SECURITY SYSTEM USING VOICE RECOGNITION

DIGITAL SIGNAL PROCESSING REPORT

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ABSTRACT:

A Voice Recognition system is a technique that involves analyzing the unique characteristics of a person's spoken input and comparing them to prerecorded signals stored in a database. The output indicates whether the input matches any of the records in the database and displays the corresponding name or file number. This system is useful in preventing unauthorized access to secure areas such as lockers, phones, and offices. Frequent monitoring of the system can help minimize the risk of loss or other issues. Additionally, it can track the number of attempts made by a person to access the system. However, the current capability of this system is limited to verifying the existence of records with matching features.

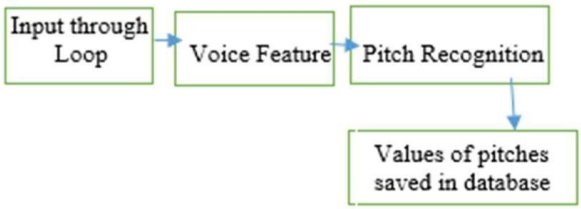
INTRODUCTION:

The technology of voice recognition can be categorized into two areas: speech recognition and speaker recognition. Speaker recognition involves analyzing an individual's audio input and comparing it with records in a database to verify the identity of the speaker based on voice features such as pitch, speed, and power energies. In this project we have used pitch. This technology is commonly used in security applications to either grant or deny access to individuals. The system displays the file number of the person whose audio input has been received, which is typically accomplished using the cross-correlation function or FFT.

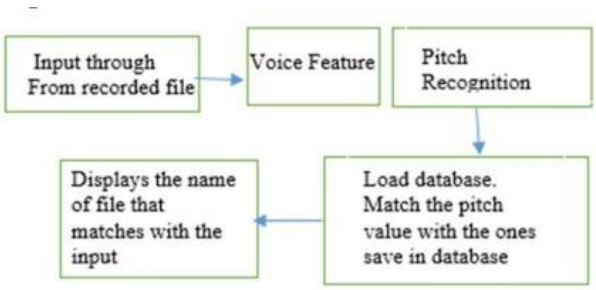
METHODOLOGY:

In this report, we will discuss a security system using voice recognition technology implemented in MATLAB. We have used database Toolbox of MATLAB, the Database Toolbox is a powerful tool for working with databases in MATLAB. It provides a wide range of functions and tools for managing and analyzing data stored in databases, and supports a variety of database systems to meet the needs of different applications.

1. *Input*



2. *Output*



TOOLS USED:

FFT (Fast Fourier Transform):

Fast Fourier Transform (FFT) is an efficient algorithm for computing the Discrete Fourier Transform (DFT) of a sequence of N equally spaced samples.

The DFT computes the frequency components of a signal by multiplying the input signal with a set of complex exponential functions at different frequencies and summing the results. The computational complexity of the DFT is O(N^2), which makes it impractical for large values of N.

The FFT algorithm exploits the fact that the DFT of an N-point sequence can be expressed as the sum of two smaller DFTs of length N/2. This recursive decomposition of the DFT can be repeated until the sequence length becomes a power of two. The FFT algorithm reduces the computational complexity of the DFT to O(N log N), which is much faster than the O(N^2) complexity of the direct DFT computation.

The FFT can be used to extract information about the frequency content of a signal, such as the dominant frequency, harmonic frequencies, and the presence of noise or distortion. The FFT is also used in many digital signal processing applications, such as filtering, convolution, and correlation.

ALGORITHM:

Step1. Voice Storing: First we saved the samples of users in the database and then system call the function of Voice Feature and save the pitch of each saved audios in the database.

Step2. Voice Matching : Give the name of the file that we want to test in the command window by giving as an input. And call the step 3 i.e. Voice Feature function match its pitch with the data stored in the database. If the voice matched with the already saved data than will display the file number.

Step3. Voice Feature: In this Feature we calculate the FFT of the voices and take the real part of the as an output and take the maximum frequencies came in FFT.

