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# Microcontroller Based Home Security and Load Controlling Using Gsm Technology

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***Abstract***—"Home automation" referred to as 'Intelligent home' or 'automated home', indicates the automation of daily tasks with electrical devices used in homes. This could be the control of lights or more complex chores such as remote viewing of the house interiors for surveillance purposes. The emerging concept of smart homes offers a comfortable, convenient and safe and secure environment for occupants. These include automatic load controlling, fire detection, temperature sensing, and motion detection and lock system etc. Furthermore it has advanced security compared to other houses and can send a message to the user for action that occur inside his/her house while he/she is away from home. It can also allow a person to control appliances from a remote location by mobile phone using GSM technology.

***Index Terms***—Home automation**,** Load controlling**,** Fire detection, Temperature sensing**,** Motion detection**,** Lock system**,** GSM technology.

## I. Introduction

As technology is advancing, so houses are also getting smarter. Modern houses are gradually shifting from conventional switches to centralized control system. Smart home automations gives the owner of a home an ultimate control over his or her home by automating lighting system, dimming, electrical appliances. Smart automated homes connect all the devices and appliances in user's home so they can communicate with each other. This advanced technology is used to do automation of a house activities, so it is also can be called as home automation [1], [2].

A smart home can be controlled by remote interface to home automation system itself via wireless technology [3], [4], [5]. A smart home automation can turn on and off a fan, light, air condition and also can control the speed of fan with the help of a mobile controller according to user needs. Because mobile controlled home automation system provides a simpler solution of a GSM network [6], [7]. It will help to shut down the whole system, improves the convenience and comfort of the user while it provides security and energy efficiency. GSM is used to digitalize a signal or data and transmit signal or data to the receiver. GSM (Global System for Mobile Communication) module can be used to send the signal over a mobile in a fixed frequency to other mobile phone connected with the receiver.

In between 1915 and 1920 electrical home appliance introduced. The smart home`s history can be easily traced back to the early turn of the century, where electrical and telephone wiring were installed in new houses. Integrated smart home infrastructure was usually built by hobbyist in the 1960s, built it was not until 1984 the term ``Smart Home`` was coined by the American Association of Home Builders. General Electric company was one of the first pioneers to develop a series of products made for smart automated homes in the mid 60`s, these products included portable automatic dish washers and microwaves.

To increase the performances of a smart automated house, lots of research is going on. For an example; The

 

**Aware Home Research Initiative (AHRI)** at Georgia Institute of Technology is an interdisciplinary research endeavor aimed at addressing the fundamental technical, design, and social challenges for people in a home setting [8].

## II. Methodology

There are two parts in our project. They are the security system and the load controlling system. In the security system we use several sensors such as temperature sensor, fire detector sensor, motion sensor. In the load controlling system we use relay to on or off the load. We have used GSM module to send message to a subscriber identification number about security purpose [9]. We have also used this GSM module to control load from remote area. The equipments that we have used in the whole project have been designed in the Proteus software. Each part of our project has been discussed in details.

### *A. Temperature sensing unit*

This unit monitors real time temperature data from two rooms continuously. Every room has its setting temperature. Above this setting value, the microcontroller sends message to the user's mobile phone that the temperature is high.

We have used Thermistor (10K) as temperature sensor with a negative temperature coefficient. Good choice for temperature sensing applications [10], [11], [12].When temperature raises the resistance of Thermistor decreases.

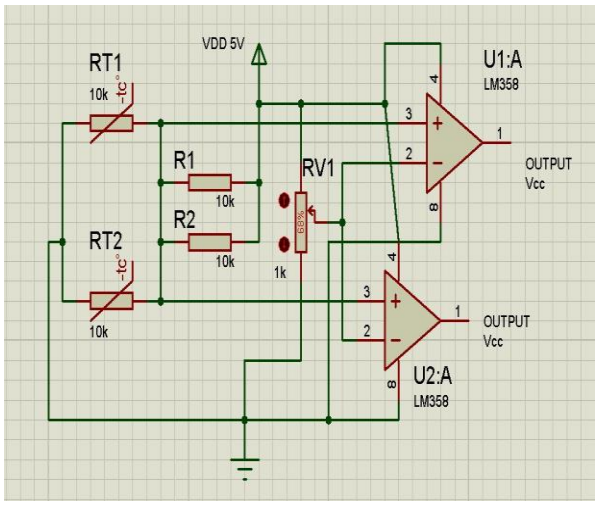


Fig.1. Temperature sensing circuit

We have used comparator to set the reference value. Below the reference value, comparator output is high and above the reference value comparator output is low. Then the output of the comparator has been sent to the microcontroller. Then the microcontroller processes the taken from the comparator and sends a message to user's mobile phone as it has been programmed.

