Voice Controlled Home Automation

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Abstract - *Home technology started for more than a decade to introduce the concept of networking devices and equipment in the house. According to the Smart Homes Association the best definition of smart home technology is: the integration of technology and services through home networking for a better quality of living. Many tools that are used in computer systems can also be integrated in Smart Home Systems. In this paper, we present the Technologies and tools that can be integrated or applied in Smart Home system.*

Automation is the use of control systems and information technologies to reduce the need for human work in the production of goods and services. In the scope of industrialization, automation is a step beyond mechanization. Whereas mechanization provided human operators with machinery to assist them with the muscular requirements of work, automation greatly decreases the need for human sensory and mental requirements as well. Automation plays an in-creasing important role in the world economy and in daily experience. In this paper, we describe the design and development of voice controllable wireless smart home using atmega 328 and atmega1284 and microphone.

Key Words: Home technology, Automation, Voice-controlled, Wireless

1. INTRODUCTION

A smart home control system is a complete wireless, voice control system which allows people to control their home devices by voice command at home. People can control the devices like electric lights, fans etc., at home. In this Paper, the controlling of basic functions of lights control and fan control are implemented. Except for basic turning ON and OFF facilities at home, we can realize the functions of fixed-time control, and error detection when some device is broken. The system is quick enough to respond to all the commands. Our smart home system is a prototype product for the future life. The purpose of it is to make people's lives more convenient. To replace turn ON or turn OFF on switches by hand, our system is controlled by voice. That should be a trend for the future 10 years which we believe that it is coming to real time soon. How to make people's life more convenient, more comfortable, safer and how to save more energy will be the series of questions, that we will discuss in this paper. Just imagine, after we cook a big pot soup and want to leave the kitchen, we don't have more hands to turn OFF the kitchen light. The concept becomes a mature product, we can set up the system in the home, and we can turn OFF the lights by voice when we hold a pot soup at the same time. When we read the book in bed at night, we are not sure when we will sleep, we can tell the system when we want the light turn OFF, the timer in the system will help to count the time and turn OFF the lights with the time we have set. For controlling any electronic devices, there should be some commands given to it. From the time of invention of electronic devices, the commands are given through switches. The drawbacks of switches are: Every time we have to go to switch and should operate it. Time and energy are wasted. This is wired communication. So after hardware switch, remote control came into exist. This is software switch. There will be some program stored in the chip. For wireless communication purpose, IR rays are used. So that the drawbacks of hardware switches are cleared. But IR rays can't penetrate through the obstacle. Hence there should be line of sight. Hence we have designed a system to overcome all the drawbacks of switches and remote control. The commands to the switches are given by voice and it is wireless communication and here we are using RF Transmitter. It can penetrate through obstacle. Hence line of sight is not required.

Shih-Pang Tseng et al. proposed Smart House Monitor & Manager (SHMM), based on the ZigBee, all sensors and actuators are connected by a ZigBee wireless network. They designed a simple smart socket, which can remote control via ZigBee.

PC host is used as a data collector and the motion sensing, all sensing data are transferred to the VM in the cloud. The user can use the PC or Android phone to monitor or control through the Internet to power-saving of the house. Arduino microcontroller receives user commands to execute through an Ethernet shield. Our house network used together for wireless ZigBee and wired X10 technologies .This system follows smart task scheduling with a heuristic for the Resource-constrained-scheduling problem (RCPSP). The mobile device can be either wired to

the central controller through USB cable or communicates with it wirelessly, within the scope of the home. Arduino contains the web server application that communicates through the HTTP protocol with Web-based Android application. The system is highly flexible and scalable and expandable. The home network monitors the appliances and sensors and transmits data to the cloud-based data server which manages the information and provides services for users by transmitting data and receiving user commands from mobile application. The proposed system has good modularity and configurability characteristics with very low power consumption in cost efficient way.

2. METHODOLOGY

The block diagram of the Voice controlled home automation is shown in Figure 1.

