

# Design of Wireless Home automation and security system using PIC Microcontroller

V. Sathya Narayanan<sup>1</sup>, S. Gayathri<sup>2</sup>

<sup>1</sup>M.E EMBEDDED SYSTEM TECHNOLOGY, ANNA UNIVERSITY,  
Coimbatore, India.

<sup>1</sup>sathyavm.2009@gmail.com

**Abstract**—The development of the new technologies in the field of electronics has brought tremendous changes in the day to day life of every human being. They have entered the fields like industry, medicine, telecommunication and also home automation. This paper introduces the intelligent home automation system (IHAM) which is developed using PIC microcontroller with the ZigBee wireless communication technology, speech recognition technique and GSM network technology that control the home appliance. The automation centres on recognition of voice commands and uses low-power RF ZigBee wireless communication modules which are relatively cheap. The home automation system is used to control all lights and electrical appliances in a home or office using voice commands with help of HM2007 chip that is widely used for such appliances. The proposed system gives the overall framework of hardware and software design, and describes ways to implement the system. The paper also explains the security system for fire hazards that may occur through smoke sensor and GSM Module that is controlled by the same controller that sends the SMS to the user if the smoke is detected.

**Keywords**-HM2007 chip, intelligent home , PIC microcontroller, ZigBee module, GSM module.

## I. INTRODUCTION

Home automation systems are developed in recent years that make use of emerging technologies for the development. Home automation has become a one of the upcoming field that introduces many technologies for making the automation easy and with good performance. Most of the system make use of a web server and mobile communication for controlling the home appliances. ZigBee is developed in recent years, a short-range wireless communications technology, with low power, low data rate, short distance, low cost, safe and reliable. This paper present a home automation system based on ZigBee technology. The Central Processing Unit for the proposed system is developed using the PIC microcontroller which is a low cost and efficient controller used in many applications. Here combine embedded system technology with the wireless technology.

Zigbee alliance group explains the latest zigbee products. It updates all the information about the zigbee technology. they provide the new products developed using the 802.15.4 standard<sup>[1]</sup>. IEEE Standard for Information technology and Tele-communications and information exchange between systems and Local and metropolitan area networks are explained in the reference<sup>[2]</sup>. There are many systems implemented for the home automation system as given in the references.

The paper is organised as follows: the section II provides the system overview. The hardware design is detailed in Section III while the software design is detailed in Section IV. The paper concludes by providing the future research and development work required to make the system more versatile..

## II. SYSTEM OVERVIEW

The overall structure of intelligent home appliance control system can be divided into two parts wireless hand-held terminal and appliances control terminal parts which consists of various components for communicating with each other. The handheld device consists of the microcontroller unit which is connected to

the zigbee module using the RS232 communication protocol. The command to the microcontroller is given by the microphone that come along the speech recognition kit for giving input to the controller. The memory chip is used to save the voice and provide the necessary signal after comparing with the recorded voice. This generated signal is sent to controller and sent out via zigbee transmitter to control purpose. The control unit contains the receiver part that receives the command from the zigbee transmitter and the microcontroller is used to control the homes appliances via relay unit. The system also introduces the messaging facility using the GSM modem which is connected to the PIC controller for sending the SMS to the mobile when the smoke is detected in the house.

#### A .ZIGBEE PROTOCOL

Zigbee protocol is one of the communication protocols that is proposed in this system. This protocol provide 250 kbps as maximum baud rate but we can use up to 115200 bps was used for sending and receiving as this was the highest speed. It is a radio frequency (RF) communications standard based on IEEE 802.15.4. Installation overhead is eliminated in this proposed system as we use the wireless communication for control the appliances. The ZigBee standard can communicate with 250kbps data rate, but 40 kbps can meet the requirements of most control systems, it is sufficient for controlling most home automation devices . Figure 1 depicts the general block diagram of a Zigbee based home automation system.



Fig. 1. Block Diagram of the system

### III. HARDWARE DESIGN OF THE SYSTEM

The central processing unit for the system is developed using the PIC 18F8722 for both transmission and reception. This IC has better performance and efficiency with 2 serial ports. It is programmed using the embedded c program for control and giving commands through the zigbee communication. PIC controller contains two serial communications ports that enables us to connect the two peripherals that can communicate through the RS 232 communication. At the reception unit we connect the GSM module and the Zigbee module for the controlling and communication purposes. Hence the overall system integrates all the modules via wireless communication like zigbee and gsm technologies.