### *B. Fire detector unit*

This unit has been used to detect flame in the corresponding room. Fire detector has the range of detection with the wavelengths from 760nm to 1100 nm and the detection angle can reach 60 °.When infrared wavelengths near 940nm, it will reach the maximum sensitivity [13], [14].When flame is found within this range, the microcontroller takes action to send message to user's mobile phone number.

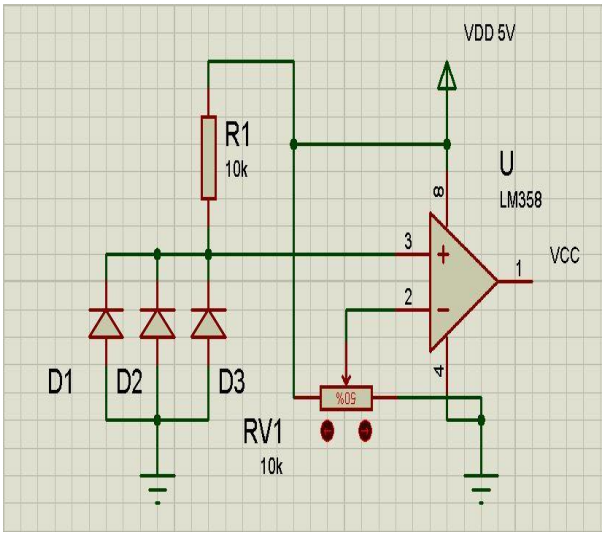


Fig.2. Fire detector circuit

When there is no flame, comparator output is high. When flame is found, comparator output is low. We have sent this comparator output value to the microcontroller input. Then microcontroller take necessary decision by reading the comparator output and send message to the users mobile phone.

### *C. Motion detector & Lock system unit*

The motion sensor gives digital output which has been used as microcontrollers input. When motion has been detected, motion detector gives logical one to the microcontroller. Then microcontroller takes necessary decision by reading the detector output. As a motion sensor we used PIR sensor which allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensor's range. They are often referred to as PIR, "Passive Infrared", "Piezoelectric", or "IR motion" sensors. PIRs are basically made of a piezoelectric sensor (which you can see above as the round metal can with a rectangular crystal in the centre), which can detect levels of infrared radiation. The PIR sensor itself has two slots in it; each slot is made of a special material that is sensitive to IR. The lens used here is not really doing much and so we see that the two slots can 'see' out past some distance (basically the sensitivity of the sensor) **[**15], [16].

In lock system, simple mechanism has been used. When a key has been inserted into the lock, two wires are connecting and give 5 volt to the microcontroller input port. Then microcontroller takes necessary decision by reading the input port. When key has been inserted, logic high input to the microcontroller pin. Then

 

microcontroller prepares to send message to user's mobile phone number via GSM module [17], [18], [19].

### D. Load controlling system

In this project the main and first priority unit is load control which has been interfaced with microcontroller. Load can be turned on or off by sending message from mobile phone. In our project we have controlled five loads via microcontroller and GSM module [20]. We can also receive update of which load is on or which load is off if we want to know it.

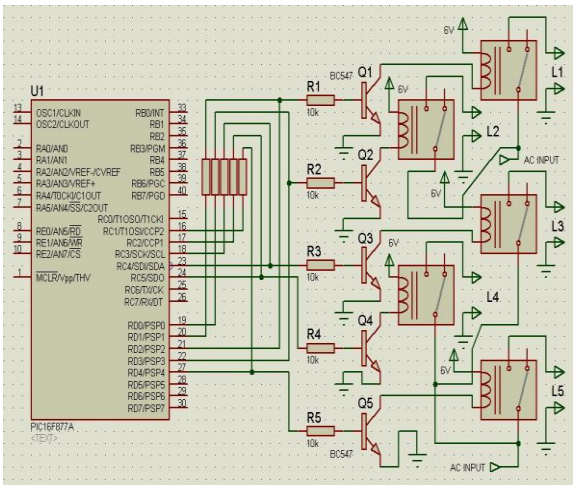


Fig.3.

