INSTITUTO TECNOLÓGICO DE ESTUDIOS SUPERIORES DE MONTERREY

Analysis of Signals and Systems (Group 01)

Project #3

Voice Recognition Password

Part 2

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Voice recognition system

The following project includes all the knowledge obtained in the class and in the other projects. In this project we create an app in the Matlab Software, that helps people with motor disabilities to interact with technology, this is possible thanks to the research area on the signals analysis, so nowadays we know that each word has a fundamental frequency that help us to identify words by analysing the spectrum of the voice signal, this spectrum includes information like the bandwidth, fundamental frequency and the amplitude of the signal, this amplitude is measure in dB (decibels).

In this case, we focus on the Fundamental frequency, because this is the key parameter to identify if a word is the same as the one that we are analysing, so for this reason we have the following:

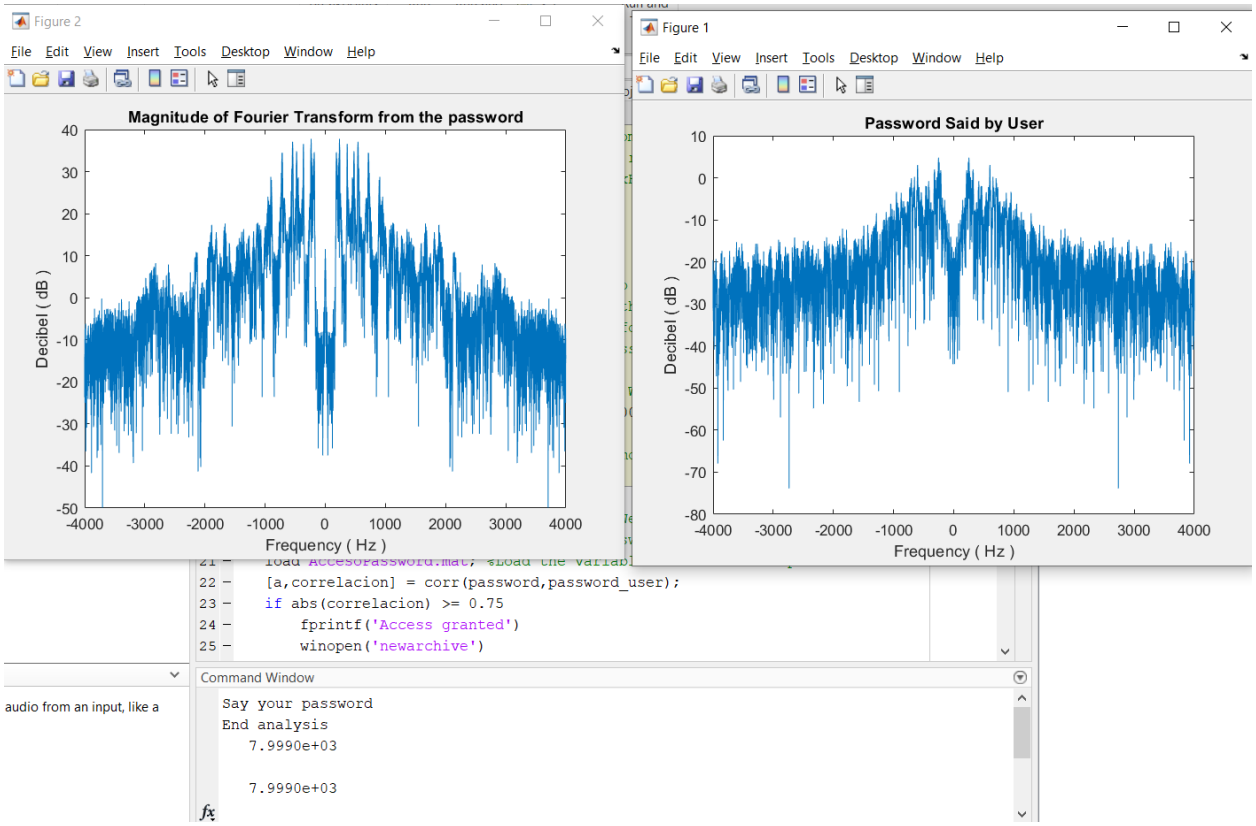
- A word with a fundamental frequency stored in a variable.
- A second word, the one that we are going to analyse in real time.
- The fundamental frequency of the second word.

