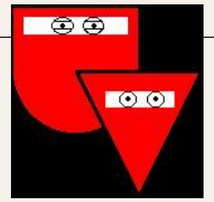

UNIVERSIDAD DEL VALLE

Final project ZAMSHA

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Introducción

In the following presentation the Shazam application will be developed using the Matlab tool, where we made use of the auto correlation function that allows us to compare the signals both entered and from the database that correspond to 15 songs allowing a fast processing in the identification of these.

Problem statement

It starts from the need to find those songs, which in itself there are already thousands in the world, that one listens to where the friend, the neighbor, the radio, among others and not know what is playing, so this application is designed which allows you to easily and intuitively recognize what you wanted to hear easily.

General Objective

Develop an audio signal recognition application in matlab

Specific Objectives

1. Implement an algorithm based on the corss-correlation to identify the songs.
2. Implement a filter to reduce the noise of the audio signal of interest
3. Design a graphical interface that is easy to use for the user
4. Carry out tests to establish the efficiency of the system.

SHAZAM

An Industrial-Strength Audio Search Algorithm

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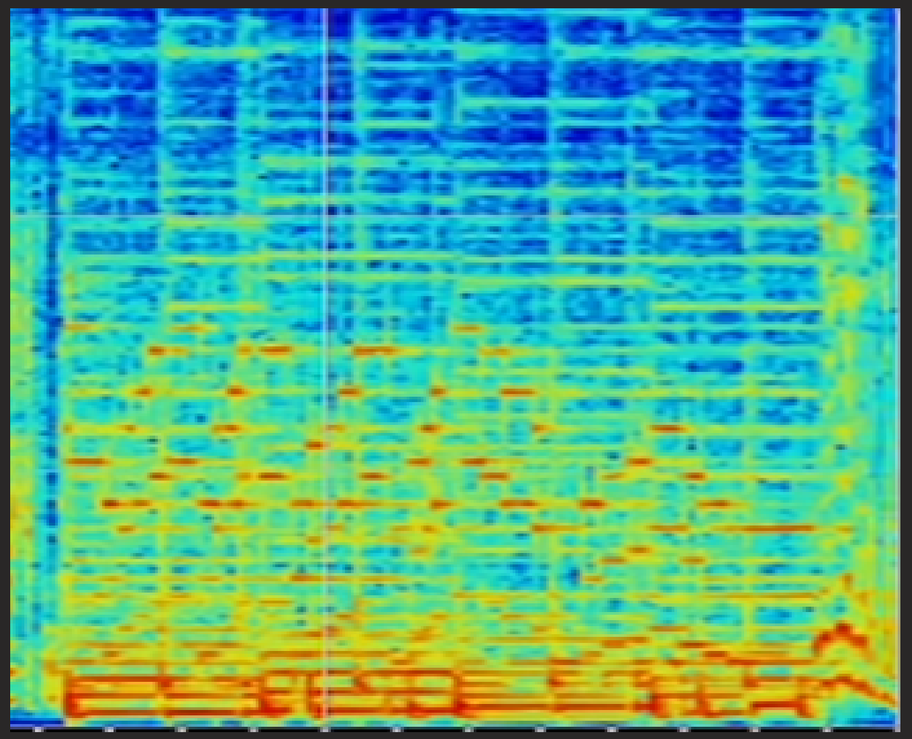
MÉTODOS: ESPECTROGRAMA



