Design and Development of SMS Based Wireless Home Appliance Control and Security System

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The rapid change in the wireless communication service and technology has made it possible to decrease the cost for communication and also to incorporate this technology with our daily life. Based on SMS/GPRS mobile device and embedded module including the self-organized home automation system, it can be integrated to allow the user end to control the home appliances and devices and to monitor the home surveillance system. In this paper a new concept of using a small mobile phone as a handy device for user to control any home autonomous system is demonstrated. A communication module with a microcontroller enabled system in sync with the cell phone to send commands and receive alerts through the complete system was used. The system for home surveillance arrangement and merged the fire smoke detector with the whole microcontroller module including the SMS sending and receiving process is designed.

Field of Research: Telecommunication Engineering.

Keywords: GSM Module, Home appliances, Home security, Microcontroller.

1. Introduction

The enhancement of mobile communication technology has led us to a certain level of progression in our daily life. Working with this concept motivated us to bring up a new and fresh concept of controlling the home appliances and the security surveillance system with the GSM and GPRS technology. The whole system is based on the embedded engineering and microcontroller is the base of this module. A microcontroller module has been designed with a GSM module for the SMS up and down stream.

The home appliances are being connected with the relays and through this relays the home appliances are being controlled. For the surveillance method smoke detector and PIR sensor has been used to make the notification process for the user part. This proposed solution will be simple and secure with robustness.

For home automation several approach has been investigated so far. A remote household appliance control has been elaborated in using internet (Alkar 2005; Jacobs 1963; Nunes 2000; Sriskanthan 2002; Liang 2002). A Bluetooth based home automation control is described by few researchers (Jia-Ching Wang 2008). A GSM based system for home automation is described which uses voice commands for control (Yuksekkaya 2006). Voice commands for home automation are being described in some research paper (Rifat Shahriyar 2008). For the simplicity and low cost we choose to use microcontroller and GSM module to the task.

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In this paper, we demonstrate the design and development of a simple secure and robust automated home automation and security system using microcontroller with a high efficiency. The developed system is verified through experiments.
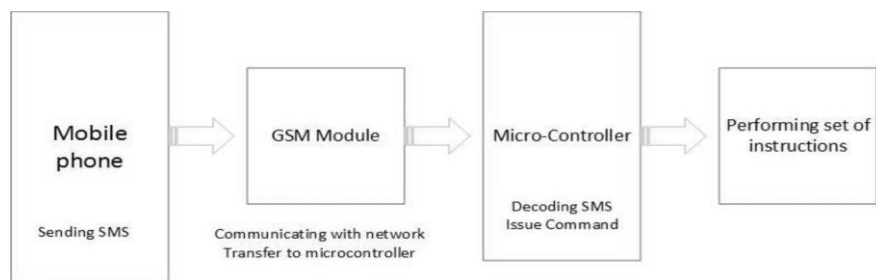
2. System Design

The design methodology and specification of the components are described below:

2.1 Design Methodology

This whole system is constitutes of basically two sub divisions. The hardware part and the software synchronization. The hardware part consist of AVR ATmega8L microcontroller enabled system and including that the GSM module has been attached with the RS-232 communication protocol. The appliances, smoke detector and PIR sensor linked with the relays. The relays are the output portals of the microcontroller. With the relays the whole system accomplishes the desired task as the commands come and goes. GSM module plays a very crucial role in the whole project. The system has been made completely autonomous and for this autonomous purpose the GSM module plays all the operational purpose. The system block diagram shown in Figure 1 illustrates the basic understanding of the whole system methodology.

Figure 1: System Methodology Diagram

Mobile phone

Sending SMS

GSM Module

Communicating with network
Transfer to microcontroller

Micro-Controller

Decoding SMS
Issue Command

Performing set of instructions

2.2 System Specifications

The key sub-systems of our developed system is as follows:

- User GSM mobile Handset: Cellular phone containing SIM (Subscriber's Identifying Module) card has a specific number through which communication takes place. The mode of communication is wireless and mechanism works on the GSM (Global System for Mobile communication) Technology. Here, the user transmits instructions to the system to control the appliance in the form of SMS.

