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Design and Implementation of a Priority Based Load Control System Based on GSM Technology Using Android Application

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Abstract-The evolution of mobile communication technology and the reduction in costs make it possible to incorporate technologies into home. This work gives an imperative understanding of the design and function of an android application along with the GSM (global system for mobile communication) technology to control various operations of appliances in household/office. Energy crisis is the most critical infrastructure constraint on Bangladesh economic growth. Whatever power source or production we have, we have to reduce the extravagance of power to lessen repetition of power failure or frequent load shedding. The authentication to the user over different home appliances inside or outside home through sending command using an android application has been developed here. This system can range from simple remote control of lighting through to complex computer/micro-controller based networks with varying degrees of intelligence and automation.

Keywords: Android Application, GSM Technology, Home Automation, Microcontroller, Smartphone

1. INTRODUCTION

Technology has advanced so much in the last decade or two that it has made life more efficient and comfortable. The comfort of being able to take control of devices from one particular location has become imperative as it saves a lot of time and effort. Therefore there arises a need to do so in a systematic manner which we have tried to implement with our system. The system we have proposed is an extended approach to automating a control system. The application of our system comes in handy when people who forget to do simple things such as turn ON or OFF devices at their home or in their office, they can now do so without their presence by the transmission of a simple text message from their mobile phone. Also unnecessary load will be switched off by setting load priority. The project is done as an experiment of Home Automation via mobile technology. This was selected because of incorporating mobile technology with controlling of appliances which we believe is the next important step to realize the Home Automation. The comfort of being able to take control of devices from one particular location has become imperative as it saves a lot of time and effort [1]. Android phones become more popular in recent years. Many reputed and non-reputed company provides this smart phones at a very low price. For this reason, developing an application for the smart phones on android platform by which we can control loads of any place like a resident, an industry or an administration. This system will thus reduce power loss to a great extent if whole resident of a community or all industry use this system.

2. DEVELOPMENT OF SYSTEM ARCHITECTURE

This total system can be divided in two subsystems [2]. The first portion is the smart phone application portion and the second portion is the microcontroller unit. The microcontroller unit is also divided in two parts, GSM unit and load control unit.

2.1 Development of android application

An android application is developed to control the system. The application is made to ease the users interaction with the system. Here is the flow chart representing the development of the android application through which desired command is sent to control unit.
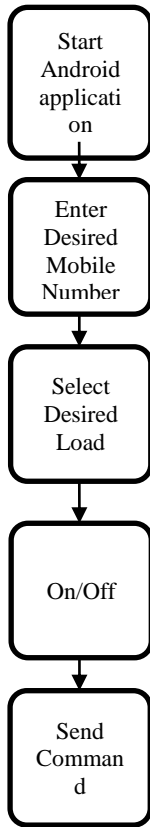
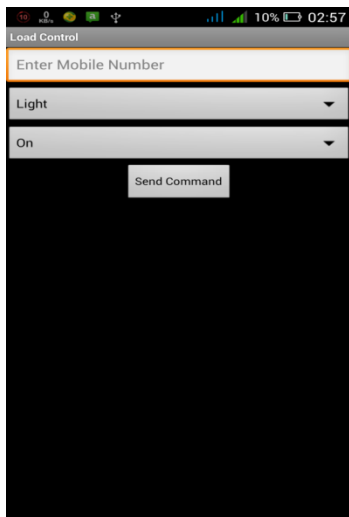Fig.1: Android application flowchart

Fig.2: Screenshot of the android application

2.2 Algorithm for priority based load control

Here is the algorithm for controlling the loads through load switching relay by controlling unit [3].
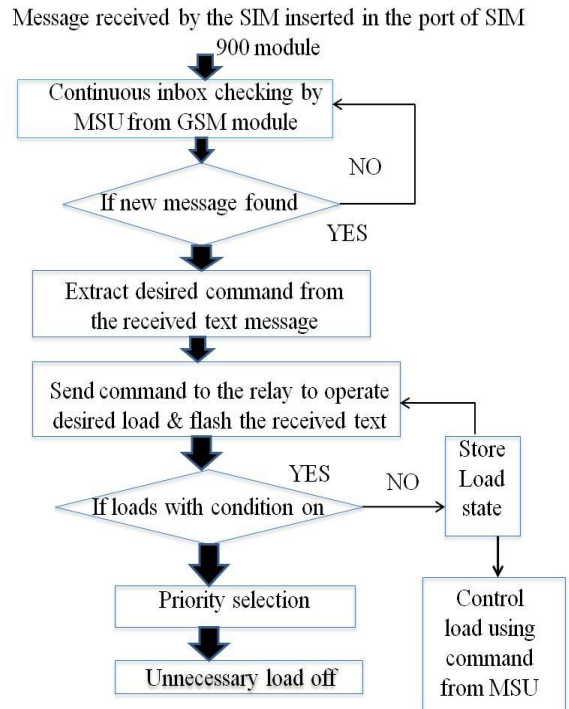