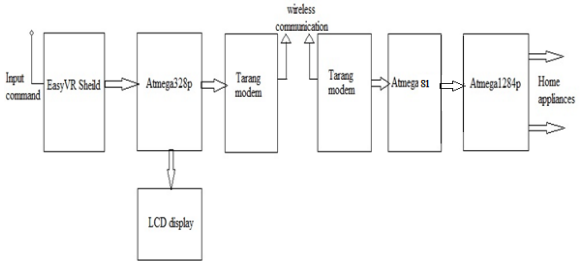

Figure 1: Block diagram of voice controlled home automation

The EasyVR module recognizes the voice command. Then the corresponding pattern of signal is sent to the microcontroller ATmega8. In ATmega8, the voice is compared and a character is assigned to each command. The corresponding character is sent to the tarang module. Then from tarang module, the wireless transmission is established. The Rx. Tarang receives the signal from the Tx. Tarang and it is sent to the microcontroller ATmega1284p. In microcontroller, the received character is compared with the database. Microcontroller pins are assigned and the corresponding action is taken place.

3. IMPLEMENTATION

3.1 Hardware implementation

The main components used are EasyVR module, Microcontroller Atmega328p, Tarang module, Microcontroller Atmega8, Microcontroller Atmega1284p and LCD display for Hardware implementation. The Circuit set-up of voice controlled home automation with the main components are shown in Figure 2.

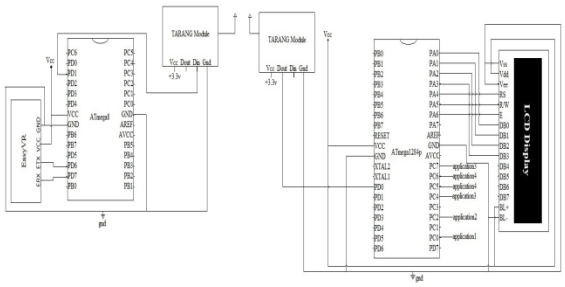

Figure 2: Circuit setup of Voice controlled home automation

3.1.1 EasyVR module:

It is a "slave" module communicating via an asynchronous serial interface (commonly known as UART interface). It consists of a microphone. Using this microphone we are giving the commands. First we have to maintain the database all commands for all voices. This process is called training the EasyVR. The EasyVR module is trained using EasyVR commander software. To train EasyVR, the ERx and ETx pins are connected to PD0 and PD1 of Atmega328p respectively.

We give the input through the microphone. The input command is compared with the database, if the pattern is matched, then the pattern coefficient is sent to microcontroller Atmega328p.

3.1.2 Microcontroller Atmega328p

The pattern coefficient is received by the microcontroller. In Atmega328p database each command is assigned with a character. Atmega328p is programmed such that the 0corresponding character is sent to the Din pin of the Tx. Tarang. For example, in our project we are controlling 4 applications. If we give a command to turn ON a bulb, it is assigned with a character "a". The same character is sent to Tx. Tarang.

3.1.3 Tarang module

We use two tarang modules. One as transmitter and other as receiver. The Tx. Tarang is connected to Atmega328p. Atmega328p sends the character to Tx. Tarang and it is transmitted to receiver tarang.

Receiver tarang is 3.3v UART. Hence the character is sent to Atmega8 before sending it to Atmega1284p. The Dout pin of the Rx. Tarang is connected to receiver pin of Atmega8.

3.1.4 Microcontroller Atmega8

It is a level shifter. It shifts the level from 3.3v UART to 5v UART. The character is received from the tarang module. Each character is assigned with 4 bit digital value. The corresponding digital bits are sent to the Atmega1284p. For example character "a" is received, the digital bits "0001" are sent.

3.1.5 Microcontroller Atmega1284p

The Atmega8 is connected to PB0, PB1, PB2, PB3 pins of the Atmega1284p. The received digital bits are compared with the database and the corresponding application will be controlled. For example, if digital bits "0001" are received, port PC0 is made high. Thus the bulb is switched ON.

