Smart Home Appliances Using ZIGBEE and Voice Command

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ABSTRACT:-In the recent years, the Home Automation systems has seen a rapid changes due to introduction of various wireless technologies The explosion in the wireless technology has seen the emergence of many standards, especially in the industrial, scientific and medical (ISM) radio band. ZigBee is an IEEE 802.15.4 standard for data communications with business and consumer devices. Zigbee is targeted at applications that requires low data rate, long battery life, and secure networking. Zigbee has a defined rate of 250 kbits/s, best suited for periodic or intermittent data or a single signal transmission from a sensor or input device. The wireless home Automation systems is supposed to be implemented in existing home environments, without any changes in the infrastructure. The automation centers on recognition of voice commands and uses low-power ZigBee wireless communication modules along with microcontroller. This system is most suitable for the elderly and the disabled persons especially those who live alone and since recognize voice so it is secure. The home automation system is intended to control all lights and electrical appliances in a home or office using voice commands. So in this paperwork our aim is to designed a voice recognition wireless ZigBee based home automation system.

Index Terms-Wireless home automation, voice recognition, zigbee, HM2007

1. INTRODUCTION

The Wireless Home Automation System (WHAS) is an integrated system to facilitate elderly and disabled people with an easy-to-use home automation system that can be fully operated based on speech commands. The system is portable and constructed in a way that is easy to install, configure, run, and maintain. A typical wireless home automation system allows one to control house hold appliances from a centralized control unit which is wireless. These appliances usually have to be specially designed to be compatible with each other and with the control unit for most commercially available home automation systems. The project demonstrates a system that can be integrated as a single portable unit and allows one to wirelessly control lights, fans, air conditioners, television sets, security cameras, electronic doors, computer systems, audio/visual equipment's etc. and turn on or off any appliance that is plugged into a wall outlet, get the status of different sensors and take decision accordingly. The overall system is controlled from a microphone which is connected with HM 2007 speech recognition chip. This chip sends the voice commands in binary sequence to microcontroller. The base station unit takes decision and send the commands to

remote station by ZigBee transceiver. The remote system receives the commands through ZigBee transceiver and performs the request function. The sensors unit is capable of detecting when the user enters or leaves the room by measuring the change in signals strength between the access Point and can accordingly turn on or off appliances such as lights and fans and in the meantime send its status back to base station.

2.LITERAURE SURVEY

Home automation is one of the major growing industries that can change the way people live. Some of these home automation systems target those seeking luxury and sophisticated home automation platforms; others target those with special needs like the elderly and the disabled. The aim of the reported WHAS is to provide those with special needs with a system that can respond to voice commands and control the on/off status of electrical devices, such as lamps, fans, television etc, in the home. The system should be reasonably cheap, easy to configure, and easy to run There have been several commercial and research projects on smart homes and voice recognition systems. Figure 1 shows an integrated

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platform for home security, monitoring and automation (SMA) from uControl [3].

Another popular commercially available system for home automation is from Home Automated Living (HAL) [5]. HAL software taps the power of an existing PC to control the home. It provides speech command interface. A big advantage of this system is it can send commands all over the house using the existing highway of electrical wires inside the home's walls. No new wires means HAL is easy and inexpensive to install. However, most of these products sold in the market are heavily priced and often require significant home make over.

3. SYSTEM OVERVIEW

The home automation system contains both a transmitter and a reciver. Each station will be packaged separately and have a separate PCB.

3.1 TRANSMITTER

The transmitter will operate with a +5V power supply. This voltage will be used as the operating voltage for all of the circuit elements in the base station. The microphone in the transmitter will be picking up audio in a close range. The audio signal from the microphone will be input into the HM 2007 speech recognition chip. The HM 2007 chip will process the audio and determine if the commands are speech commands and valid then it will pass the commands through microcontroller and ZigBee to remote station where the matched command operation will be performed . A 16 x 2 LCD interfaces with the microcontroller to display the current status of the sensors and relay switches on/off state. A sound alarm is given in the transmitteras well as in the receiver which indicate the status of water level either water in the tank is overflowing (To off the water motor) or below limit(To on). The HM 2007 chip does voice analysis and recognition on the microphone audio signals. The HM 2007interfaces directly with a microphone and the microcontroller in turn interfaced with ZigBee transceiver. The word length to be recognized will be selected to be the highest amount of 1.92 seconds. This will allow a maximum of 20 words to be memorized with the 8K-byte memory used. This will suit the needs of our product, as the speech commands will never surpass 20 words. measuring the change in signals strength between the access Point and can accordingly turn on or off appliances such as lights and fans and in the meantime send its status back to base station.



Fig1. Block diagram of transmitter



Fig2. Kit of transmitter.

3.2 RECEIVER

The receiver will operate with same +5 V power supply. The microcontroller receives the digital signal commands from the base station using the Zigbee wireless protocol and performs the request function. On the basis of command signals received it will update the status of relay switches board. It also read the sensors values and update the LCD status on the remote station. The sensors unit is capable of detecting when the user enters or leaves the room by measuring the change in signals strength between the access Point and can accordingly turn on or off appliances such as lights and fans and in the meantime send its status back to receiver.

