

# Voice Controlled Door Lock System Using Matlab and Arduino

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**Abstract-** Voice controlled hardware applications are ruling the modern era. Most of the home appliances are expected to be automated through voice. This project illustrates an alter method of voice processing by combining MATLAB and ARDUINO. With this a voice is being processed and a door lock system is operated through Arduino. FFT is used to detect the voices. In this the FFT compares pitch of the given input voice and the sample voice stored in the database. Through this project any application can be added at the output. This project mainly deals with opening and closing a door lock for personnel use.

**Key words:** voice processing, FFT, MATLAB, Arduino, pitch detection.

## I. INTRODUCTION

Voice processing has been widely used in the modern era. This technology emerged in a very rapid manner in which huge number of applications has been created. Speech processing is the study of speech signals and the processing methods of these signals. The signals are usually processed in a digital representation, so speech processing can be regarded as a special case of digital signal processing, applied to speech signal. Aspects of speech processing includes the acquisition, manipulation, storage, transfer and output of speech signals. The input is called speech recognition and the output is called speech synthesis [13].

### A. Speech technology

It relates to the technologies designed to duplicate and respond to the human voice. They have many uses. These include aid to the voice-disabled, the hearing-disabled, and the blind, along with communication with computers without a keyboard. They enhance game software and aid in marketing goods or services by telephone [11].

### B. Speech coding

It is an application of data compression of digital audio signals containing speech. Speech coding uses speech-specific parameter estimation using audio signal processing techniques to model the speech signal, combined with generic data compression algorithms to represent the resulting modelled parameters in a compact bit stream.

The two most important applications of speech coding are mobile telephony and voice over IP. The techniques employed in speech coding are similar to those used in audio data Compression and audio coding where knowledge in psychoacoustics is used to transmit only data that is relevant to the human auditory system. For example, in voice band speech coding, only information in the frequency band 400 Hz to 3500 Hz is transmitted but the reconstructed signal is still adequate for intelligibility.

Speech coding differs from other forms of audio coding in that speech is a simpler signal than most other audio signals, and a lot more statistical information is available about the properties of speech. As a result, some auditory information which is relevant in audio coding can be unnecessary in the speech coding context. In speech coding, the most important criterion is preservation of intelligibility and "pleasantness" of speech, with a constrained amount of transmitted data. This leads to a sophisticated way to access the embedded devices. There are many methods to process a voice. This project comes with a tedious alter method to process a voice in the level of under graduates. By using MATLAB interfaced with ARDUINO a hardware is operated through voice commands. This can be used in a very small scale and only for personnel use because of its lengthy process. The use of voice processing algorithms makes this project to take an attempt of proposing an alter way of voice processing [12].

## II. LITERATURE SURVEY

### A. Secure speech controlled robot using MATLAB & Arduino

The speech is primary mode of communication among human being and also the most natural and efficient form of exchanging information among human in speech. The aim of this research is to describe the main aspects influencing control robot using MATLAB and ARDUINO. By using MATLAB, we can identify the speaker voice and also provide security system for robot using string matching. Its advantage is in the easy way of controlling where the templates of the whole commands are used, which makes it very suitable in case of the automatic speech identification systems with small dictionary of voice commands.

Works by comparing speech signal from the user to library (database).Controlling robot using MATLAB & Arduino.

FFT & DCT is used for comparing samples of voice for Minimum error comparison. Controller used here is Arduino UNO.

FFT - 76% accuracy.

DCT -56%accuracy.

Using normalization of FFT we can successfully identify sound using min error comparison. MFCC is used for more accuracy Mel frequency cestrum coefficient. Output can be used like LED's. Next would be continuous speech [1].

#### B. Home automation with MATLAB and Arduino interface

The Home automation market is very promising field that is growing at faster rate. Lot of discussion has been carried out about home automation systems. It shows that, home automation is a technology involving centralized & autonomous control of housing, buildings and industry, including safety features against various sudden unanticipated scenarios. Home automation basically incorporates an electronic control of household activities like control of electrical appliances, lightning, central heating & air conditioning and security system. The rapid growth and application of control systems has not been confined to industrial use but also implemented in personal and private spaces of people all around the world. The idea of autonomous home has been one of the most desirable technologies in life of human beings and considerable improvements have been made in this field. The system presented in this paper shows continuous monitoring and control of home appliances with Arduino Matlab interface. Realizing the hardware potential, software suppliers Like Math works and National Instruments have included the Arduino package on the software accessories of MATLAB and LAB View. House hold equipment can be controlled using MATLAB & Arduino using relay. In this Arduino board gives signal to relay board to turn ON/OFF the required device. The results are displayed in MATLAB GUI. If 1 is pressed an output is taken in Arduino. If 2 is pressed another output is operated. It is operating without voice commands [3].