#### A. WIRELESS TRANSMISSION UNIT

The transmission unit consist of a module to get the speech as input and give the control signal to the PIC

microcontroller. The voice is sampled into digitized signal and compared with the voice store in the memory and the data is transferred through the serial communication of PIC for ON/OFF operation can use of home appliances .the zigbee module connects to the PIC microcontroller through RS232 serial communication and data transmission between the transmission and reception module is done serially. The Fig. 2 shows the transmission part of the proposed system.



Fig. 2.Block Diagram of transmission unit

#### B.VOICE RECOGNITION MODULE

The voice recognition module consists of HM 2007 and it consists of HM 2007 IC, SRAM and keypad. In this module there are two operations manual and CPU mode. The mode is selected through the keypad and the error code is generated by chip for the correct input from the user. The control signal from the chip is given to controller for the process. The speech recognition system will process the signal and store the command in a static RAM IC. Figure 3 shows the schematic of the speech recognition board

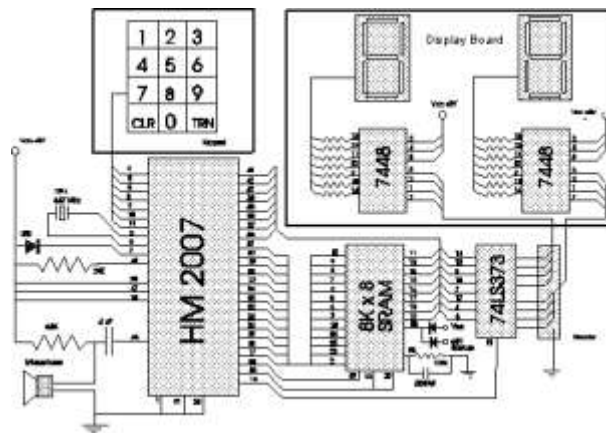


Fig. 3.schematic of the speech recognition module

#### C.WIRELESS RECEPTION UNIT

The reception unit has a switching circuit using relays for controlling the home appliances that operates at 240v but the operating volts of microcontroller is 5v.hence we use relays which is an electromechanical switch that ON/OFF the appliances depending on the signal obtained from the controller by allowing the current to flow when the internal coil is magnetised. The signal is generated at the different pins of the PIC microcontroller depending on the digitalized commands received by the zigbee module. The reception module

also have the the smoke sensor that is used to generate signal when smoke is detected. The GSM module is connected on the other serial port RS232 for sending message to a particular number when the smoke sensor generates the signal. This is implemented for security purpose. The below figure 4 shows block diagram of reception unit.

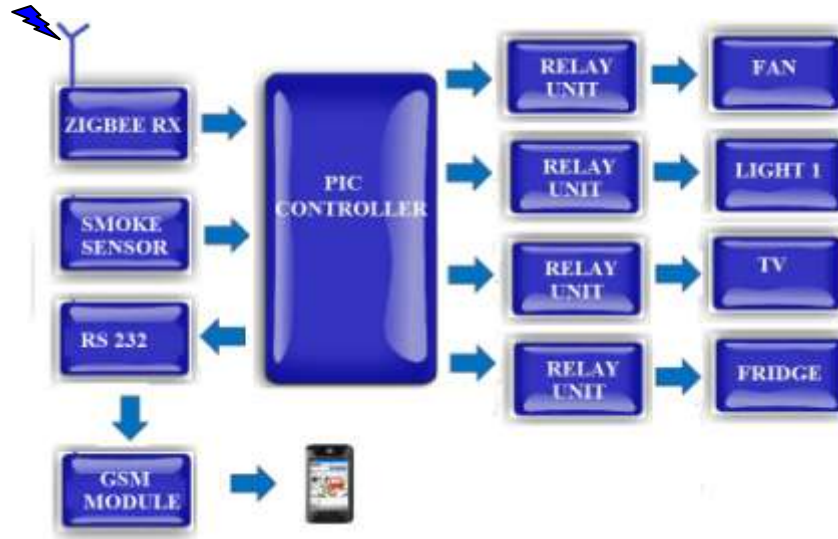


Fig. 4. Block Diagram of receiver unit

#### IV. SOFTWARE DESIGN OF THE SYSTEM

As the PIC microcontroller is used as the central processing unit of the system, we can write the program for the IC in embedded C programming language. The various software tools for development are the following:

Mplab IDE v8.36

Proteus simulation software

The software is developed in modules and integrated for over all implementation of the system. The various software modules developed are the following.