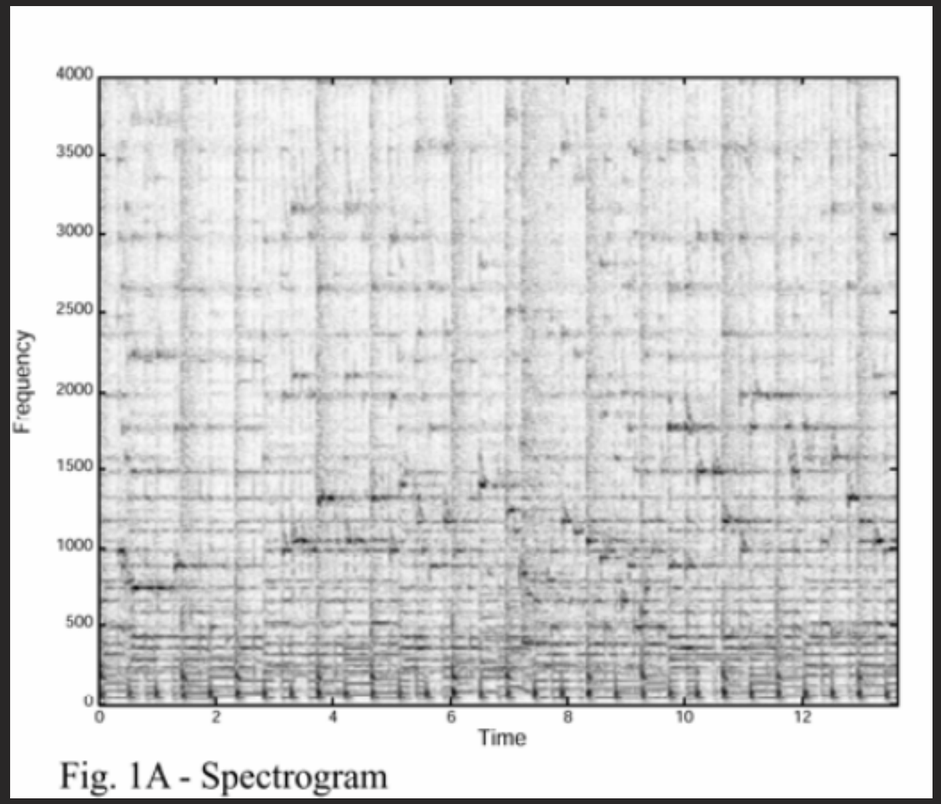


Fig. 1A - Spectrogram

MÉTODOS: ESPECTROGRAMA