- Receiver GSM module: It is a hardware component that allows the capability to send and receive SMS to and from the system. The communication with the system takes place via RS232 serial port. Cell phone can be attached at the place of GSM hardware but it limits the hardware functionality such as sending or receiving of SMS.

- Microcontroller embedded module: The module contains the micro-controller (AT89C51) and a timeout generator circuit. This is the main part of the system. On receipt of the SMS message, text words are checked with predetermined format which includes desired device ON/OFF commands. To read a message

the microcontroller sends the appropriate AT command to the Receiver GSM module which works as a GSM modem.

- Switching Module: This module drives (switches ON/OFF) the appliance according to the command sent in the SMS. The switching module is controlled by the microcontroller. The switching module is be in the form of a relay which allows a low power circuit to switch a relatively high current on or off for example a bulb connected to the 220V mains supply. The switching process is done by the relay in the project.

2.3 Module Designing

The framework of the proposed system is shown in Figure 2.

Figure 2: System Framework
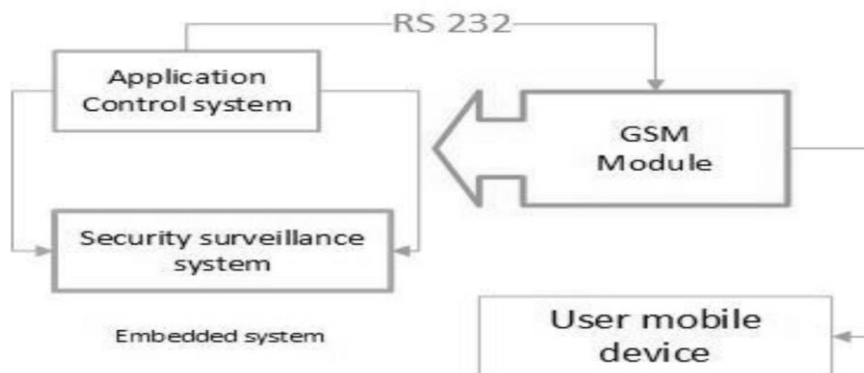
Serial I/O is considered as options for connection between the GSM module and the microcontroller. Using the microcontroller, a control circuit will be implemented to control the electrical appliances. The GSM module has been attached with the microcontroller and for this purpose a communication protocol has to be implemented. Pursuing this RS-232 parallel communication protocol has been brought up here to secure the communication issue. The GSM module is equipped with a SIM (Subscriber identity module) and this SIM maintains the complete communication with the user and the system. RS-232 circuit is mainly voltage level converter. In our project, microcontroller voltage level is 5V and GSM module voltage level is 3.6V. Here we use SIM300 GSM module demo board. This demo board is actually design for communicate with computer. So voltage level of this communication environment is around 7.5V. With this voltage level command the relays are controlled and with the peripherals we can secure the fire alarm and the PIR sensor. Below diagram describes the working topology for the RS-232 communication module units. The voltage level transition using the RS-232 is the key to this work. If this voltage level transition is not been made then the appliance control would be a tough challenge. The block diagram of RS-232 voltage conversion is shown in Figure.3 for the better justification of the RS-232 communication protocol and device utilization.

Figure.3: RS-232 Framework
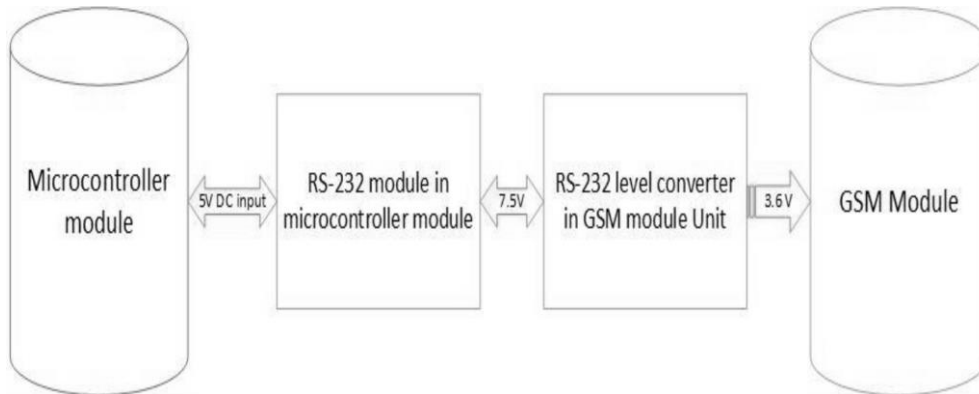
The process works in the fully automated way. When the users want to reach any home appliances he/she has to just send a SMS to the desired mobile number in the GSM module. The RS-232 port will the digital message turns in to analog voltage level signal and with this voltage level the relays are being terminated and the home appliances can be turned on and off. This could be one of the very easiest way.