#### based robotic arm

Hand tracking system gets so much attention in recent time because of its great applications. This method can be implemented by so many techniques. Here we show a straight forward technique of tracking the human hand using the robotic arm. This paper shows the interfacing of human hand using robot arm. With this method the robotic hand can be controlled using human hand. Its demonstration is done by using image processing technique to detect different colours at different axis of human hand. This technique is very useful since it takes real time video of hand and tracks it to get interface with robotic arm. A laptop camera will get the video and track the RGB (red, green and blue) colours at different axis of hand denoting X and Y axis. Tracking of such hand will interface the controller with robotic arm. The main aim behind this approach to program a robotic arm, so that it should be controlled by human hand and will reach the locations where human will not be able to reach and do the given task by direct interfacing with human hand. In this we can see the real time movement of robotic arm. By using MATLAB we can identify the speaker voice and also provide security system for robot using string matching. Its advantage is in the easy way of controlling where the templates of the whole commands are used, which makes it very suitable in case of the automatic speech identification systems with small dictionary of voice commands. Voice samples of the users or authorised persons are first recorded and stored in the computer memory using a microphone. When the program detects the same voice next time, it displays the templates (or commands) being detected and other information [2].

### III. PROPOSED SYSTEM

This project illustrates an alter method of voice processing by combining MATLAB and ARDUINO. Recognising speech involves extracting relevant features from the signal, followed by decoding. Every second of a typical 16 kHz speech has 16,000 data samples that contain not only speech information, but also speaker characteristics, background noises and other artefacts. So, to process the speech we are using pitch detection method. This method is achieved through FFT. The FFT performs voice detection by checking the closest pitch value of the given voice samples. Then the recorded samples are made to differentiate by its pitch levels. According to the detection the high and low value for the motor is set. Now the motor starts rotating according to the given code.

Using the same voice, we can operate many applications or different appliances. There is a total of 7 to 8 methods with which we can approach different method to process voice. Security strength can be set according to our requirement.

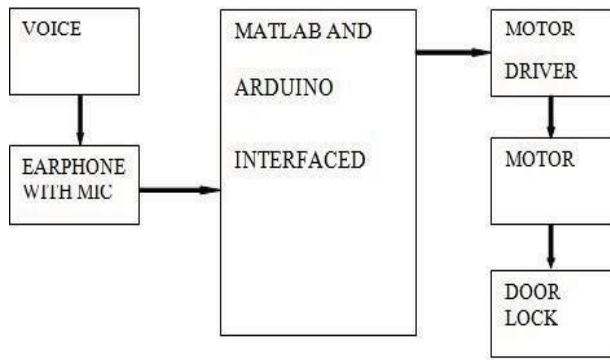


Fig. 1 Block Diagram

The voice sample is given through an earphone with the help of a MIC present in it. The given voice will be checked in the voice processing area i.e. MATLAB. If the voice is matched with the database, then the Arduino will run the motor as per the instructions given to the motor driver. Then the door lock attached with the motor will run. The rotation of the motor will make the door lock to open and close according to its forward and reverse rotations.

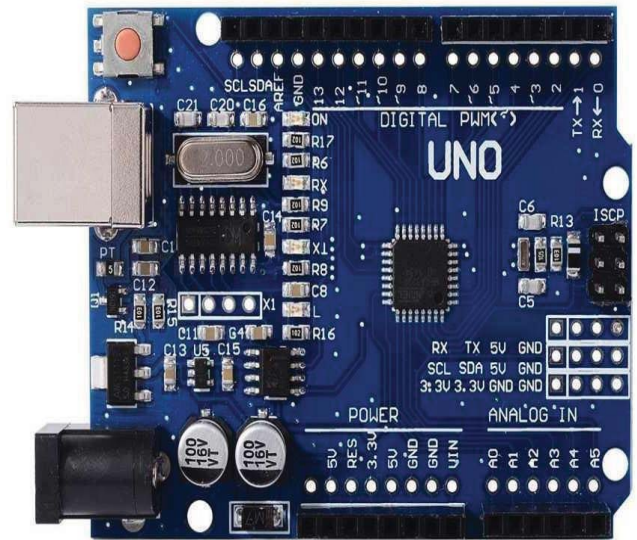


Fig. 2 Arduino UNO

#### B. FFT

FFT stands for Fast Fourier Transform. It is a frequency domain representation of a signal. It produces frequency spectrum which contains all the information about the signal [1]. For finding the FFT of a speech signal in MATLAB is to store the recorded voice into a variable say A. It reads the sound file A.  $Y = \text{fft}(A)$ .  $B = \text{abs}(Y)$ .  $\text{Plot}(Y)$ . This is the way FFT filters the voice excluding the background noises and other artefacts.