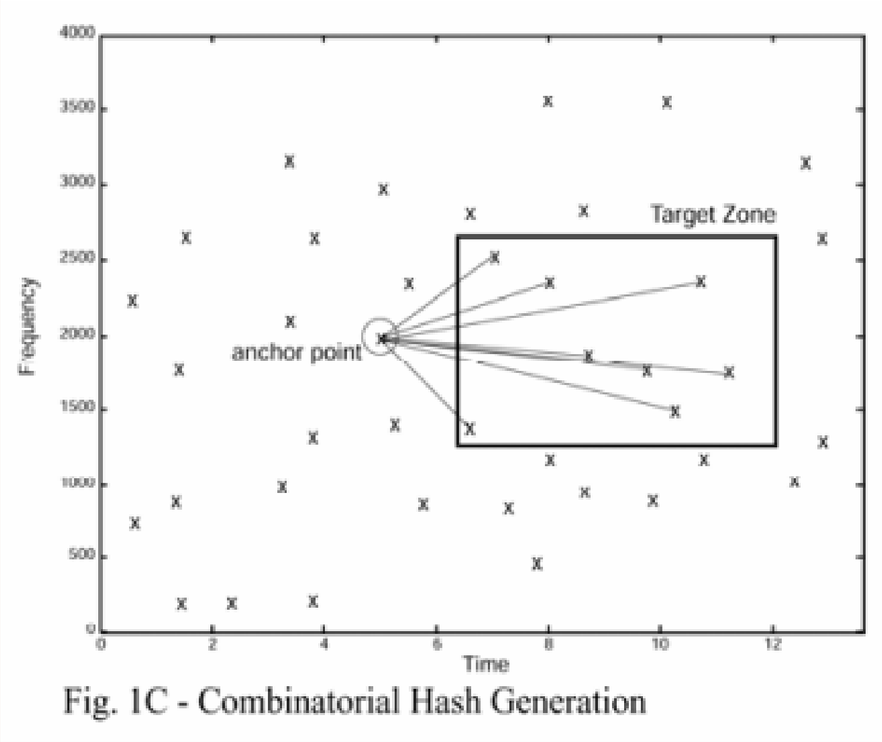
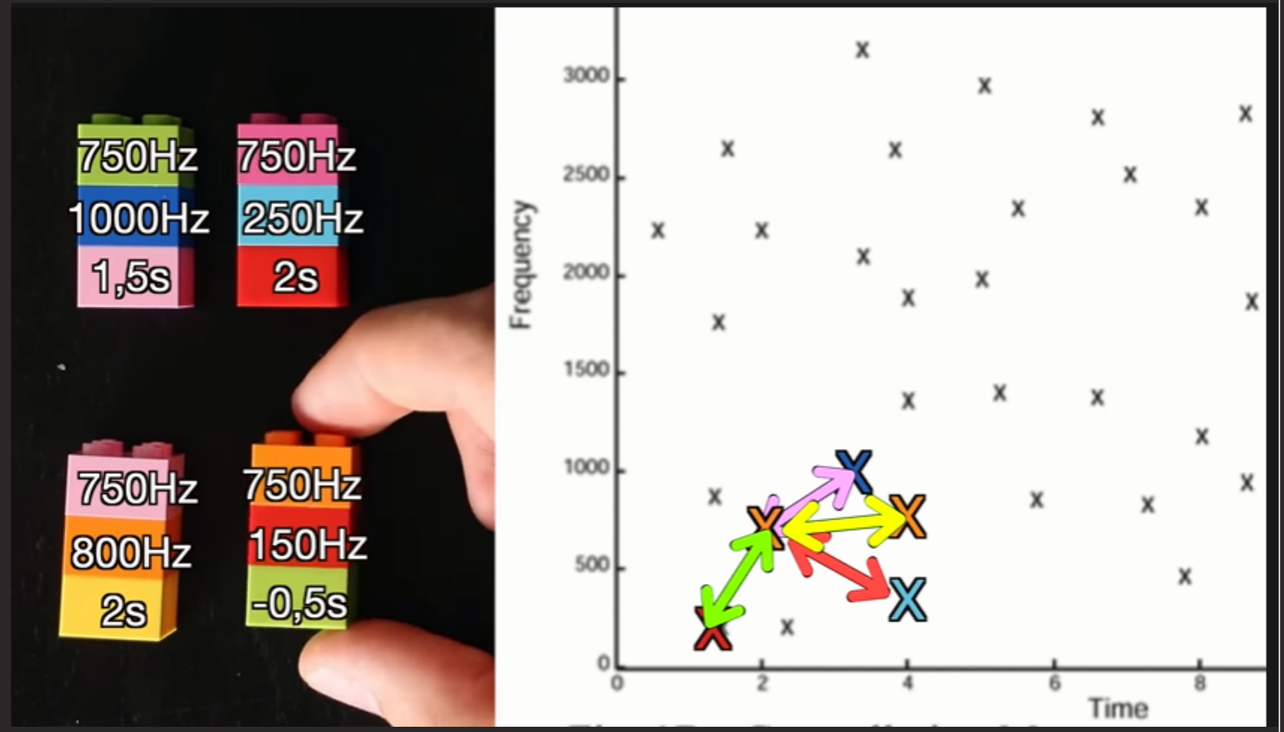