The app displays the time frequency domain graph, this helps us to see if the sound was recorded, also the app displays the fundamental frequency on the screen.

Now that we explained the basics of our project, we are going to show the evidence that demonstrates that we fill all the requirements.

- The app is able to record signals from the computer's microphone:
- We display the signal sound in time and the fundamental frequency. (Time seconds)
- Display the fourier transform. (dB x Frequency in Hz)

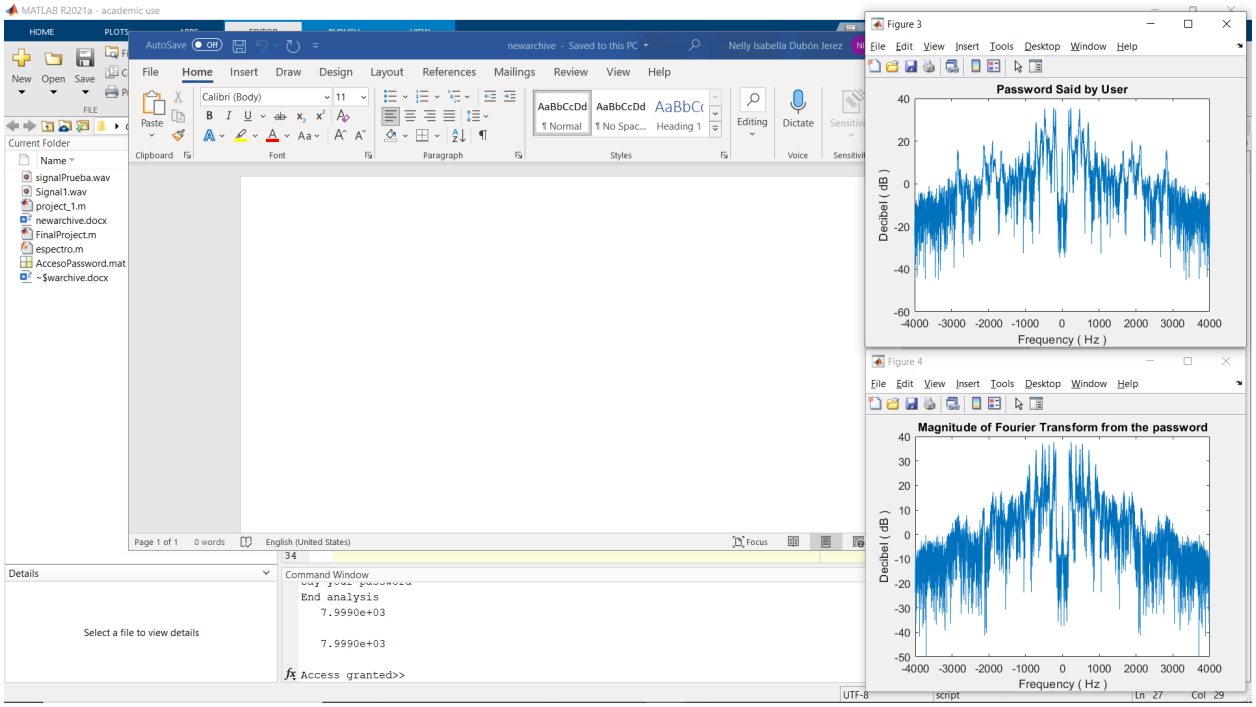
The following figure shows the three past requirements, where the program first records a password (said by a user) and afterwards, compares it with the password that had been established previously. These signals were both transformed into Fourier Transform. In this case presented below, the passwords didn't match.



