

# Controlling Home Area Networks by Smart Phone

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**Abstract:** This paper presents the overall design of Home Automation System (HAS) with low cost and wireless remote control. This system is designed to assist and provide support in order to fulfil the needs of elderly and disabled in home. Also, the smart home concept in the system improves the standard living at home. The main control system implements wireless Bluetooth technology and GSM to provide remote access from smart phone. The switches status is synchronized in all the control system whereby every user interface indicates the real time existing switches status. The system intended to control electrical devices in house with relatively low cost design, user-friendly interface and ease of installation.

**Keywords:** HAS, Bluetooth Technology, Smart Phone, GSM

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## I. INTRODUCTION

An effective way of using Bluetooth and GSM technology is proposed to access the home appliances. The Android Mobile Phone Platform becomes more and more popular among software developers, because of its powerful capabilities and open architecture. It uses GSM and Bluetooth to revolutionize the standard of living. This system provides ideal solution to the problems faced by home owners in daily life. The system is wireless therefore more adaptable and cost effective. The GSM is used for automated appliance control by using the SIM300 module with PIC controller.

## II. RELATED WORK

There are many definitions of home automation available in the literature. Delgado et al [1] considered the problems with the implementation of home automation systems. Furthermore the possible solutions were devised through various network technologies. Several issues affecting home automation systems such as lack of robustness, compatibility issue and acceptability among the old and disabled people were discussed.

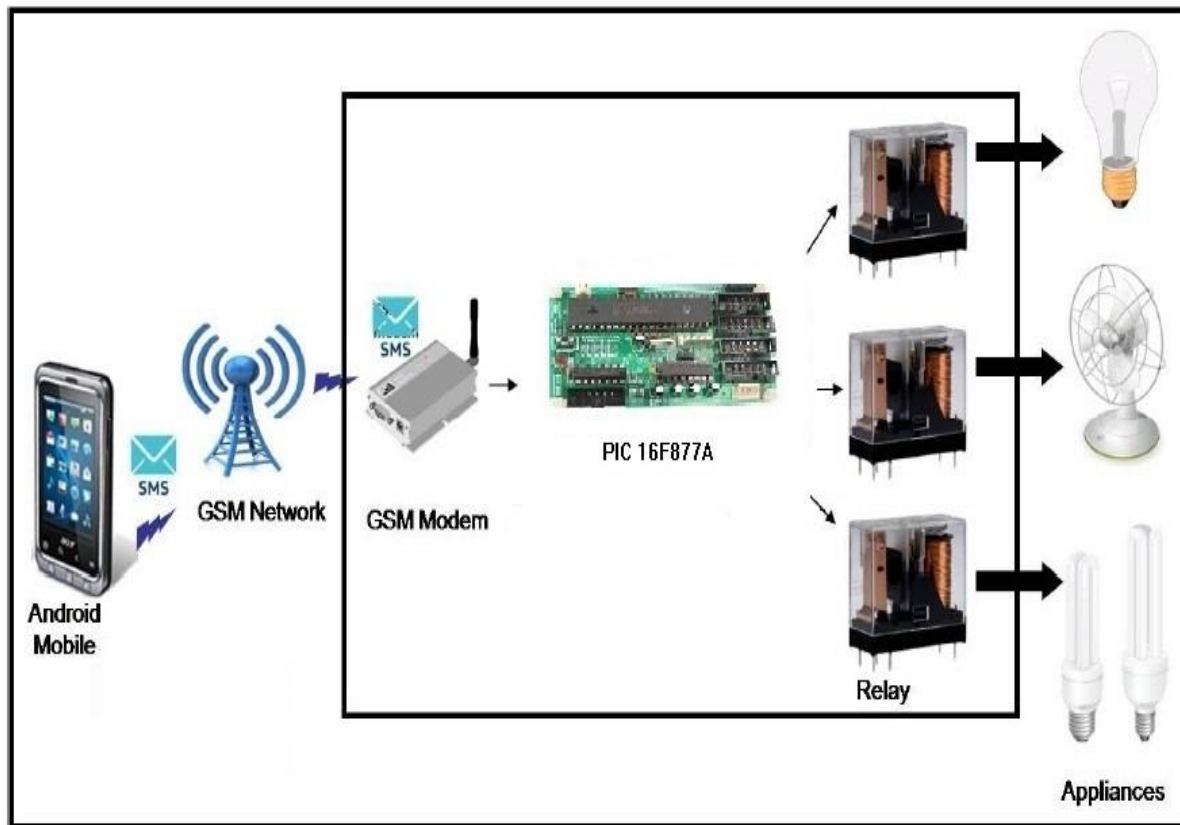
Ciubotaru-Petrescu et al [2] presented a design and implementation of SMS based control for monitoring systems. The paper had three modules involving sensing unit for monitoring the complex applications. A microcontroller worked as processing unit and a communication module that used GPRS modem or cell phone via serial port RS-232. The SMS was used for status reporting such as power failure. Murthy et al [3] explored primary health-care management for the rural population. A solution proposed the use of the mobile web-technologies providing the PHC services to the rural population. The system involved the use of SMS and cell phone technology for information management, transactional exchange and personal communication. Jawarkar et al [4] proposed remote monitoring through mobile phone involving the use of spoken commands. The spoken commands were generated and sent in the form of text SMS to the control system and then the microcontroller on the basis of SMS would take a decision of a particular task. Malik et al [5] focused on the controlling of home appliances remotely and providing security when the user was away from the place. The HACS system provided security against intrusion as well as automated various home appliances using SMS. Ahmad et al [6] described how to manage and control