Fig. 1C - Combinatorial Hash Generation



MÉTODOS: ESPECTROGRAMA

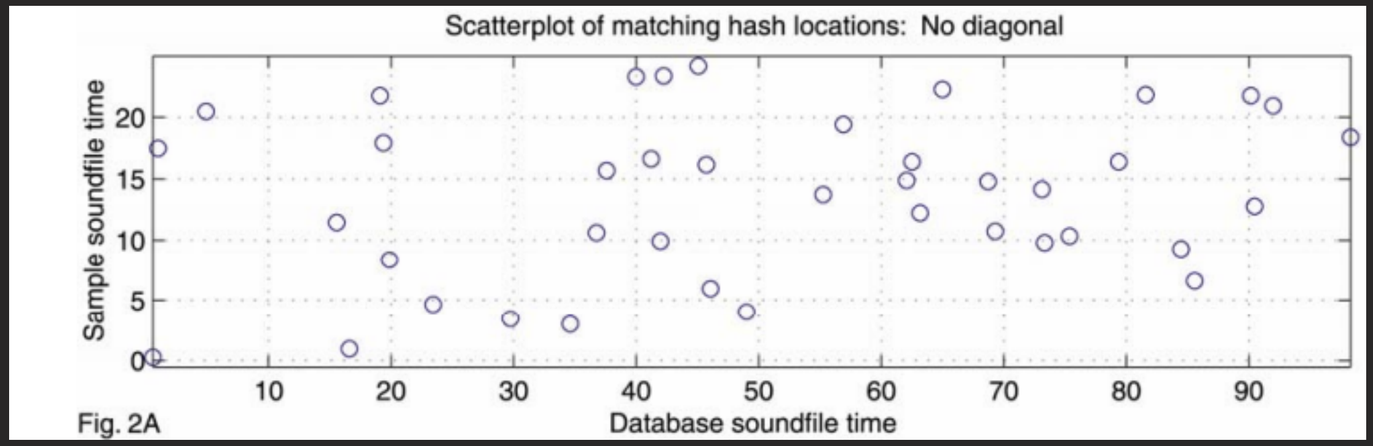
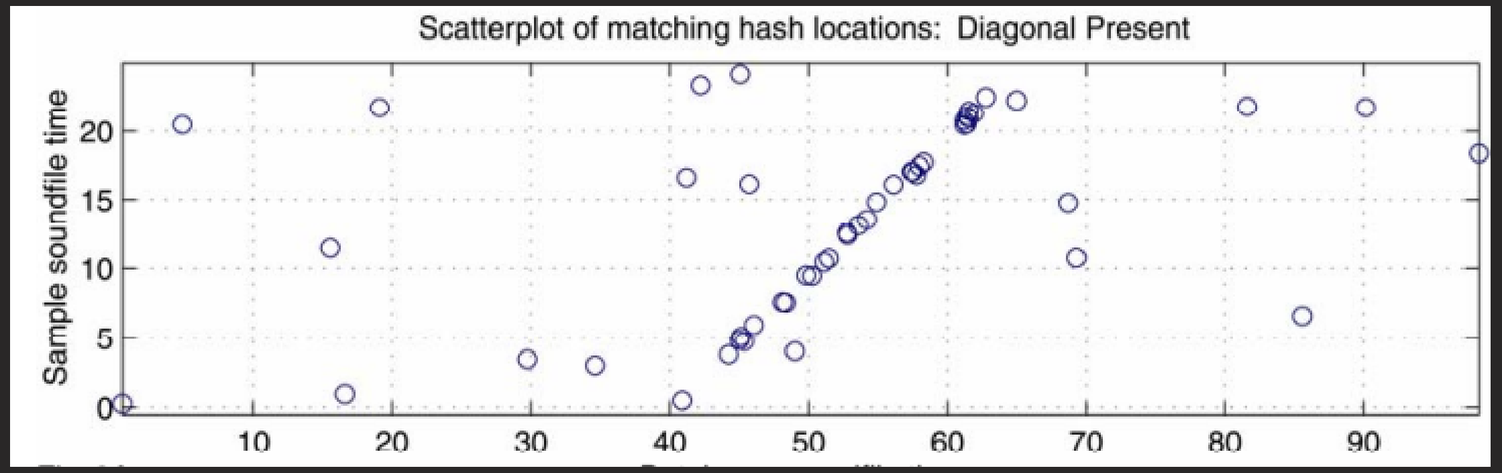
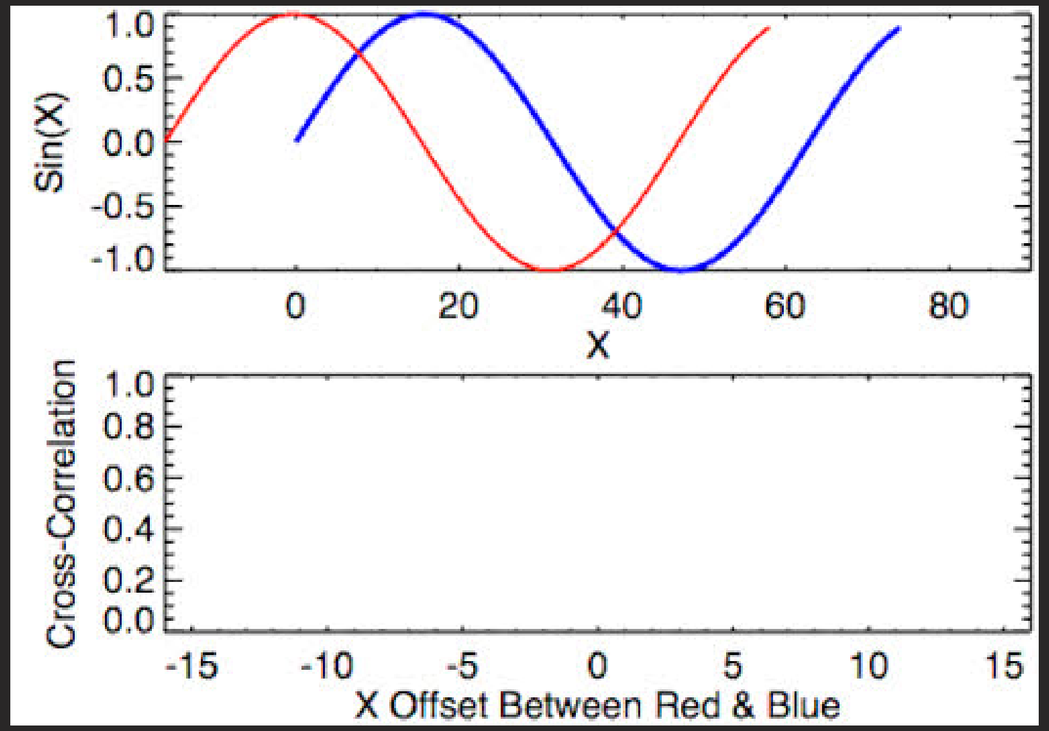


