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VOICE CONTROLLED COMPUTER SYSYTEM USING FUZZY LOGIC

Poorna .B.R[1], Resshma.J.P[2], Vidhya Varma.E[3]
[1,2,3] *Department of CSE, Mar Baselios College of Engineering And Technology*

Abstract— The human voice is the most natural user interface for communication and computing on a variety of devices. For command and control applications in PC and non-PC devices, voice recognition is an excellent interface. The hardware just needs the right programming—and the sound of your voice. There is a wide research and development in this area trying to take maximum advantage of this technology, and in coming years many new applications and research areas will continue to appear. We propose a computer system that uses HM2007 voice recognition kit and arduino microcontroller to demonstrate how to control the computer system using voice with fuzzy logic. Speech recognition is also an integral part of this software, which is a technology that allows the computer to identify and understand words spoken by a person. Speaking is easier and more intuitive than selecting buttons and menu items. Human speech has evolved over many thousands of years to become an efficient method of sharing information and giving instructions. This computer software will free a person from having to sit in front of a metal box and require them to do mouse clicks, hunt for tiny icons and navigate menu structures in order to obtain information, perform tasks or run programs. In a voice controlled system the users are provided with passwords by the administrator. Only those users who are authenticated are allowed to use this system. The administrator has the privilege to add, edit and remove users. The users can change their passwords if needed. Using this system both the administrator and the users can perform system level operations and can use certain applications. The system is efficient and effective in terms of speed and time.

Keywords—Human voice recognition, HM2007 voice recognition kit& 8 bit arduino microcontroller

I. INTRODUCTION

From earlier days itself computers were operated using mouse and keyboard .For normal computer operations and for applications, a keyboard is available and the user can type reasonably well, typing is likely to be the most efficient interface for the foreseeable future. But recent study examined the effect of structural changes caused by rheumatoid arthritis (RA) on computer keyboarding style to provide insights on how changes may affect worker performance. Computer keyboarding styles, as measured by the keyboard-personal computer style instrument, were compared between 45 keyboard operators with RA and 29 without. A severity of structural changes score (SSCS) was assigned after recruitment by observing subjects' hands while operating a keyboard. Significant differences between each item of keyboarding style by diagnosis were identified through Chi square analyses. Logistic regression models with age, diagnosis, SSCS, and touch typing training as the predicators further evaluated the effect of structural changes on each item of personal keyboarding style. Significantly more keyboard operators with RA used high force keystrokes, did not use a wrist rest, moved their hands to strike keys, maintained their wrists and fingers in a fixed position and used fewer than two fingers to activate keys.

The amount of variance explained by each model varied from 8 to 56%. SSCS was the most common predictor of keyboarding style (54% of significant models), followed by age (35% of significant

models), diagnosis (19% of significant models), and touch typing training (15% of significant models). Severity of structural changes and age are significant predictors of keyboarding style for computer operators with RA. The keyboarding styles used by computer operators with RA appear to reduce typing productivity and have the potential to put stress on joints already affected by RA. Computer operators with RA may benefit from worksite modifications that replace keyboards through some other techniques. In this modern world computer is an electronic device, which is used by everyone in this world. Mouse is the separate output device that is attached within the computer. There are many disadvantages of using the mouse that is the area the mouse is kept always should be flat. It is not easy to use in the laptops and for that the touch pad is used. It should be cleaned regularly and if dust has attached means it will not work. Sometimes while working with the mouse will cause with the affect to the repetitive strain injury that is not good to health. The main disadvantages are that it often gets repairs and should be replaced very often, which makes a separate cost to buy the mouse. Separate memory space is required for each file to copy on the desk of the computer that is unnecessary. Sometimes while using the mouse it will hang up and at that time it is very difficult to use the mouse. Once mouse gets repaired it cannot be replaced by another mouse. The technology of this part in the computer has not improved lot.

II. EXISTING SYSTEM

In earlier days, using a computer was very hard because they were large machines. Everything had to be typed in by hand using keyboard, and there was no way to alter things if you made a mistake. After studying and designing for a long time, Engelbart succeeded in inventing an input device which he named 'XY index'. At first, it needed two hands to use, but it was changed so that only one hand was needed to use it. This is the mouse that we use today. So therefore the existing computer system is a system which uses mouse and keyboard to perform every operation. The main disadvantages of the existing system are:Overhead due to manual processing using hands, Time consuming and Lack of efficiency.

III. PROPOSED SYSTEM

We propose a computer system controlled using voice with fuzzy logic. The human voice is the most natural user interface for communication and computing on a variety of devices. For command and control applications in PCs, voice recognition is an excellent interface. The hardware just needs the right programming—and the sound of your voice. The major features of the system are: Efficient, Develop faster processors and more memory, Useful for the disabled people. The project uses two hardware components namely HM2007 voice recognition kit and 8 bit arduino micro-controller.

3.1. HM2007 VOICE RECOGNITION KIT

The speech recognition system is a completely assembled and easy to use programmable speech recognition circuit. Programmable, in the sense that you train the words you want the circuit to recognize. This board allows you 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. Some of interfacing applications which can be made are controlling home appliances, robotics movements, Speech Assisted technologies, Speech to text translation, and many more.