Table 1. Message command for load control

| Command | Response |
|---|---|
| A | Load 1 ON |
| B | Load 2 ON |
| C | Load 3 ON |
| D | Load 4 ON |
| E | Load 5 ON |
| a | Load 1 OFF |
| b | Load 2 OFF |
| c | Load 3 OFF |
| d | Load 4 OFF |
| e | Load 5 OFF |
| X | All Load OFF |
| Y | All Load ON |
| S | Send status about load on or off |

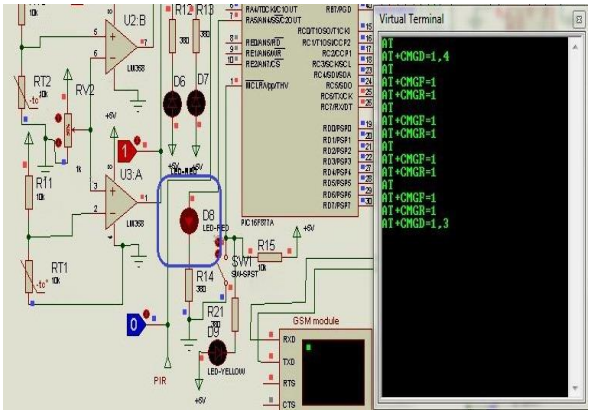


Fig.4. Command shown in virtual terminal

## III. Results And Discussions

In this section we have been discussed about the physical construction and operations of the project. There is GSM module which receive message and send data into microcontroller. Microcontroller read message and take necessary action to control the loads. GSM module also send message to mobile unit when temperature is high or flame is detected or motion is found of human body. This module also sends status about load and sensor to the mobile unit when user wanted to know the status.

### A. Command sends to GSM module

Microcontroller send different type of command to operate the GSM module such as initialization module, delete message, read message, set text mode, send message etc. At first GSM modem is initialized and set the baud rate. Then it deletes all messages from SIM. When GSM module is ready for receive data, the red LED (D8) is turn on. Now it is ready for receive message and send data to microcontroller.

### B. Operation of Temperature sensor

When temperature is below the reference value which has been set by the variable resistor, comparator output is high and above the reference value comparator output is low. We have been used comparator output in microcontroller input. In Proteus software simulation we have used logic toggle to set pin low or high.

When logic toggle pin make zero, the red LED is on, connected to output of temperature sensor which means temperature is high. Then microcontroller sends message to user's number (01770044141) which is shown in the fig 2.

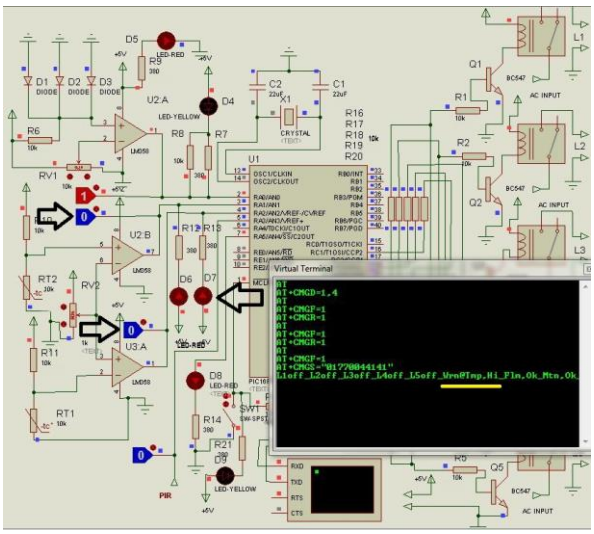


Fig.5. Software simulation of temperature sensor

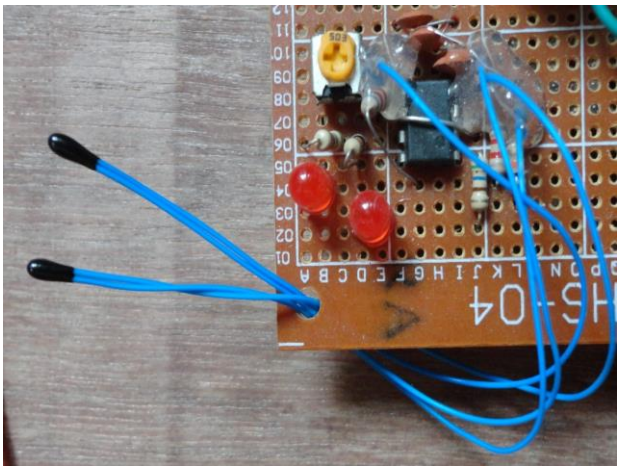

Fig.6. Hardware simulation of temperature sensor

Two red LED is off when temperature is below to the reference value. When temperature increases and above to the reference value, LED is on and microcontroller input is zero and it prepares for send message of warning.