Fig. 2A



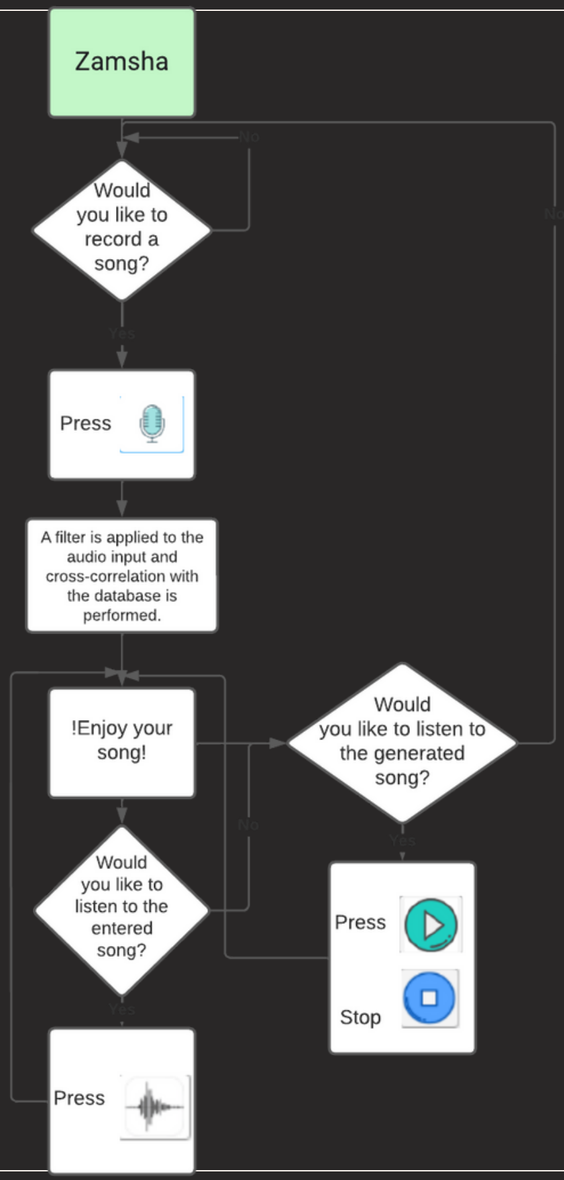
CROSS-CORRELATION



$$r_{xy}(l) = \sum_{n=-\infty}^{\infty} x(n)y(n-l) \qquad l = 0, \pm 1, \pm 2, \ldots$$