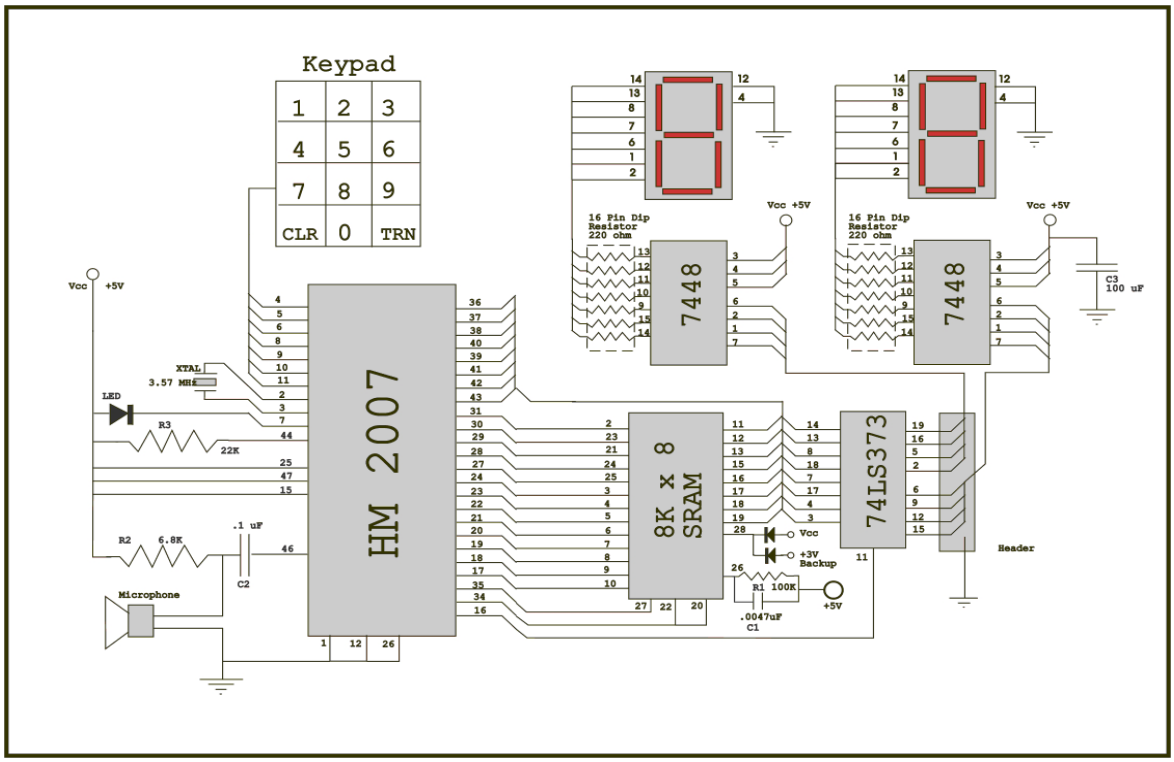

Figure 1. HM2007 Voice Recognition Kit

3.1.1. Using the System: 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. When the circuit is turned on, "00" is on the digital display, the red LED (READY) is lit and the circuit waits for a command.

3.1.2. Training Words for Recognition: Press "1" (display will show "01" and the LED will turn off) on the keypad, then press the TRAIN key (the LED will turn on) to place circuit in training mode, for word one. Say the target word into the onboard microphone (near LED) clearly. The circuit signals acceptance of the voice input by blinking the LED off then on. The word (or utterance) is now identified as the"01" word. If the LED did not flash, start over by pressing "1" and then "TRAIN" key. You may continue training new words in the circuit. Press "2" then TRN to train the second word and so on. The circuit will accept and recognize up to 20 words (numbers 1 through 20).It is not necessary to train all word spaces. If you only require 10 target words that are all you need to train.

3.1.3. Testing Recognition: Repeat a trained word into the microphone. The number of the word should be displayed on the digital display. For instance, if the word "directory" was trained as word number 20, saying the word "directory" into the microphone will cause the number 20 to be displayed.

3.1.4. Error Codes: The chip provides the following error codes. 55 = word to long, 66 = word to short**,** 77 = no match

3.1.5. Clearing Memory: To erase all words in memory press "99" and then "CLR". The numbers will quickly scroll by on the digital display as the memory is erased.

3.1.6. Changing & Erasing Words: Trained words can easily be changed by overwriting the original word. For instances suppose word six was the word "Capital" and you want to change it to

the word “State”. Simply retrain the word space by pressing “6” then the TRAIN key and saying the word “State” into the microphone. If one wishes to erase the word without replacing it with another word press the word number (in this case six) then press the CLR key. Word six is now erased.