home appliances using mobile phone, people could use this system to do things in their home from a far place before they reach home. To control an appliance the user has to send a command in the form of SMS from his/her mobile phone to a computer which was connected to the appliance. Once the message was received the computer would send the command to a microcontroller for controlling the appliance appropriately.

### III. SYSTEM ARCHITECTURE

The Bluetooth and GSM based Home Automation System (HAS) is developed using various mobile programming language and cross mobile platform like Windows, Java Me, Android respectively.

The GSM based Home Automation System uses SIM300 module and PIC16F877A controller based relay driver circuit with GSM Modem, which is able to communicate with the Home Appliances over GSM Network as shown in fig 1.



**Fig.1 System Architecture**

The GSM Modem is used to send SMS, make and receive calls. It can also do other GSM operations and it uses the highly popular SIM300 module for all its operations. This SIM 300 module comes with a standard RS232 interface which can be used to easily interface the modem to micro controllers and computers. Many appliances can be added to the mobile application and is based on the user need.

SIM 300 module is a plug and play GSM Modem and comes with an onboard wire antenna for better reception. The Board provides an option for adding an external antenna through an SMA connector The SIM300 allows an adjustable serial baud rate from 1200 to 115200 bps.

The modem consists of all the required external circuitry required to start experimenting with the SIM300 module like the power regulation, external antenna, SIM Holder, etc.

#### IV. DESIGN OF HAS

The circuit consists of the PIC controller that is interfaced with all sensors and with the smart phone through GSM and Bluetooth as clearly shown in fig 2.