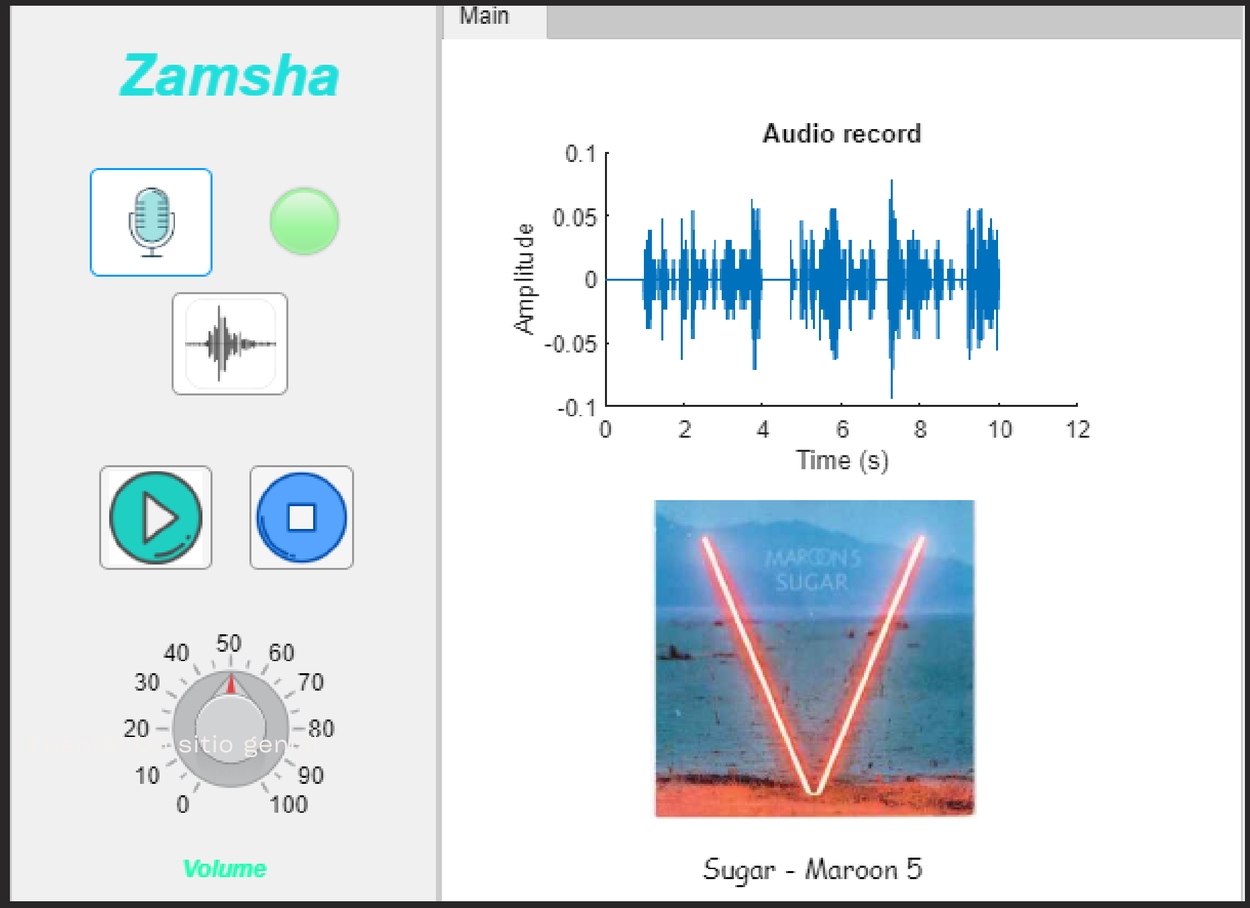
Implemented solution

- BLOCK DIAGRAM



Implemented solution

- Graphic interface



Implemented solution

- Dataset

```
Archivo = fopen('BasedeDatosCanciones.txt');
Path = textscan(Archivo,'%s %s %s', 'delimiter', ';'
```

```
canciones/El Rookie  Falta otro en el barrio.mp3;CARATULAS/El Rookie  Falta
canciones/Hailee Steinfeld BloodPop  Capital Letters.mp3;CARATULAS/Hailee St
canciones/In the name of love -- Bebe Rexha.mp3;CARATULAS/In the name of lov
ver.jpg;Forever -
canciones/sugar.mp3;CARATULAS/sugar.jpg; Sugar - Maroon 5
.mp3;CARATULAS/sav
canciones/Tus besos - Los Caligaris.mp3;CARATULAS/tusbesos.jpg;Tus besos - L
canciones/Usted no me olvida -- Joaquin.mp3;CARATULAS/usted no me olvida.jpg
```