3.1.7. Simulated Independent Recognition: The speech recognition system is speaker dependant, meaning that the voice that trained the system has the highest recognition accuracy. But you can simulate independent speech recognition. To make the recognition system simulate speaker independence one uses more than one word space for each target word. Now we use four word spaces per target word. Therefore we obtain four different enunciations of each target word. (speaker independent).The word spaces 01, 02, 03 and 04 are allocated to the first target word. We continue do this for the remaining word space. For instance, the second target word will use the word spaces05, 06, 07 and 08. We continue in this manner until all the words are programmed. If you are experimenting with speaker independence use different people when training a target word. This will enable the system to recognize different voices, inflections and enunciations of the target word. The more system resources that are allocated for independent recognition the more robust the circuit will become. If you are experimenting with designing the most robust and accurate system possible, train target words using one voice with different inflections and enunciation's of the target word.

3.2. ARDUINO

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can be communicate with software running on your computer (e.g. Flash, Processing, MaxMSP.) The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free.

The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment. There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Netmedia's BX-24, Phidgets, MIT's Handyboard, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

- **Inexpensive** - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than $50
- **Cross-platform** - The Arduino software runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.
- **Open source and extensible software**- The Arduino software and is published as open source tools, available for extension by experienced programmers.

3.3. WORKING

The block diagram of the circuit is given below.

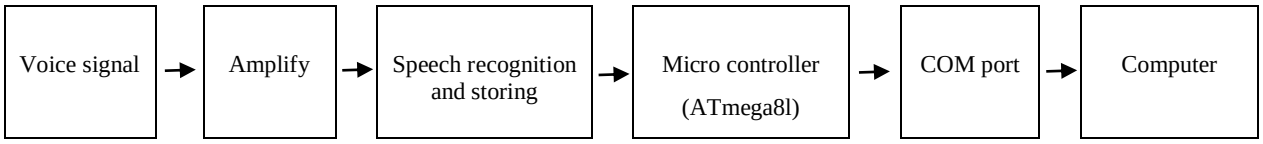

Figure 2. Circuit Diagram

The speech recognition system is a completely assembled and easy to use programmable speech recognition circuit. Programmable, in the sense that you can train the words (or vocal utterances) that you want the circuit to recognize. This circuit board allows you to experiment with many facets of speech recognition technology. It has an input of 8 bit data out of which, it can be interfaced with any microcontroller for future development. Some of its interfacing applications are controlling home appliances, robotics movements, Speech Assisted technologies, Speech to text translation, and many more.

The voice signal is amplified and fed to speech recognition circuit. Speech recognition circuit contain an IC chip HM2007, 8K x 8 static RAM, LED display, an 8 bit data output pins, etc. HM2007 IC contain an on-chip comparator circuit. if the analog input signal exceeds the reference voltage to any comparator, the comparator turns ON. For example in a two bit ADC, If all the comparator are OFF , the analog input signal will be between 0 and +V/4. If C1 is high (ON) and C2 and C3 are low, input must be between +V/4 and +V/2. If C1 and C2 are high while C3 is low, input must be between +V/2 and +3V/4 and so on, If all comparator outputs are high, the input signal must be between +3V/4 and +V. The outputs of these comparators are then fed to a coding network to provide equivalent bits to the input analog voltage. This can be stored into a static RAM. Interfacing of speech recognition kit with computer is done by a advanced micro controller kit named "Arduino". Arduino is an open-source single-board microcontroller, descendant of the open-source Wiring platform, designed to make the process of using electronics in multidisciplinary projects more accessible. The hardware consists of a simple open hardware design for the Arduino board with an Atmel AVR processor and on-board input/output support. The software consists of a standard programming language compiler and the boot loader that runs on the board.

In the arduino processor (ATmega8L), we store an arduino program using fuzzy logic, then HM0007 compares voice signal with data stored in the static RAM, as coded in the program, and output the correct decision to arduino processor which is an input to arduino kit, which is then processed using fuzzy logic as per the given conditions in the program and after doing all the processing, the corresponding data output will be sent to the COM port of computer as specified in arduino software (COM3). Port number specified may vary depending on the driver installed in the computer. Using a Dot Net technology, a software is used to read data from the COM port which helps to perform different operations in the computer like shutdown, restart, Log off , play music etc as per the bit recorded in the voice recognition kit.

3.4. PROJECT SCHEME

3.4.1. User Management: Concerned with the creation and management of various user accounts for the system. Only authenticated users are allowed to use the system features. The users are given a username and password in order to access the system. Two categories of users are identified in the system. They are Administrator and Users. The administrator can add, modify and delete users. Administrator can also perform system level operations like shutdown, reboot, logoff etc. and use certain an application like calculator, paint, notepad, WordPad, excel etc. and also manages authentication (logging in) and authorizations (permissions). The users can perform system level operations and can use certain applications

3.4.2. Voice Recognition Kit Training: Training the HM2007 voice recognition kit using voice. The corresponding system level operations and applications are stored as commands in each button.

IV. CONCLUSION

Voice Controlled Computer System Using Fuzzy Logic even though is fully functional, is not beyond the scope of enhancements and has its own limitations. The software is compatible with system having Windows XP OS only and can work only in a reasonable environment containing noise.

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