Home Security & Control Over Appliances By GSM

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Abstract — The aim of this research is to design and implement a cost effective and yet flexible and powerful home security system using the GSM technology. A mobile based home security system is needed for the occupant’s convenience and safety. The system is designed to detect burglary, leaking of harmful gas; smoke caused due to fire and after detecting suspicious activity it sends a alarm message to the owner number. The whole process is controlled by a android cell phone application. The user can activate all the alarm system while going outside thorough the apps. The app has the feasibility of activating and deactivating the alarm system with the additional control for some home appliance switching. With this system installed a person can travel anywhere in this world within the GSM covered region with the assurance of complete safety of his/her house.

Key words: GSM, home security system, remote appliance control

I. INTRODUCTION

Home automation is a process for improving the quality of resident’s life by facilitating flexible, comfortable and a secure environment. In international markets Internet based home automation systems is one of the most popular system. The remote controlling and monitoring of a house using internet requires a laptop or a computer which is comparatively large in size and heavy to carry around all day long. So an alternate can be a mobile phone with operating system on it for remote monitoring and controlling of a house. A mobile phone can be carried all day long so it is feasible to use a mobile phone rather than a laptop or a computer to remotely monitor the status of our house. Earlier system was dependent on telephone line using a phone based remote controller . In general the home automation faces four significant challenges.

The WSN (Wireless Sensor Network) technology also has the advantage of wide covering area which ensures remote monitoring and fast network establishment with reasonable cost . The key difference between WSN and GSM is its wide covering area which facilitates very long distance communication. Describes working structure and simulation of a GSM based remote sensing and appliance control using FPGA. Describes home automation process using speech recognition, GSM and internet.

The main advantage of GSM network is that its wide area coverage even to remote rural area and it is battery powered. The user can get the theft and intruder alarm within a second wherever he/she is. To get the alarm message from the security system installed in the user premises the user has to activate the alarm through the application each time he/she leave the house. To activate and deactivate the alarm system the user has to log on to the system with a specific password. This prevents any misuse or unexpected alarm activation of the system. If the users unexpectedly left any electrical home appliance in running condition then they could also turn that off by the application. This saves us from a lots of energy wastage. The application and system is completely user friendly. Someone won’t need to be an expert to run the application in his/her mobile. The designed system has the option for adding more sensors. The user also can add more relays to get control over more appliances if he/she wants. So altogether the system is a modern intelligent home security system which can give us a relief whenever we want to leave out home.

II. SYSTEM ARCHITECTURE AND WORKING PRINCIPLE:

A. System overview:
The available GSM communication options are:
(1)Based on SMS: Turning on/off load simply by sending a SMS. This can also generate an alarm based on intruder or fire hazard by sending an SMS to the owner.
(2)Based on voice call: It is actually a smart intruder alarm that calls the police or fire station with a pre-recorded voice message.
(3)Based on Internet: By using this feature we can control the device from anywhere in the world where there is an internet connection.

Here we have chosen the SMS based communication option. The total system is controlled by 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. The system has the following features:

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

(1) 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.

(2) User friendly interface: The system is user friendly. Anyone with a little knowledge in android can use it to control the home appliances and can also ensure the safety of his/her house. 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) Emergency alarm: whenever the system detects an unexpected event occurring in the house then alongside sending a message to the user it sounds an noisy alarm instantaneously. So that the neighbors can also be notified that something unexpected has occurred in the house.

(4) Very 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.

(5) **Wide area coverage:** Now a day’s almost every corner of the world is covered by GSM network. So the users can interact with the system even from a very remote place far from urban areas.