Fig.3: Flowchart for priority based load control

2.3 Sms retrieve using GSM modem (SIM 900)

To enable a computer/PC to read SMS from a message storage area, the GSM/GPRS modem or mobile phone has to support the AT commands [4] +CMGR (command name in the text: Read messages) and + CMGL (command name in the text: List messages). The +CMGR AT command is used to read an SMS at a certain location of the message storage area, while the +CMGL AT command is used to read SMS messages that have a certain status from the message storage area. The status can be "received unread", "receive read", "stored unsent", "stored sent" etc. The +CMGL AT command also allows you to retrieve all SMS messages stored in the message storage area. Following is an example for illustrating the difference between +CMGR and +CMGL .Suppose I want to use my computer/PC to read a text message from the message storage area and you I know the index at which the SMS text message is located. In this case, I should use the +CMGR AT command. Here is the command to be typed (assume the SMS text message is stored at index 3) [5].

```
AT+CMGR=3
```

The GSM/GPRS modem or mobile phone should return something like this:

```
+CMGR: "REC READ","+85291234567",,"07/02/18,00:12:05+32"
Hello, welcome to our SMS tutorial.

OK
```

Suppose I am now in another room. I want to use my computer /PC to retrieve all SMS that has not been read before. In this case, I should use the +CMGL AT command. In SMS text mode the command line to be used should be

AT+CMGL="REC UNREAD"

This time the response of the GSM/GPRS modem or mobile phone should be something like this:

```
+CMGL: 1,"REC READ","+85291234567",,"07/02/18,00:05:10+32"
Reading text messages is easy.
+CMGL: 2,"REC READ","+85291234567",,"07/02/18,00:07:22+32"
A simple demo of SMS text messaging.
+CMGL: 3,"REC READ","+85291234567",,"07/02/18,00:12:05+32"
Hello, welcome to our SMS tutorial.

OK
```

The +CMGL AT command can also be used to read all SMS messages stored in the message stored area. To do so in SMS text mode the command line should be something like this

AT+CMGL="ALL"

This time the response of the GSM/GPRS modem or mobile phone should be something like this :

```
+CMGL: 1,"REC READ","+85291234567",,"07/02/18,00:05:10+32"
Reading text messages is easy.
+CMGL: 2,"REC READ","+85291234567",,"07/02/18,00:07:22+32"
A simple demo of SMS text messaging.
+CMGL: 3,"REC READ","+85291234567",,"07/02/18,00:12:05+32"
Hello, welcome to our SMS tutorial.

OK
```

As we can see above the +CMGR AT command can only be used to read one SMS message at a time, while the +CMGL AT command can be used to read multiple SMS messages at a time.

2.4 Circuit diagram
Using arduino mega the operational circuit is built. The schematic diagram is given at fig.

3. CIRCUIT OPERATION
The remote user sends commands to the receiver through android application. GSM receiver receives messages sent from the user smart phone, at the same time it decodes the sent message and sends the commands to the microcontroller.

Microcontroller issues commands to the appliances and the devices connected will switch ON/OFF.

Microcontroller also checks among priority related loads and if any given condition is found the lower priority load will be switched off automatically [6].
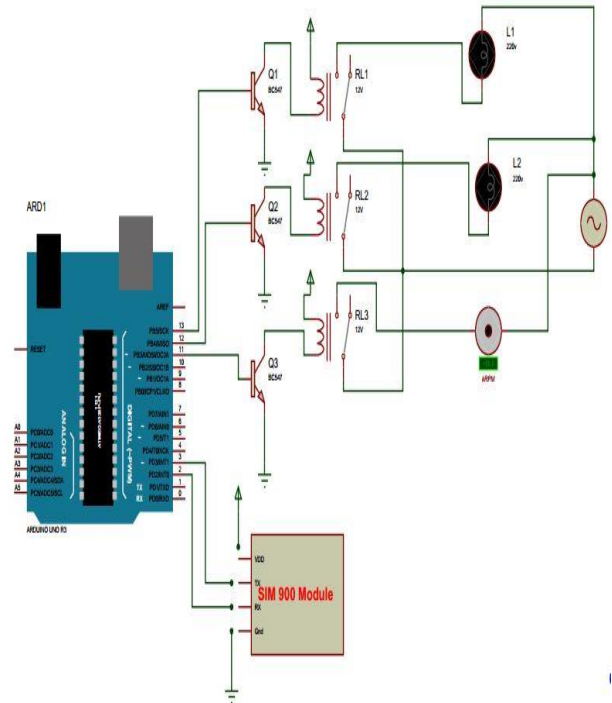