3.2 Software Implementation

Software Requirements are Arduino and TMFT

3.2.1: Arduino:

Arduino is one of the open-source platform used to build many projects. Arduino consists of both a physical programmable circuit board and a software, or Integrated Development Environment (IDE) which runs on the computer(PC), which is used to write and upload C++ programming code to the Arduino board which is shown in Figure 3.

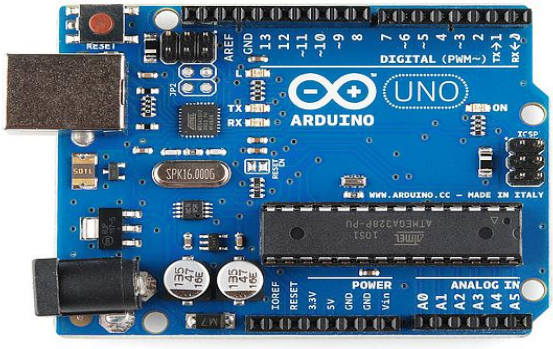

Figure 3: Arduino Board

This platform called arduino has become very famous these days and Unlike previous programmable circuit boards, the Arduino does not need a separate piece of hardware in order to load new program code onto the board, only a simple USB cable is needed. Lastly, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

3.2.2 Tarang Multi functional Tool (TMFT):

Tarang wireless modules are low to medium-power devices and suitable for adding wireless capability (2.4Ghz ISM band) to any product with serial data interface. The modules require minimal power and provide reliable delivery of data between devices. The I/O interfaces provided with the Module help to directly fit into many industrial applications.

3.3 System Requirements:

To set up this Project, we require some of the necessary system requirements those are:

- Windows XP operating system
- 256 MB RAM
- Intel Pentium Processor

4. APPLICATIONS AND ADVANTAGES

4.1: Home devices:

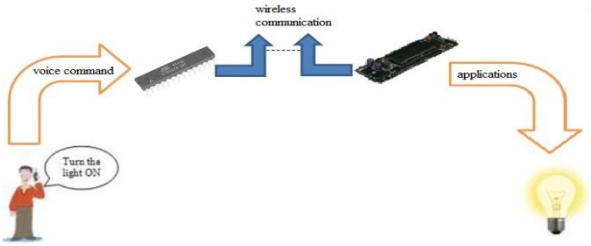

Figure 4: Voice command to turn on and off devices

Here in the above Figure 4, we can control almost all home devices using voice command. We can Turn ON and Turn the devices like Fan, Lights, Music system, Cooler, TV etc. by the voice command. By using timer also we can control the turning ON and OFF of Fan and Light after some delay.

Ex: Turn ON light after 30 sec, Turn on heater after 5 hours.

4.2: Wheel Chair:

This is mainly for physically challenged people. They can control their wheel chair by giving the command LEFT, RIGHT, FORWARD, BACK etc.

4.3: Robot Control:

We can control the movement of Robot without using the remote. The speech recognition software running on a PC is capable of identifying the 5 voice commands 'Run', 'Stop', 'Left', 'Right' and 'Back' issued by a particular user.

There are some of the advantages like Quick Response which helps to save the time and energy and they are more convenient, more comfortable, safer to use.

The disadvantages are only few electronic devices can be controlled and sometimes the EasyVR fails to recognize the command due to noise from outside environment.

5. RESULTS AND DISCUSSION

In our project we are controlling 4 applications with 12 commands. The applications which we controlled are 2 bulbs and 2 fans. The commands used are:

Table 1: List of Commands used for applications

Applications	Sl. No.	Commands	Character assigned
Bulb 1	1	Supply 1 ON	A
	2	Supply 1 OFF	B
	3	Supply 1 ON after 30 sec	C
Fan 1	4	Supply 2 ON	D
	5	Supply 2 OFF	E
Bulb 2	6	Light ON	F
	7	Light OFF	G
	8	Light OFF in 20 sec	H
	9	Light dim	I
Fan 2	10	Fan ON	I
	11	Fan OFF	J
	12	Fan lower speed	K