#### C. Pitch detection

In speech recognition, pitch is the relative highness or lowness of a tone that is heard by the ear. It depends on the number of vibrations/second produced by vocal cord. For unvoiced speech the vocal tract remains open, for voiced speech it opens and closes periodically. The frequency of the opening is called pitch [13].

#### D. Working Principle

This project basically works by recognising a voice from which the hardware part works. First the input voice sample is given to the MATLAB database through earphone. According to users need many voice samples can be recorded and stored in the MATLAB database. The method which is used to detect the voice is FFT. User records a new input voice data to the MATLAB database; thus, the recorded voice samples are converted into feature extracted data signals. Then given voice has to be trained. In this stage, if the value of the pitch is closest to the trained voice then the voice will be detected. If the data is matched with near accuracy according



Fig. 3 L293D Motor Driver





Fig. 4 DC Motor

#### IV. RESULT

The voice samples are taken as input and the features are extracted as pitch levels using FFT. The FFT of the given input voice samples is given below in Fig

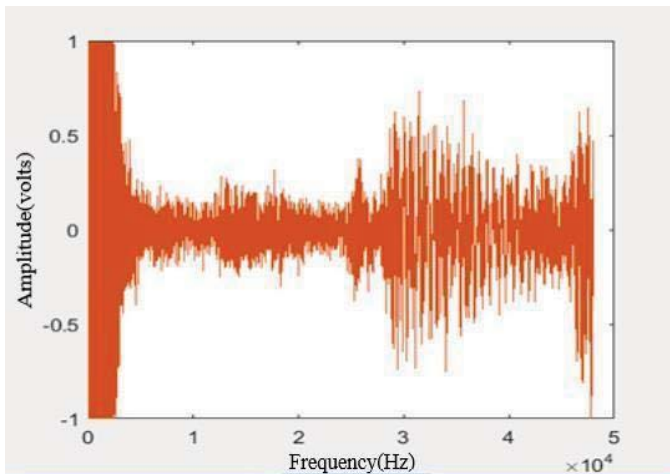


Fig. 5 Input wave form of the given test sample

The two voices are therefore recorded and registered. In the next step the given input voice must be compared with the registered voices with respect to the pitch value as given below.

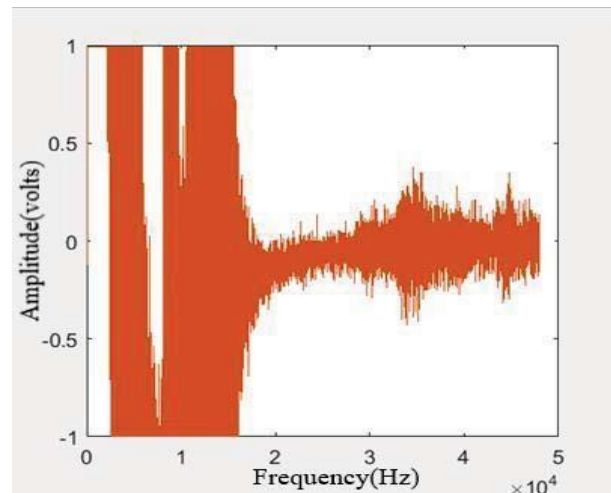


Fig. 6 Input wave form of the given voice data

The above mentioned graph denotes the FFT of the given input waveforms. E.g. the pitch value of the first voice sample is 1628. It will be stored in the MATLAB database. Now the second voice sample is stored in given and it is stored in the database. If the voice uttered from the user matches the pitch value of the voice sample stored in the database the Arduino part will be activated and the motor driver will give access to the motor. From there the door lock which is connected to the motor will start rotating. If the voice command is “open the door” the motor starts rotating in anticlockwise direction. If the uttered voice command is “close the door” then the motor will rotate in clockwise direction.

#### V. CONCLUSION AND FUTURE ENHANCEMENT

The stored input voice sample and the new given voice data is compared and matched for closest pitch levels by using FFT. The graphs and plots are made for voice processing. The output i.e. the door lock system is operated. The future development of this project is using wireless communication method to process the voice and to operate the hardware part through Arduino in a wireless medium.

## VI. REFERENCES

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