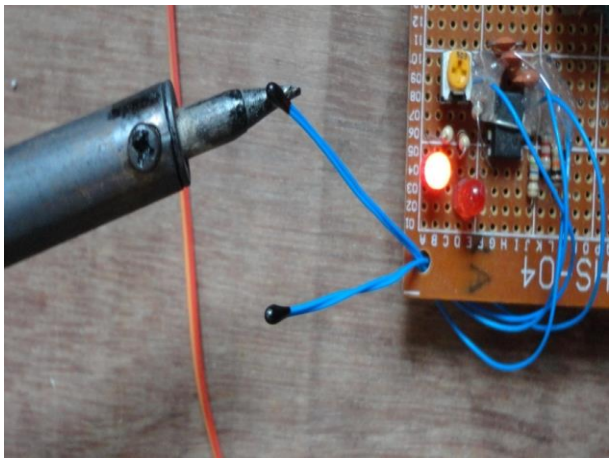

Fig.7. Temperature of sensor 1 is increase

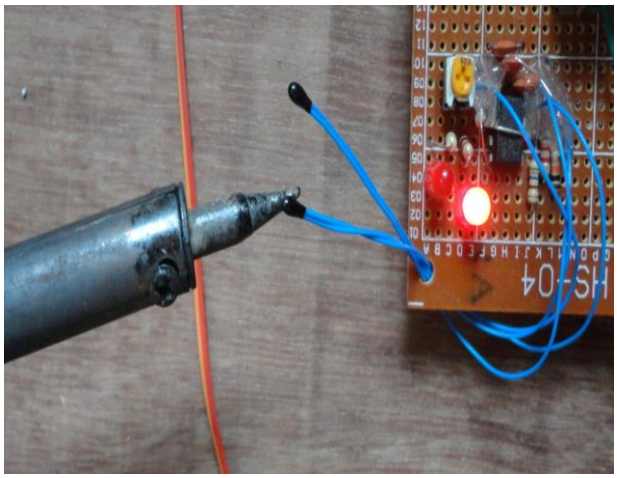

Fig.8. Temperature of sensor 2 is increase

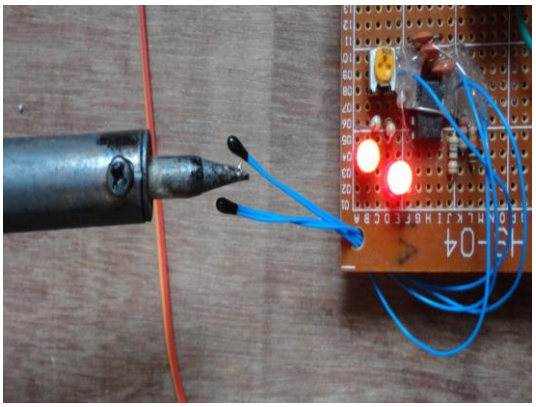

Fig.9. Temperature of both sensors is increase

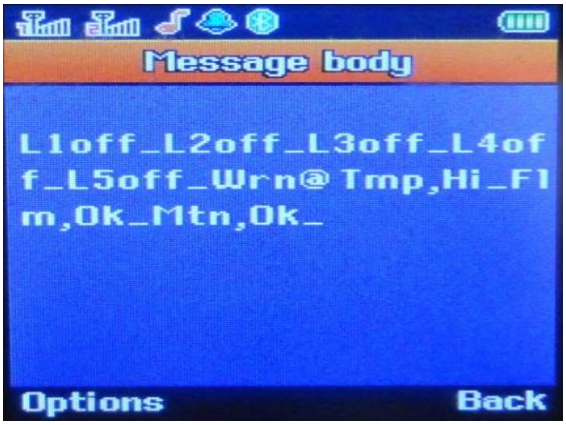


Fig.10. Temperature warning message

### *C. Operation of fire detector*

Flame sensor is like a diode. At first we have set the detecting range of sensor using variable resistor. Red LED is the power LED using in the circuit. When fire has been detected in the detecting area then yellow LED is on. Clear the microcontroller pin and then microcontroller send message to the user's mobile phone number.