SOURCE CODE:

A) Voice Storing

```
Clear all;
Close all;
clc;

%% Store Features
FN=[1 2 3];

for i=1:3
filename=strcat('FileStored\abc',num2str(i),'.wav');
b = audioread(filename);
FE(i,1)=VoiceFeatures(b);
try
loaddatabase
F=[F;FE];
FN=[1;2;3];
database=[database;F;FN];
save database.matdatabaseFFN

catch
F=FE;
savedatabaseFFN
end
end
```

B) Voice Matching

```
clearall;
closeall;
clc;

% Input for testing
name=input('Whose file do you want to run? Enter name:
','s');
file=strcat('InputFile\',name,'.wav');
 b=audioread(file);
%% Feature Extraction
FE=VoiceFeatures(b);
%% Classify
loaddatabase
D=[];
for(i=1:size(F,1))  %returns the length of 1st dimension of F
        d=sum(abs(F(i)-FE));
        D=[D d];
End

%% Smallest distance
sm=inf;
```

```
ind=-1;
for(i=1:length(D))
if(D(i)<sm)
        sm=D(i);
        ind=i;
end
end

% Output
file_number=FN(ind);
sc=strcat('The file number of ', name, ' in training is:
');
disp(sc)
file_number
disp(' Voice Matched')
% Plotting
%test file
[t,x]=audioread(file);
subplot(3,1,1)

plot(abs(t(:,1)))
xlabel('Time')
ylabel('Amplitude')
title('InputFile')
%train file
subplot(3,1,2)

filet=strcat('FileStored\abc',num2str(file_number),'.
wav');
[v,s]=audioread(filet);
plot(abs(v(:,1)))
xlabel('Time')
ylabel('Amplitude')
title('FileStored')
%Pitch
subplot(3,1,3)
plot(real(fft(v)))
title('PITCH')
```

C) Voice Features

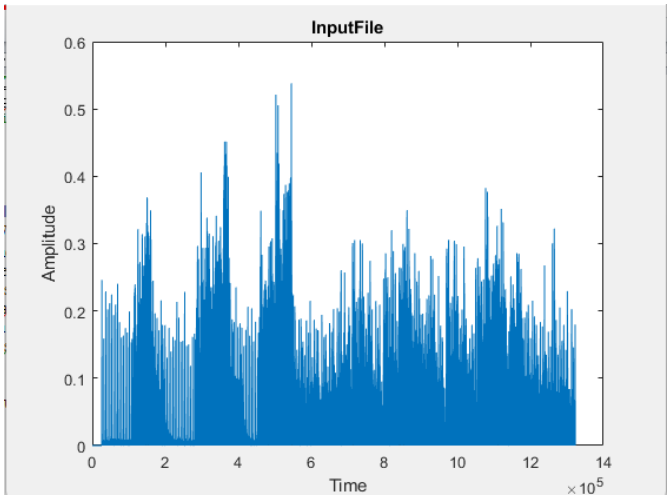
```
function [xPitch]=VoiceFeatures(b)
F=fft(b(:,1));
%plot(real(F));
m=max(real (F));
xPitch=find(real(F) == m,1) %find out
first instance of maxima
```

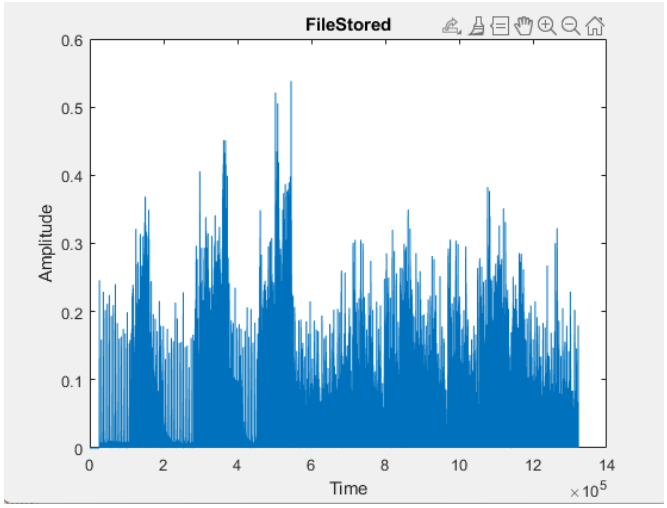
RESULT:

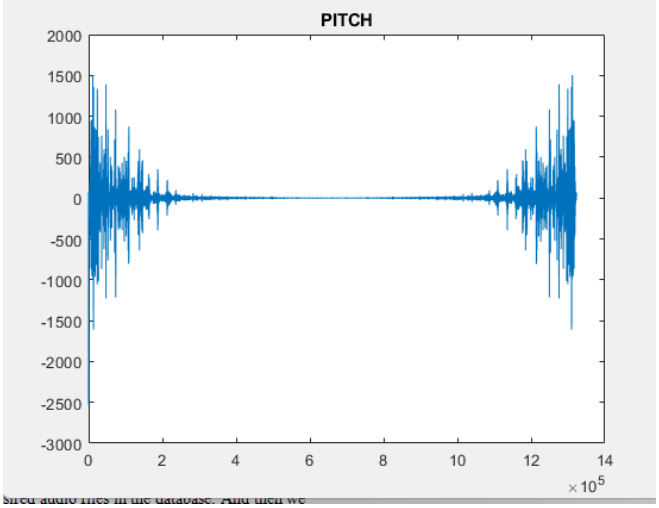
We have successfully demonstrated the voice storage process by initially running the code to store desired audio files in our database.

Subsequently, we tested the input files against the files stored in our database. If the input files matched with the files in the database, permission was granted and "Voice Matched" will be display on the command window along with file number stored in database; otherwise, an error will displayed.

```
Command Window
Whose file do you want to run? Enter name: xyz3

xPitch =

       11110

The file number ofxyz3 in training is:

file_number =

     3

 Voice Matched
>>
```







DISCUSSION

A security system that utilizes voice recognition technology was developed. The code prompts the user to input the name of the file they wish to run. Once input is given, the system matches the audio file with the existing audio data stored in the database. If there is a match, the system prints "Voice Matched". Additionally, the system generates a plot of both the “inputfile” and the “file stored” in the database, as well as the pitch of the audio. The generated plot clearly shows that the inputfile and the files stored in the database have the same plot, confirming a successful match.

The implementation of a security system using Voice Recognition technology can have several limitations, such as accuracy, security, and scalability. The accuracy of the system depends on several factors, such as the quality of the recorded voice samples, environmental noise, and the variations in the user's voice due to illness or stress. The security of the system can be compromised by spoofing attacks, where an imposter attempts to mimic the voice of an authorized user.

The scalability of the system depends on the size of the database and the computing resources required for real-time matching and processing.
To overcome these limitations, future research can focus on improving the accuracy and security of voice recognition systems using advanced signal processing, machine learning, and behavioral biometrics. For example, combining voice recognition with other biometric modalities, such as facial recognition or fingerprint scanning, can improve the overall accuracy and security of the system. Additionally, research can focus on developing more robust algorithms for detecting and preventing spoofing attacks, such as analyzing the user's behavioral patterns and the context of the request.

CONCLUSION

In conclusion, the development of a security system using voice recognition technology in MATLAB has proven to be a successful project. The system prompts the user to input a file name and matches

the audio data with the existing data in the database. The system then generates a plot of the input file and the stored file, along with the pitch of the audio, providing a visual representation of the match.

The main contribution of this project is the application of voice recognition technology in security systems. The use of MATLAB has allowed for accurate and efficient processing of the audio data, resulting in reliable matching and authentication. The project also demonstrates the effectiveness of visual representation in confirming a successful match.

The implications of this work are significant in various fields that require secure access control. This technology can be applied in practical settings, such as authentication in banking, government facilities, and confidential data access. The system's accuracy and efficiency make it a valuable tool for ensuring secure access control and reducing the risk of unauthorized access.

In summary, this project has demonstrated the potential of voice recognition technology in security systems, providing a reliable and efficient method for access control. The application of MATLAB and visual representation has contributed to the system's accuracy and effectiveness, making it a valuable tool for various practical settings.

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