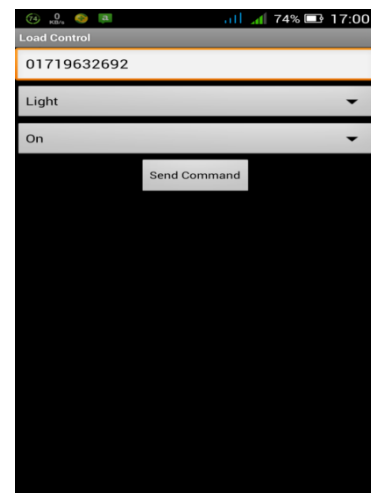Fig.4: Circuit Diagram for GSM based load controlling

Fig.5: Light on command in android app

4. Application
With a view to helping the consumer as well as the power distributor to control various electrical appliances and minimizing power loss, this project will come into great effect. For following aspects this project will help o a great extent.
- Home Automation
- Office Automation

- Industrial Automation
- To control water pump sets in agricultural fields.

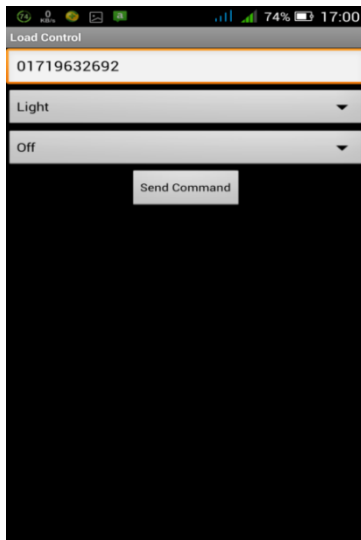The security system can be employed in household or any organization.
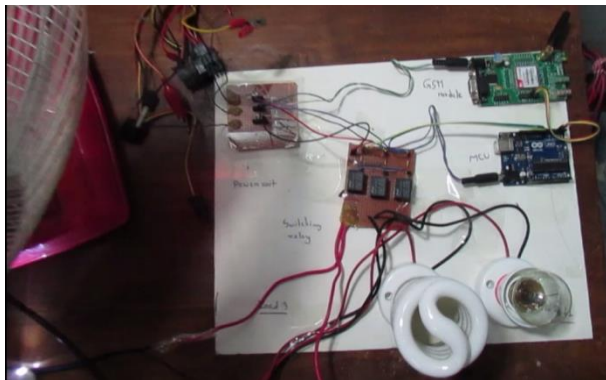

Fig.6: Light off command in android app

Fig.7: Physical circuit arrangement load control unit

5. CONCLUSION

The extensive capabilities of this system are what make it so interesting. From the convenience of an android smart phone application, a user is able to control and monitor virtually any electrical devices. This makes it possible for users to rest assured that their belongings are secure and that the television and other electrical appliances was not left running when they left the house to just list a few of the many uses of this system. Also by setting the priority issue most important power wastage management has also come into effect. The end product will have a simplistic design making it easy for users to interact with. This will be essential because of the wide range of technical knowledge that homeowners have.

6. FUTURE IMPROVEMENT

The future implications of the project are very great considering the amount of time and resources it saves. This project can be used as a reference or as a base for realizing a scheme to be implemented in other projects of greater level such as weather forecasting, temperature updates, device synchronization, , home security etc.

The project itself can be modified to achieve a complete Home Automation System which will then create a platform for the user to interface between himself and his household appliance. Besides the following works can be improved based on this project

- 1. It can be used for high security in banks and other organizations.
- 2. Using real time clock, the appliances which need response in real time can also be controlled through the wireless link.
- 3. Connecting more Devices.
- 4. Provision To Store Several Mobile Numbers
  5. Video Recording Once Alarm Gets Triggered

7. REFERENCES

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