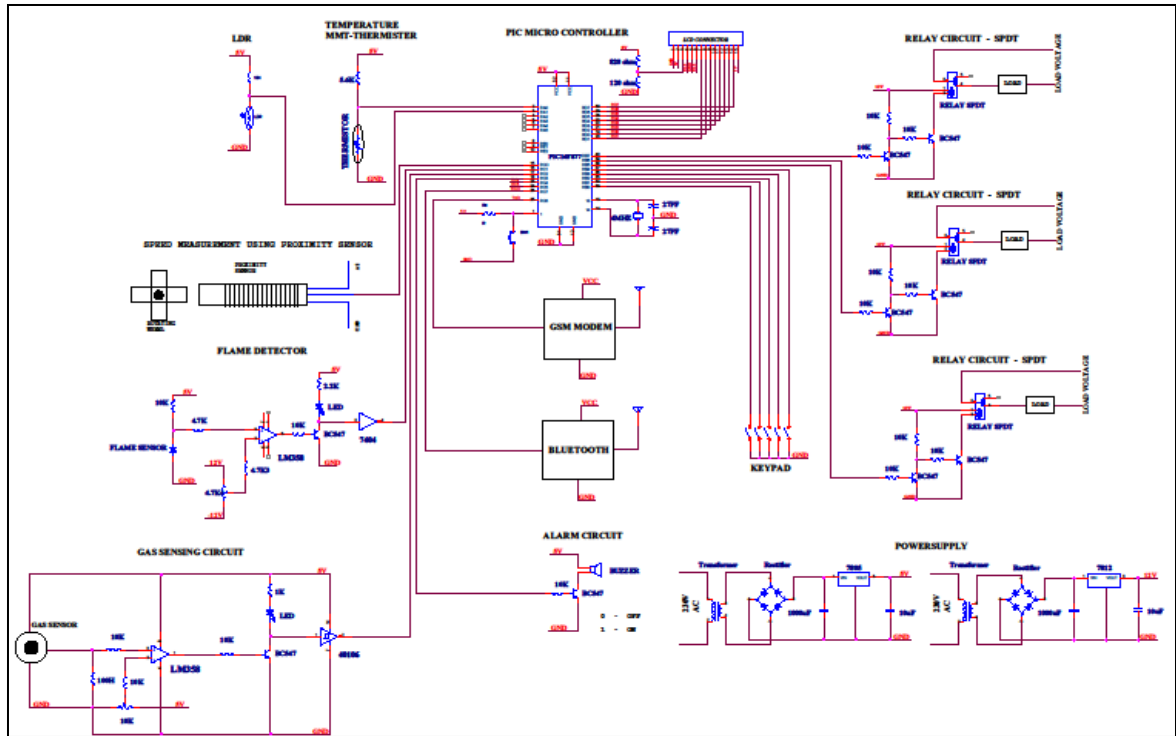


Fig.2 Circuit diagram

The GHAS (GSM Home Automation System) hardware works as client part and connected to GSM Modem and known as circuit for GHAS. It comprises of PIC microcontroller (16F877A), GSM Modem, Fire Sensor, Gas Sensor, LDR Sensor, Proximity Sensor, Temperature Sensor and Relay components.

The Light Dependent Resistors are very useful especially in light or dark sensor circuits. Normally the resistance of an LDR is very high, but when they are illuminated with light resistance drops dramatically. This prevents current from flowing to the base of the transistors. Consequently the LED does not light.

Inductive proximity sensors are used for non-contact detection of metallic objects. Their operating principle is based on a coil and oscillator that creates an electromagnetic field in the close surroundings of the sensing surface. The presence of a metallic object (actuator) in the operating area causes a dampening of the oscillation amplitude.

The rise or fall of such oscillation is identified by a threshold circuit that changes the output of the sensor. The operating distance of the sensor depends on the actuator's shape and size and is strictly linked to the nature of the material.

Temperature sensor devices are tools specially designed to measure the hotness or coolness of an object. However, sensors are actually measuring the atomic activity and movement of an object. When temperature sensor devices read an object with zero atomic activity, the temperature point is considered absolute zero.

The Fire Sensor circuit exploits the temperature sensing property to detect heat from fire. At the moment the sensor senses heat, a loud alarm will be produced. The circuit is too sensitive and can detect a rise in temperature of 10 degree.

A Gas Sensor is a device that detects the presence of gases in an area, often as part of a safety system. This type of equipment is used to detect a gas leak and interface with a control system so a process can be automatically shut down. A gas detector

can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave. Gas detectors can be used to detect combustible, flammable and toxic gases, and oxygen depletion.

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages.

A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities.

The smart phone used for this project has to be received a setting in order to access and control the devices in the home. The home accessible settings have the layout of available rooms and available devices at home premises.

In order to access those devices the user has to send the signal to the controller module through Bluetooth or GSM. In PIC 16F877 is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC 16F877.

For example if the user wants to switch ON the light means, he/she should give the signal from smart phone to the PIC by using the GSM. The receiver module also has the GSM module through which the signal is received.