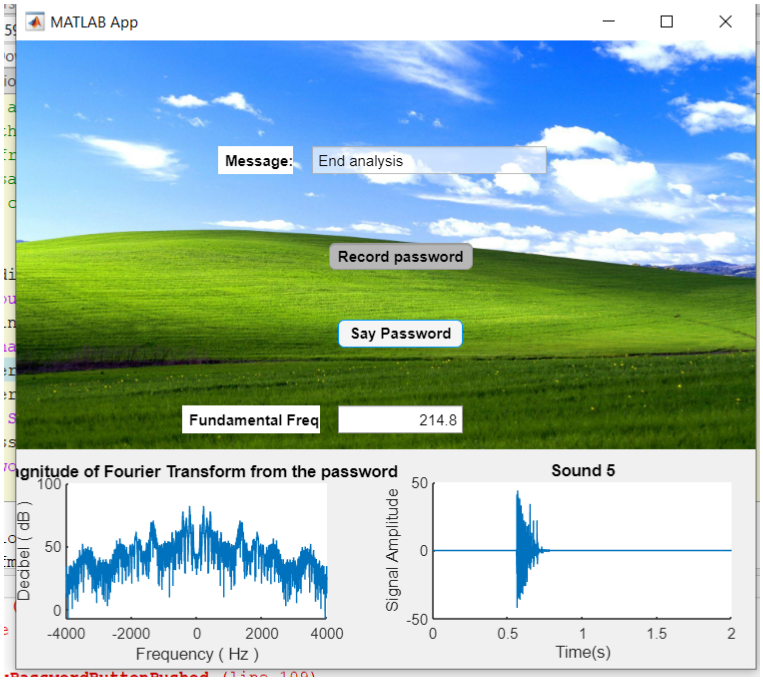
Graphical Interface must have two options:

- We are able to record a password and save it, then time and frequency graphs must appear in the interface, as well as the fundamental frequency.
- After this, if the listen sounds match, we open a Word Document.
- If this sound doesn't match, then the matlab routine doesn’t open the word document.

The following figure shows the program running, in this case. The password established previously by the user was the word “Acceso” and it was the same password said by the user when the program was run. Both password matched, and the code displayed in the command center that access has been granted, later it proceeded to open the previously created file in word named “newarchive.docx”



Interface Description



The message box at the top indicates the instructions for the user. For example, as you click “Record Password” it tells when to start speaking and when to stop. As you click “Say Password”; it does the same.

The “Record Password” button allows you to set the password, and after that it will display the time and frequency graphs below, as well as the fundamental frequency.

Lastly, in the “Say Password” button you can try to say the password you set. If it’s successful, it will open a word document.

How to use the GUI APP (instruction manual)

First, press the “Record Password” button to start recording your password. The message box will indicate when to start and when to stop speaking.

Once the previous step is completed, you can attempt to say the password by clicking the “Say Password” button. This will give you 5 seconds to say the password. If it matches with the previously set, it will open a word document.

How we developed the GUI APP at matlab

As the team created a three-part project consisting of three different files, the main challenge for the project was to find the way to properly combine them in the app, as you cannot recall other open codes in a code when you are coding in a normal Matlab setup.