![Fig. 1: Block diagram of the system](image)

**C. Reason for choosing such a system:**
As stated earlier in this paper the home automation system has four main challenges. There are these are high cost of ownership, inflexibility, poor manageability, 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 is GSM communication:**
The security mechanisms of GSM are implemented in three different system elements. The SIM, the GSM handset and the GSM network. The SIM contains the IMSI, the individual subscriber authentication key, the ciphering key generating algorithm, the authentication algorithm, as well as a PIN. The GSM handset contains the ciphering algorithm. The encryption algorithms are present in the GSM network as well. The Authentication Center (AUC), part of the Operation and Maintenance Subsystem (OMS) of the GSM network, consists of a database of identification and authentication information for subscribers. This information consists of the IMSI, the TMSI, the Location Area Identity (LAI), and the individual subscriber authentication key (Ki) for each user. In order for the authentication and security mechanisms to function, all three elements (SIM, handset, and GSM network) are required. This distribution of security credentials and encryption algorithms provides an additional measure of security both in ensuring the privacy of cellular telephone conversations and in the prevention of cellular telephone fraud.

**E. The system:**
The block diagram of the whole system is shown in Fig.1. The system that resides in the home is actually shown here. The other part which is not shown in the figure is the cellular phone which will be in the hands of the user. The readings of the sensor are taken as an input of an 8 bit ATmega328 microcontroller. The microcontroller according to the previously given instruction and threshold value then decide whether to sound an alarm and send and alert message to the user or not. It sends the alarm message to the user through the GSM module.

The GSM module operates through the operating SIM. Any instructions that come from or go to the user are coming to the module using the operating SIM number. The module then decodes the message that comes from the user and sends commands accordingly to the operating microcontroller. The module also receives the signal from the operating microcontroller and sends message to the user accordingly. 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](image)
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. To prevent the misuse of the system application has password protection. The user has to log on to the system by entering a specific password. 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 has to change the password in case if someone knows it accidentally then the user can change the password by clicking “Setting” tab of the application. But however to change an old password 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.

The microcontroller will also tell the GSM module to send the corresponding message to the user’s cell phone. The microcontroller also has some relays connected with it. The GSM module receives the configuration sent by the user and tell the microcontroller to turn on or off the home appliances accordingly. As stated earlier user can also turn on or off specific sensors or appliances simply by pressing a button of the mobile application. The total flow chart for the algorithm use the control the whole system is shown in fig. 5.

Fig.3: the application interface

II. Program flow chart:
If the value of the sensors exceeds the threshold value then the alarm system will be activated by the microcontroller. The microcontroller will also tell the GSM module to send the corresponding message to the user’s cell phone. The microcontroller also has some relays connected with it. The GSM module receives the configuration sent by the user and tell the microcontroller to turn on or off the home appliances accordingly. As stated earlier user can also turn on or off specific sensors or appliances simply by pressing a button of the mobile application. The total flow chart for the algorithm use the control the whole system is shown in fig. 5.

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 to detect any kind of motion. The smoke sensor was also tested by burning paper. The appliance control
process through the application was tested by using some electric bulb as the load. Everything looks perfect for use. With a hard case the system can be made commercially available. Additional relays are connected to ensure the feasibility for the user to connect additional load for controlling as shown in fig. 6.

Fig.6 : Additional relays to connect more appliances for controlling
In the application the users also have the option to add more appliances and name it. 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 WORKS
As with mobile application the system will be modified to control through internet 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 can also be used to track the position of the user so that the system can sense whether the user is in home or not. It will certainly improve the overall managing quality of the system and will save the user from manually activating and deactivating the sensors each time he/she leaves or come to 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 implementation of a low cost but secure home security system for general users. The most stunning feature of the system is the user can control the system through an android application. Android mobile phones are now most popular in the market and most people prefer to use those for their 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 control appliances and as well as to get notified about the present 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 designing a PCB board which is also very small in size. Reduced size makes it more applicable for commercial manufacturing and distribution.

VI. NOMENCLATURE
SMS - Short Message Service
SIM - Subscriber Identity Module
PIN - Personal Identification Number
GSM - Global System for Mobile Communications

REFERENCES