The electro-magnetic relay with a wire coil is surrounded by an iron core. A path of very low reluctance for the magnetic flux is provided for the movable armature and also the switch point contacts. The movable armature is connected to the yoke which is mechanically connected to the switch point contacts. These parts are safely held with the help of a spring. The spring is used so as to produce an air gap in the circuit when the relay becomes de-energized. When using logic signals to control a relay, a driver circuit must be used to boost the current needed to energize the relay's electromagnetic coil.

By using the relay, ON or OFF operation is performed. The feedback signal is given back to the user by the feedback circuit. This circuit is designed to control the load. The load may be motor or any other load. The load is turned ON and OFF through relay.

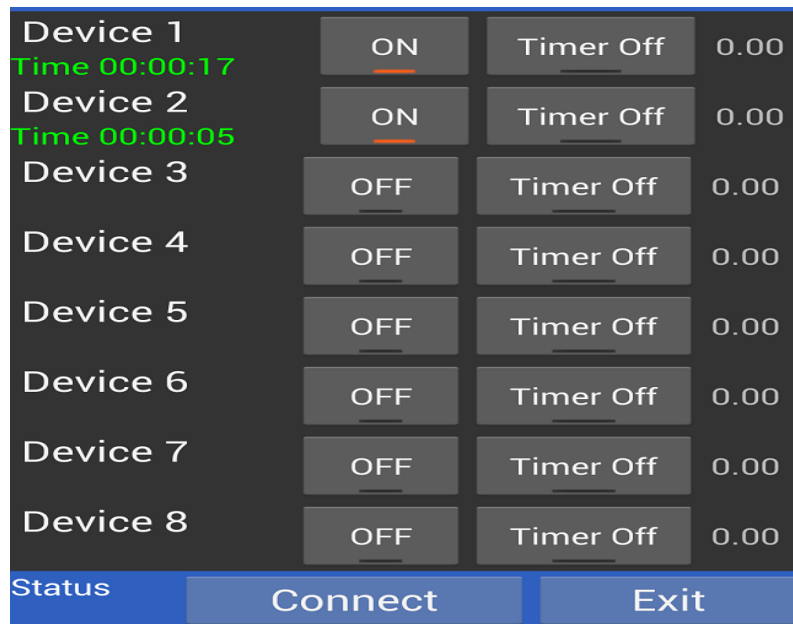
## V. IMPLEMENTATION

The Circuit power is switched ON and the status of blinking LED of GSM Modem is checked for the availability of GSM network. If everything is done correctly a stable LED and GSM Network is seen.



**Fig.3 Real implementation of Home automation system**

The hardware kit is having all the sensors that are connected to the corresponding relays. When it senses the signal, it sends it to the PIC controller. The figure 3 shows the real implementation of GHAS.



**Fig.4 HAS application in Smart Phone**

The HAS application is installed in the smart phone and it is shown in the figure 4. A layout is displayed and is having the entire devices and their status. If it is in ON condition it is displayed in the mobile screen. So it can be easily identified whether the device is in ON or OFF condition. When the 'disconnect' option is given, the application will exit.

The following steps are followed to send signal from smart phone. The 'GHAS' application is opened and the correct password is entered in password box of GHAS app. The device Control Screen will be appeared on the mobile screen. The status of every device can be checked from Grid Menu as shown in figure 4.

## VI. CONCLUSION

Design and implementation of the GSM Home Automation System (HAS) using the Smart phone has been discussed. The purpose of the GHAS is to use mobile phone's inbuilt SMS facility and GSM Modem for automation of Home Appliances.

Different hardware and software unit of the GHAS is described. The complete application software has been designed using MPLAB for Android and Embedded C Language. The GHAS application program is tested on various Android mobile phones which are quite satisfactory.

## VII. ACKNOWLEDGEMENT

The authors would like to thank the anonyms reviewers for their valuable suggestions. The work described in this paper was supported by the R&D cell, Kongunadu College of Engineering and Technology, Tholurpaty-621 215, Trichy, Tamilnadu, India Ref No: KNCET/EEE-EST/RD-02.

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