The whole process has been done in software simulation by logic toggle pin by making zero. When fire has been detected by the sensor then the yellow LED is turned on and the microcontroller gets logic zero and sends a message to the user's mobile phone number.

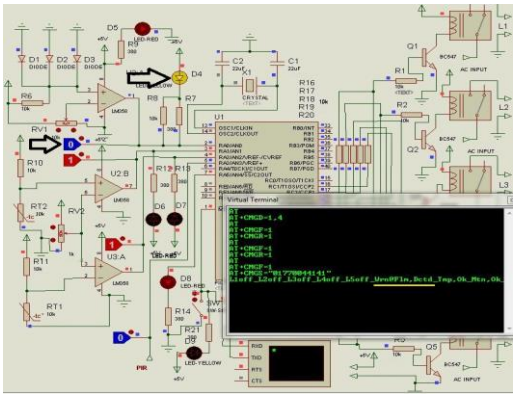

Fig.11. Software simulation

When fire has been detected by the sensor then the yellow LED is turned on and the microcontroller gets logic zero and sends a message to the user's mobile phone number.

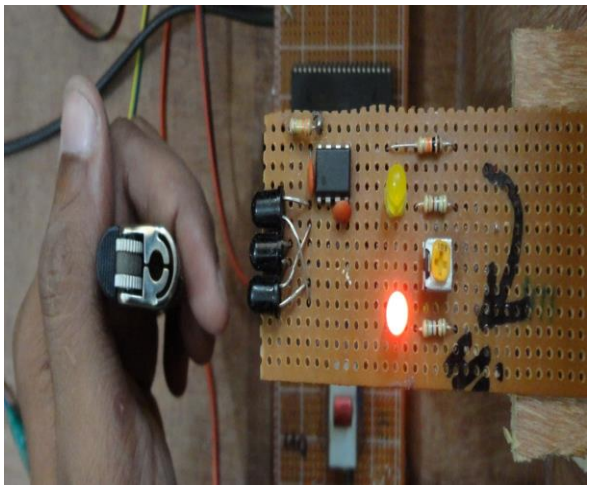

Fig.12. When fire is not present

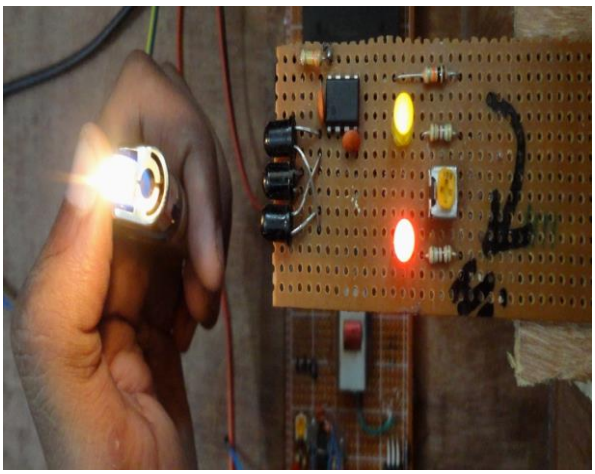

Fig.13. When fire is detected


Fig.14. Fire detection warning message

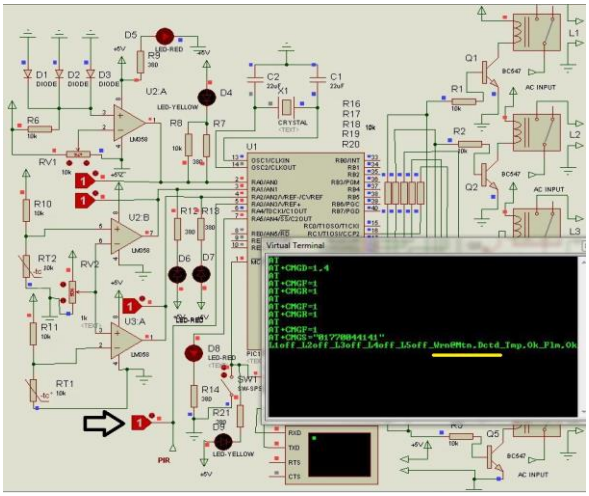

Fig.15. Software simulation of motion sensor

*D. Operation of Motion detector & Lock system*

When motion has been detected the microcontroller sends message to the user's mobile phone number.