4. HARDWARE DESIGN

This section will discuss the methodology involved in the design of the Voice Recognition Wireless Home Automation System Based on ZigBee. The project was divided into parts to make the design process modular. In the prototype board fabricated by the authors, these parts replaced with their specifications are:

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Fig3.Block diagram receiver



Fig4.kit of receiver

4.1 SPEECH RECOGNITION UNIT

The speech recognition system is a completely assembled and easy to use programmable speech recognition circuit. Programmable, in the sense that we can train the words that we want the circuit to recognize. This circuit board allows us to experiment with many facets of speech recognition technology. It has 8 bit data out which can be interfaced with any microcontroller for further development.

4.1.1 FEATURES OF VOICE MODULE

- Self-contained standalone speech recognition circuit
- User programmable

• Up to 20 word vocabulary of duration two second each

• Multi-lingual

• Non-volatile memory back up with 3V battery onboard. Will keep the speech recognition data in memory even after power off.

• Easily interfaced to control external circuits & appliances

4.1.2 HM2007

It is a single chip CMOS voice recognition LSI circuit with the on-chip analog front-end, voice analysis, recognition process and system control function.

A 20 isolated word voice recognition system can be composed of external microphone, keyboard, 8K SRAM and other components, combined with a microcontroller, an intelligent recognition system can be built. It support two control mode: Manual mode and CPU mode. It is also available in 48-pin PDIP. The pin description of HM2007 is shown above. The keypad and digital display are used to communicate with and program the HM2007 chip. The keypad is made up of 12 normally open momentary contact switches. The 74LS373 8-bit registers feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. The high-impedance 3-state and increased high-logic-level drive provide these registers with the capability of being connected directly to and driving the bus lines in a bus-organized system without need for interface or pull-up components. The IC 7448 is BCD to 7segment common cathode IC. To display the data, we have to convert it from BCD to 7-segment code. The IC makes this process. It has four inputs called BCD inputs and seven outputs to drive the display. The voice recognition system schematic diagram is shown below in fig.4. A microphone is connected directly with pin 15(MICIN) of HM2007which is shown below. On this system, voice is trained first and then recognized whenever a command is given through microphone.



Fig5: Schematic of speech recognition board

4.2 ZigBee RF communication

Zigbee protocol is the communication protocol that's used in this system. Zigbee offers 250 kbps as maximum baud rate, however, 115200 bps was used for sending and receiving as this was the highest speed that the UART of the microcontroller could be programmed to operate at. For each byte transmitted, there is a start and stop bit. Hence the actual baud rate is :

Actual baud rate = configured baud rate*(8/10)

Actual baud rate = $115200*(8/10) = 92160 \dots(1)$

ZigBee is а low-power wireless communications technology designed for monitoring and control of devices. Based on the 802.15.4 standard, ZigBee technology provides a robust and reliable solution in noisy radio frequency (RF) ZigBee technology supports two environments. features sets (ZigBee Feature Set and ZigBee Pro Feature Set) which focus on specific markets. The "ZigBee" feature set targets home and light commercial environments that are designed for simpler plug and forget networks

4.3 ZigBee Key Features:

- Low Power
- Robust
- Mesh Networking
- Interoperability

5. APPLICATIONS

Voice recognition Wireless Home Automation Based on ZigBee is a very useful project for the adults and physically disabled persons, who are not able to do various activities efficiently when they are at home and need one's assistant to perform those tasks. With the Voice Recognition along with ZigBee network we can eliminate the complication of wiring in case of wired automation and also it prevent to get up and down again and again to on/off appliances. ZigBee Home Automation provides operating range much higher as compared to Bluetooth and other wireless sensor module .With the use of ZigBee Home Automation circuit considerable amount of power saving is possible and it is flexible and compatible with future technologies so it can be easily customized for individual requirements. On the other hand with voice recognition system, it provides secure access to home. So when we are living in a fast world where everything is changing with in no time such security is essential.

6 .EXPERIMENTAL RESULTS

| Sr. No. | Voicecommand | Display | Appliance |
|---------|--------------|---------|------------|
| 1 | On | 01 | Bulb 1 on |
| 2 | Off | 02 | Bulb 1 off |
| 3 | F1 | 03 | Fan on |
| 4 | F2 | 04 | Fan off |
| 5 | B1 | 05 | Bulb 2 on |
| 6 | B2 | 06 | Bulb 2 off |

Table no 1 : voice command output



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Fig7.ouput of command1

Fig8. Output of command2

7.FUTURE SCOPE

- Adding confirmation commands to the voice recognition system.
- Integrating variable control functions to improve the system versatility such as providing control commands other than ON/OFF commands. For example "Increase Temperature", "Dim Lights" etc.
- Integration of GSM or mobile server to operate from a distance.
- Design and integration of an online home control panel.

8.CONCLUSION

A WHAS based on voice recognition was built and implemented. Through this system we have been able to control the switching on and switching off of two different devices solely through voice commands. The proposed system therefore provides solutions for the problems faced by old or disabled persons in daily life and makes their life easier and more comfortable by proposing a cost effective and reliable solution. The system developed can be used to control AC and DC appliances through speech. Voice recognition was successfully implemented using the low power HM2007 voice model.

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