Bulb 1: Bulb is connected to AC supply. For controlling bulb, we are using first 3 commands. When "a" is received at the Rx. tarang, it is sent to Atmega8. Atmega8 sends the 4 bit digital value "0001" which corresponds to "a", to atmega1284p. A Bulb is connected to PC0. As soon as the digital value "0001" is received, PC0 is set and the bulb is turned ON. Similarly, to character "b", digital bits assigned are "0010". When "0010" is received by atmega1284p, PC0 is reset. When 3rd command is given, character "c" is sent to receiver after 30 sec. Then to character "c", digital bits assigned are "0011". When "0011" is received by atmega1284p, PC0 is set.

Fan 1: Fan is connected to AC supply. For controlling fan, we are using next 2 commands. When "d" is received at the Rx. tarang, it is sent to Atmega8. Atmega8 sends the 4 bit digital value "0100" which corresponds to "d", to atmega1284p. A fan is connected to PC2. As soon as the digital value "0100" is received, PC2 is set and the fan is turned ON. Similarly, to character "e", digital bits assigned are "0101". When "0101" is received by atmega1284p, PC2 is reset.

Bulb 2: Bulb connected to DC supply. For controlling bulb, we are using next 4 commands. When "f" is received at the Rx. tarang, it is sent to Atmega8. Atmega8 sends the 4 bit digital value "0110" which corresponds to "f", to atmega1284p. A Bulb is connected to PC4. As soon as the digital value "0110" is received, PC4 is set and the bulb is turned ON. Similarly, to character "g", digital bits assigned are "0111". When "0111" is received by atmega1284p, PC4 is reset. When 3rd command is given, character "h" is sent to receiver after 20 sec. Then to character "h", digital bits assigned are "1000". When "1000" is received by atmega1284p, PC4 is reset. For 4th command, character "l" is sent to receiver. Then to character "l", digital bits assigned are "1100". When "1100"is received by atmega1284p, PC4 is reset and PC5 is set. To PC5 one resistor is connected, intern it is connected to bulb.

Fan 2: Fan which is connected to DC supply. For controlling fan, we are using next 3 commands. When "i" is received at the Rx. tarang, it is sent to Atmega8. Atmega8 sends the 4 bit digital value "1001" which corresponds to "i", to atmega1284p. A fan is connected to PC6. As soon as the digital value "1001" is received, PC6 is set and the fan is turned ON. Similarly, to character "j", digital bits assigned are "1010". When "1010" is received by atmega1284p, PC6 is reset. For3rd command, character "k" is sent to receiver. Then to character "k", digital bits assigned are "1011". When "1011"is received by atmega1284p, PC6 is reset and PC7 is set. To PC7 one resistor is connected, intern it is connected to fan.

6. CONCLUSION AND FUTURE SCOPE

We realize all the function in our project which we expected at the beginning of the final project. We expected use voice to control the home devices in a wireless system. We could parallel control the different home devices at the same time, such as lights, fan and music. If we have chance to do the same topic next time, we want to control bigger device, such as the TV or air-condition. We want to make people's life more convenient and we use very low power even if there is no harm for people. So there is no much more band influence for society. Actually, our product will

bring much more benefit for people for the future 10 years. It can make an easier life for people with physical disabilities, develop programs to increase the quality of life, is one of the objectives of this project.

Our smart home system is a simulation product for the future life. The purpose of it is to make people's lives more convenient. To replace turn on or turn OFF on switches by hand for current product, our system is controlled by voice. That should be a trend for the future 10 years which we believe that it is coming to real product soon.

In Future we could set up the smart home system in the smart cell phone which we could control the home electrical device by talking to cell phone application. One more thing is we want to add the security system at next time by put the sensor near the window to make our home more safety and can also include noise cancellation circuits to create noise free environment. Number of devices controlled in home can be increased so that we can control all the electronic devices in home.

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