The very basic difference between with the other model is that the whole system doesn't need any internet connection so in a remote condition it can be used. Another most significant specification of the developed system is the security control of the household and the fire protection service. The device is not that much big in size so it can be placed in any place and the usage is ease of access. A photograph of the developed system is shown in Figure.4.

Figure 4: Photograph of the Developed System
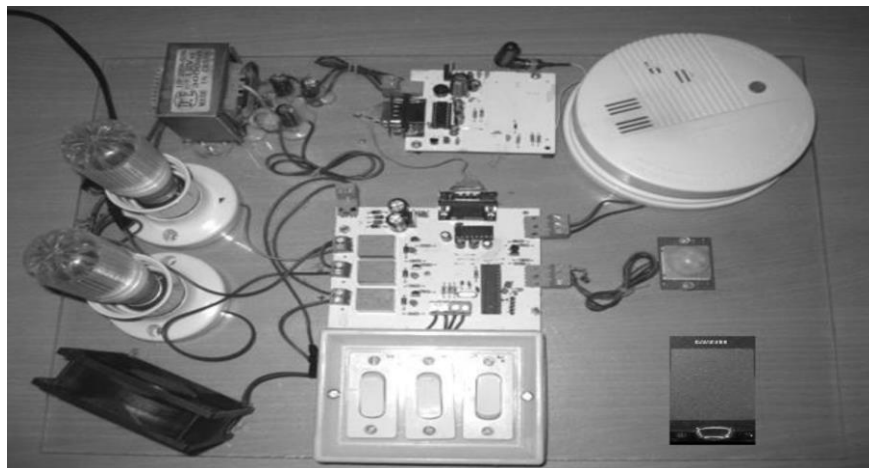
3. Prototype Verifications and Results

The prototype we had designed and verification for that we had connected some lights and other appliances with the module so we can test the whole system. With our illustration we can manual switch mode on and off the devices and also get to know the power status of the each device.

Figure.5: Switching on and Off

According to the given snapshots as shown in Figure 5, the appliances are being switched on and off. Not only switching the status check procedure has also been made. The whole process just made with the sending SMS and receiving SMS. The loads are usually the devices which are connected with the relay, As shown in the prototype illustration photo after sending the status check command the from the GSM module we are getting back the reply command as it was made set in the microcontroller. After the status checking the user can also control the loads only using the user mobile. The SMS were sent and the commands were fetch from RS-232 port in the embedded system and how this whole system module are being organized.

Rather than the home appliances on the relay sensor were connected and the smoke detector. These are used as the home security system. The PIR sensor acknowledge any unauthorized entry in the residence and notify the user's about it. In case of fire alarm system the smoke detector has been deployed.

For the motion sensor sensed any motion then it would send below the SMS from set-up of GSM module to our mobile handset and this SMS send to our mobile handset afterward 1 minute left and continuities as shown in Figure 6.

Figure 6: Snapshot of SMS When Motion Sensor is Triggered

At any time if smoke detector received any smoke then it would shout alarm and send the SMS from device of GSM module to user's mobile device as shown in Figure 7.

Figure 7: Snapshot of SMS When Fire Sensor is Triggered

4. Conclusions

In this paper, low cost, security, far and wide accessibility, auto configuration, remotely controlled solution for automation of homes has been implemented. The method discussed in this paper has achieved the target to control home appliances remotely using the SMS-based system satisfying the user needs and requirements. From the convenience of a simple cell phone, a user is able to control and monitor virtually any electrical device in household. By connecting all the appliances with the system through power line communication or wireless to the system, all electrical household appliances can be controlled by sending a message from a mobile handset. Future works may be done on enhancing the security of this system.

5. Acknowledgment:

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