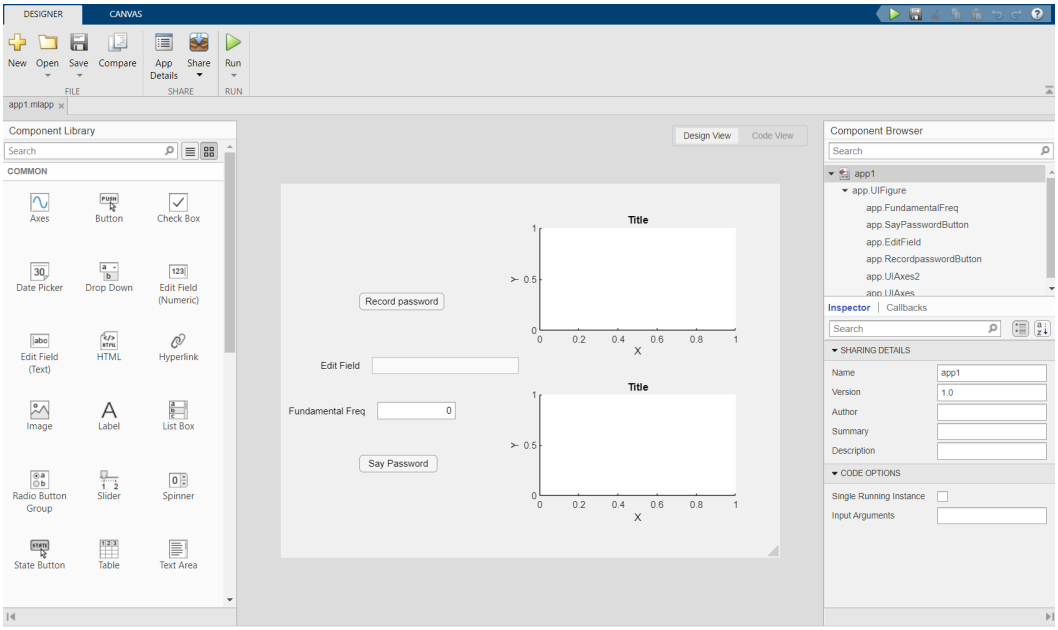
Easy points:

- **To display the display functions as message boxes**
- **To connect the graphs display to the graphs that were generated in the code**
- **To understand the functioning of the buttons and to trigger the code**

- **The design of the interface, dragging elements.**

  Difficulties:

- **To understand what parts of the three codes we generated should be in each part, and how they will work together appropriately.**
- **To resolve difficulties such as conflict of variables and functions for the program to correctly run.**



- Above, we have the interface in its first stage, this is before giving it an aesthetic look. As you can see, we added a *Record Password* button, and a *Say Password* button. Also, we added a *Fundamental frequency* indicator to indicate the frequency of the password said.

Conclusions

This project involves a lot of concepts that we have learned at the analysis of signals and system's class, in fact the project can help people with motor disabilities, but the voice is a powerful tool to use in other areas like in the industry and IOT (Internet Of the Things), but in this case it can be also used to

help people to improve their lifestyle, from using technology to adapting different areas of the city to make their life comfortable.

This kind of activities help us a lot, because nowadays this kind of applications are below research thanks to the new technologies, one of this technologies is the 5G of telecommunications, the speed and amount of information that can be managed by this net is bigger than the ones in the past and can help people from all over the world to transmit their information correctly and make possible some applications that in the past, can't be developed because of infrastructure and old technologies.

Finally, we have to emphasize the importance of the signals, because the signals are the main medium to transmit information and without these signals this information can be lost, so we have the responsibility to do more research in this area to use them more efficiently.

Teamwork Annex

Team member	**Tasks**
Isabella Dubón A00824441	**Project coding at matlab (✓)** **Investigation and development of the GUI (✓)** **Report (✓)** **Code Testing (✓)** **Assist to consultancies (✓)** **GUI testing (✓)**
Mauricio Aguilar A01351310	**Project coding at matlab (✓)** **Investigation and development of the GUI (✓)** **Report (✓)** **Code Testing (✓)** **Assist to consultancies (✓)** **GUI testing (✓)**
Héctor Pequeño A01246364	**Project coding at matlab (✓)** **Investigation and development of the GUI (✓)** **Report (✓)** **Code Testing (✓)** **Assist to consultancies (✓)** **GUI testing (✓)**