##### A) DATA FROM HM2007

- 1) The data from the speech recognition module and store in a separate memory location.
- 2) Compare the command using switch case statement in the program so that the command for each appliance is triggered through wireless communication.

##### B) ZIGBEE COMMUNICATION

- 1) Serial communication registers are initialized
- 2) Transmit the data serially through the zigbee module by placing the data in TXREG register.
- 3) At the receiver side, received the data through RCREG register and store in a separate memory location.
- 4) Turn ON/OFF the relay depending on the received data.

##### C) GSM MODULE AND SMOKE DETECTION

- 1) For smoke sensor the ADC registers are initialized and the voltage is obtained in the analog input pin of the PIC controller.
- 2) The ADC value is processed and compared with predefined value for triggering GSM module by sending

data signal through RS 232.in the controller we make use of another serial peripherals registers for this purpose.

The overall program flow for the home automation is depicted in the figure 5.

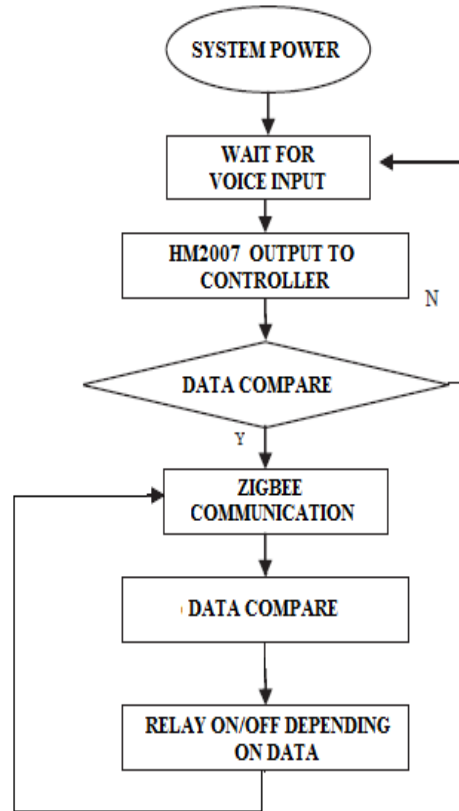


Fig.5. Flow Chart for the software development

## V. CONCLUSION AND FUTURE WORK

A home automation system based on voice recognition which uses PIC microcontroller as CPU was explained in this paper . The system is focussed on at elderly people and differently abled people. The prototype developed can control electrical devices in a home or office. The system implements voice recognition unit using HM 2007. The system implements the wireless network using ZigBee RF modules for their efficiency and low power consumption. The security system will be useful in case of the fire accidents at the home.

Future work will entail:

- 1) Operating system based design will be more efficient. Use of real time OS in the software.
- 2) Integrating the GSM technology to control the devices remotely.
- 3) Design and integration of an online home control panel.

## REFERENCES

- [1] Zigbee Alliance website, <http://www.zigbee.org>.
- [2] Part 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) specifications for Low-Rate Wireless Personal Area Networks (WPANs).  
<http://profsite.um.ac.ir/~hyaghmae/ACN/WSNMAC1>.
- [3] Christopher hallinan, Embedded Linux Premier, A Practical Real World approach second Edition, Posts & Telecom Press, 2008.8:5~9.
- [4] R.Saravanan , A.Vijayaraj, “ Home Security Using Zigbee Technology”, IRACST - International Journal of Computer Science and Information Technology & Security (IJCSITS), Vol. 1, No. 2, 2011
- [5] E.Kinney P. Gordy, L. Hester, J. A. Gutierrez, M. Naeve, B. Heile, and V. Bahl, “Home networking with IEEE 802.15.4.
- [6] Zigbee Alliance, “Zigbee vision for the home: Zigbee wireless home automation,” Zigbee Whitepaper, Nov. 2006.
- [7] Y. Usha Devi, “ Wireless Home Automation System Using ZigBee ”, International Journal of Scientific & Engineering Research Volume 3, Issue 8, August-2012.
- [8] D. Brunelli, M. Maggiorotti, L. Benini, and F. L. Bellifemine, “Analysis of Audio Streaming Capability of Zigbee Networks,” in *EWSN 2008*, 2008, LNCS 4913, pp. 189-204.
- [9] (2010) uControl Home security system website. [Cited 2010 14th Oct]. Available: <http://www.itechnews.net/2008/05/20/ucontrol-home-security-system/>.
- [10] (2010) uControl Home security system website. [Cited 2010 14th Oct]. Available: <http://www.itechnews.net/2008/05/20/ucontrol-home-security-system/>.