the user.

The GSM module operates with the help of the operating SIM. Any instructions transfer between user and the system are

made using the operating SIM number. The module then decodes the incoming signal from the user and acts accordingly by directing the microcontroller. The module also gets the signal from the microcontroller and sends message to the user. So the GSM module is the bridge between the home system and the user. A pictorial view of the system is given in Fig. 2.

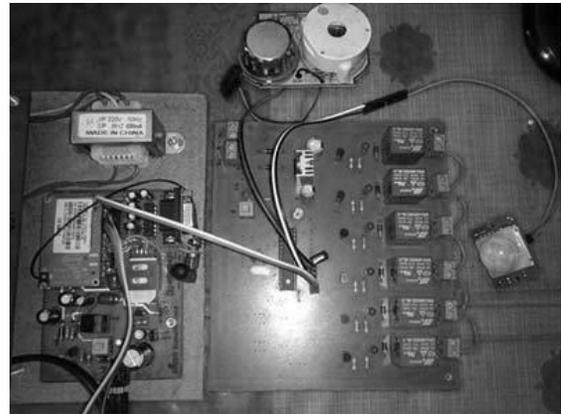


Fig. 2: the system which reside inside the house

F. How is this system different from others:

GSM based home security system already available in the market, but they are neither easy to use nor economical. The main advantage of our system is that it is based on android OS and therefore provides user friendly user interface. In other similar models user has to input a specific keyword for performing each operation of the system, but in this system the developed android application will perform that work and user will have to just change it using the applications user interface and press the button "Send Config". There is another option in this application which command the system to "Check Status", return a Message that will contain all device current status into a readable graphical form.

G. Operation of the system:

The user should use a mobile phone operating on android operating system. For remote monitoring the application should be installed in the phone. The home screen with buttons in application is shown in Fig. 3.

Through this application the user can get the status of the home appliances. If he/she has accidentally left something on in the house then it can be turned off using this application by simply touching the on/off. For instance the want to turn on the Air condition before going home so that the bedroom has a comfortable temperature enough then they can perform through this application.

The notification sensor buttons increases the feasibility of the application and simply allows the user to activate or deactivate the sensors. These sensors have only to be activated by the user before leaving the house.

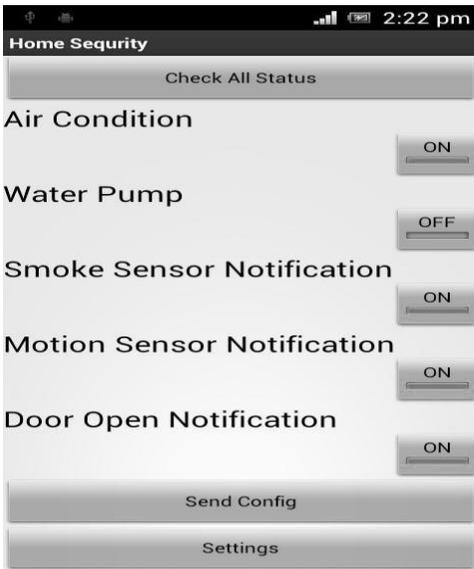


Fig.3: the application interface

When the user comes to the house then they have to deactivate the sensors so that they won't send any notification to the user while he/she is inside the house.

Application has password protection to prevent the misuse of the system. By entering a specific password the user has to log on to the system. The user need to give the number he wants to get connected that means the number of the SIM that the home system use. Then they will be asked to give the password which was set previously.

If the user can also change the password by clicking "Setting" tab of the application. But however to change an password and set a new one the user has to log on with the old password to open the application. These steps ensure total security of the system. Fig. 4 shows the window which will appear when the user presses the application icon.



Fig.4: The application opening window here the user has to provide the password to get access to the application.

H. program flow chart:

If the value of the sensors exceeds the maximum value then the alarm system will be triggered by the microcontroller. The microcontroller will also convey the GSM module to deliver the corresponding message to the user's cell phone.

As stated earlier user can turn on/off a specific sensors or appliance only by pressing a button in the mobile application. The chart below shows the control of the system and its algorithm.

III. RESULT

A prototype of the system was made and tested as shown in Fig.2. The system works quite well. The motion sensor was accurate, were free from errors and false dections. The smoke sensor was also tested. The appliance control process was tested through the application by using some light bulb as a load. Everything works well and is ready to use. With an outer layer the system can be made safe. Additional relays are connected to ensure the feasibility of the product when connected to additional load.