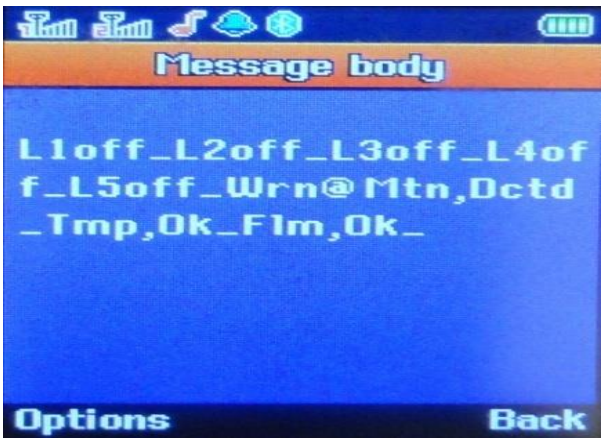


Fig.16. Motion detection warning message

In the lock system we have used two plates where we have provided a voltage difference. One plate is connected to positive terminal and another plate is connected to the microcontroller. When the key has been inserted to the lock these plates make a contact with each other then microcontroller gets data one and a message has been sent to the user's mobile phone number.

*E. Operation of Load controlling system*

In our project we can control each and every load individually. In this system we can turn on or off every load by sending a message from the user's mobile phone number. Such as for load 1, if we want to turn on we have to send a message writing the code 'A' and on the other hand if we want to turn off we have to send a message writing the code 'a'. Rest of the loads can be controlled in this way.

 

Fig.17. Load controlling system

There is another feature in the load controlling system and that is, if we want to know the loads present condition we have to send a message writing the code 'S'. This code will be received by the GSM module and a reply message will be sent to the user's mobile phone number that which loads are on and which loads are off.


Fig.18. Status of Load

*F. Implementation with Remote Controller*

This project also can be implemented with a remote controller where the remote controller will be used to turn on or off the house hold loads. The speed of the fan also can be varied with the help of remote controller.

*G. Implementation for security purpose*

For security purpose face detection and image processing technology can be used in this project. To turn ON or Lock down the whole system so that no one can operate anymore a password can be used which would be the image of the user. Also numeric and finger print can be used as a password with the help of keypad or finger print sensor which will provide a secured system for a user.

*H. Implementation of Heart Beat Sensor*

We can use heart beat sensor which will show the his\her heart beat rate with the help of display. This feature can be also used for speed controlling of fan or for varying the temperature of the Air-conditioner. So that, the room achieves a comfortable atmosphere.

*I. Visitor Counting Sensor*

In this project we have used visitor counter and that will count the number of present visitors. Existing number of visitor will be shown in the display. The speed of the fan can be increased or decreased also the temperature of the air-conditioner can be varied as the number of visitors' increases or decreases to maintain a comfortable living condition for the visitors.

## IV. Conclusion

With advancement of technology things are becoming simpler and easier for us. Automation is the use of control systems and information technologies to reduce the need for human work in the production of goods and services. The communication of home is only through the SMS which has been tested with the mobile networks and is working on any mobile network. By this project we have stepped one step further to the future. The sensor based security system detects the motion and sends message to fire, police station and owner. There are various parameters which can be adjusted in this software. The developed GSM based security system gives good response to the sensor and sends SMS when it detects the fire or temperature is increased above desired level. Besides, it can send a message to the user for action when the owner is out of station and the home is locked which helps us to keep more secure of our home. Moreover, owner can control loads (on/off) automatically by mobile using GSM technology from anywhere. This project will have a large effect to the living standard of human being. In the system, a lot of other features can be added to the user's requirement depending upon the situation. A lot of things can be done in the project in the future but due to time limitations, this time it was not possible. This system can also be applicable in bank. If some emergency occurs, then the volt of the bank can be automatically locked down. Emergency fire service can also be done by this system. This system is practically easy to use and user friendly so it have a good future. It is cheap to build so it can be industrially produced and served in the market. Overall this project discusses the analysis, design and implementation of home automation.

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