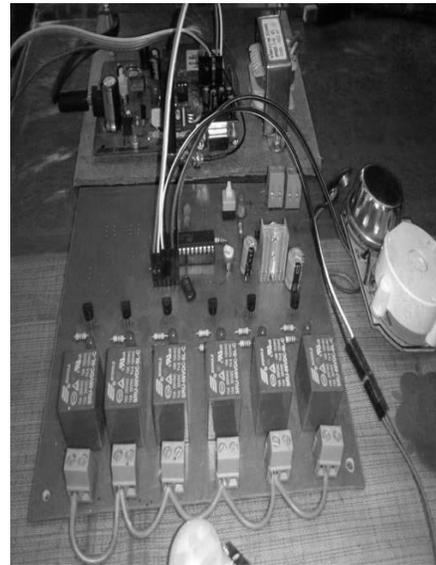
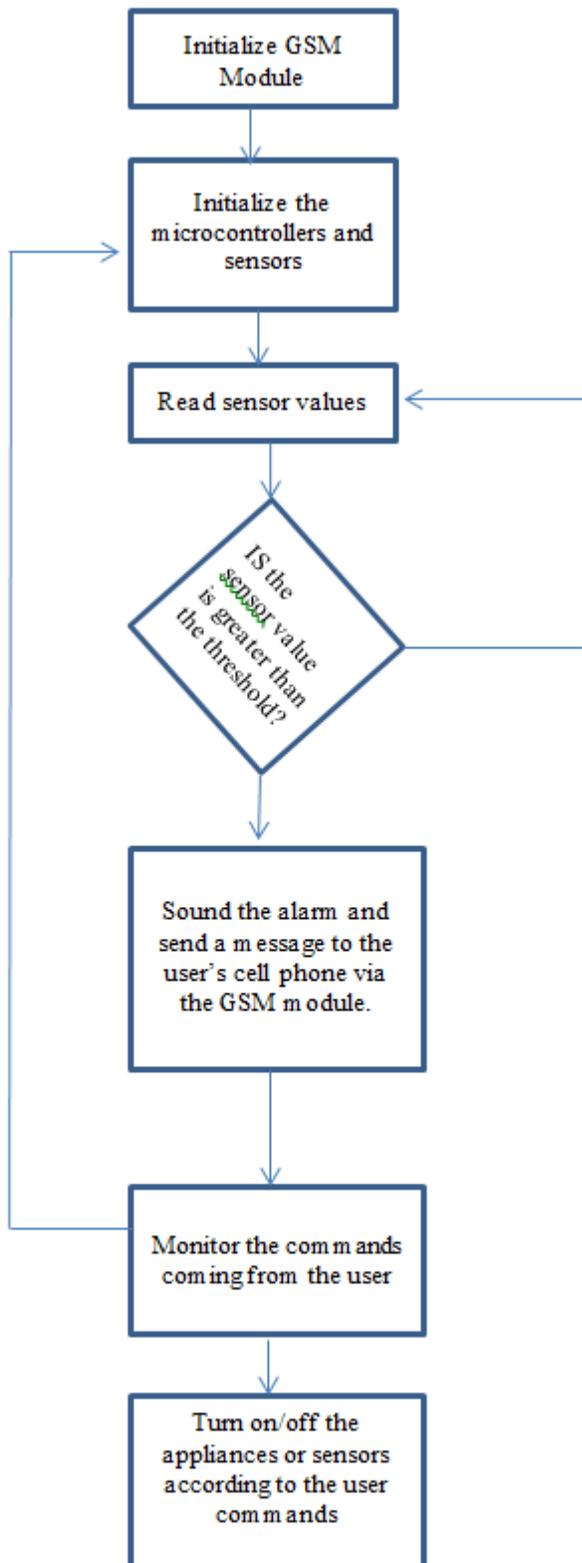


Fig.6 : Additional relays to connect more appliances for controlling

In the application the users also have the option to include more appliances as per the need. For this he/she need to go to the setting and just click on “add more appliances”. After naming the appliance it will be appeared on the application main window. The user has to deactivate all the sensor notification button manually after reaching home.

IV. FUTURE INITIATIVE

Mobile application will be made more intuitive and user friendly with more options for controlling the devices. Additional feature to control devices through internet will also be added so that the user can log in through internet to control the appliances and get real time notification of the status of the sensors by using internet. GPS tracking will be enabled can also be used to track the position of the user. It will certainly improve the overall functioning of the system and will save the user from manually controlling the sensors each time he/she leaves home. The sensors are connected through wires but it can be connected through a Wireless Sensor Network to remove the complexity of passing the wires from one room to other.

V. CONCLUSION

This paper presents the design and use of a economical and secure home security system for general users. The most prominent feature of the system is that the user can control the system through an android application. Android mobile phones being popular in the market and most preferred for use make this more apt for sake of simplicity and versatility. Many previous works require the user to type and send and Short message to send command to the system. But this paper present an unique and easy way to manage appliances and as well as to get notified about the condition of the house. Certainly anyone would agree that pressing a single button is more comfortable than to typing a SMS. The whole system was implemented by fabricating it on a

PCB board which will be very small in size. Reduced size makes it more applicable for commercial manufacturing and distribution.

REFERENCES

- [1] Wael M El-Medany, Mahmoud R El-Sabry. "GSM-Based Remote Sensing and Control System using FPGA" Proceedings of the International Conference on Computer and Communication Engineering 2008(ICCCE08)
- [2] Home Network Technology Based on Wireless Sensor Network", Academic Journal of Shenyang Jianzhu University, Vol. 21, No. 6, pp.753-756, Nov. 2005 (in Chinese)
- [3] Coskun and H. Ardam, "A remote controller for home and office appliances by telephone," IEEE Trans. Consumer Electron., vol. 44, no. 4, pp. 1291-1297, Nov. 1998.
- [4] A.J. Bernheim Brush, Bongshin Lee, Ratul Mahajan, Sharad Agarwal, Stefan Saroiu, and Colin Dixon, "Home Automation in the Wild: Challenges and Opportunities", CHI 2011, May 7–12, 2011, Vancouver, BC, Canada.
- [5] E. M. C. Wong, "A phone-based remote controller for home and office automation," IEEE Trans. Consumer Electron., vol. 40, no. 1, pp. 28-34, Feb. 1994.
- [6] Wu Chengdong, Zheng Jungang, Liu Daren, Xie Kun, "Study on Smart
- [7] [7] Baris Yuksekkaya, A. Alper Kayalar, M. Bilgehan Tosun, M. Kaan Ozcan, and Ali Ziya Alkar. "A GSM, Internet and Speech Controlled Wireless Interactive Home Automation System" IEEE Transactions on Consumer Electronics, Vol.52 No. 3, pp: 837-843,2006.

AUTHORS

First Author – Abhinav Gupta, Mechanical Engineering,
Vellore Institute of technology

Second Author – Komal Tomar, Electrical and Electrical
Engineering, Vellore Institute Of technology