Implemented solution

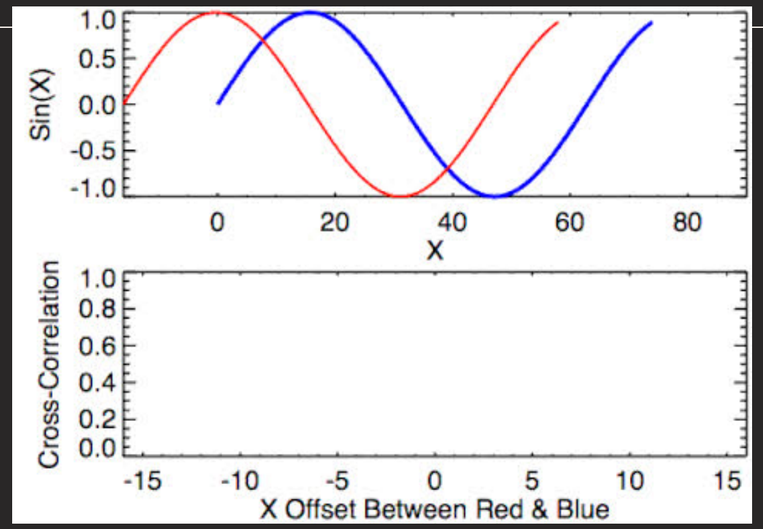
- Record Button
- Filter

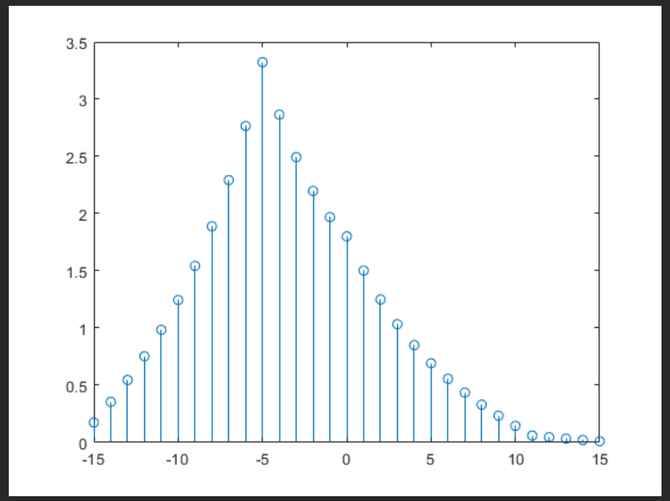
```
Tiempo = 10;
FrecuenciaGrabacion = 8000;
recObj = audiorecorder(FrecuenciaGrabacion,8,1);
sample = FrecuenciaGrabacion * Tiempo;
record(recObj);
pause(0.1);
```

```
app.x = filter(b,a,app.x);
```

Implemented solution

- Cross-correlation






```
Correlacion = xcorr(CancionMono,app.x);
```

Implemented solution

- Decision algorithm

```
for i = 1 : Numcanciones
    [Cancion, Fs] = audioread(Path{1}{i});
    Cancion = resample(Cancion, FrecuenciaMuestreo, Fs);
    CancionMono = Cancion(:,1);
    Correlacion = xcorr(CancionMono,app.x);
    Max_song = max(Correlacion);
    disp(Max_song);
    if (Max_song >= Max)
        Max = Max_song;
        Fila = i;
        app.y = CancionMono;
    end
    disp(Max);
end
```

```
app.Label.Text = Path{3}{Fila};
app.Image.ImageSource = Path{2}{Fila};
```

CANCIONES	PRUEBA 1	PRUEBA 2	PRUEBA 3
Don´t your worry child	10,81	9,06	3,64
Quevedo x BZRP	Falló	64,23	15,37
Me porto bonito	3,01	14,81	10,07
Vibrando Paguan Paguan	20,9	27,11	20,25
El rooki Falta otro en el barrio	7,883	15,169	6,19
Capital letters - Hailee	6,025	3,23	41,58
In the name of love	7,189	28.051	45,661
Forever Labirith	22,68	15,42	7,855
Sugar Marron V	4,151	4,9028	6,1383
Save your tears	17,7624	52	9,7967
Tus besos	27,7484	33,4298	43,7522
Usted no me olvida	12,5689	12,7353	43,7522
Un monton de estrellas	Falló	28,7203	40
Pachito eche	35,6998	21,9815	16,6049
Smooth Criminal	14,2369	55,4396	103,3282

Results

Se obtuvo una eficiencia del 95,56 %

Scopes and limitations

When a song is entered that is not found in the database, the system delivers one of the songs from the dataset.
It should also be taken into account that having a better microphone and good equipment to carry out the process will provide better results.

The program is capable of filtering the audio signal and identifying 15 songs.

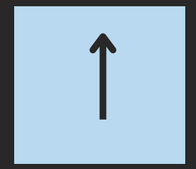
Conclusions

1. It was possible to implement an algorithm based on cross-correlation to identify songs.

2. It was possible to implement a filter to reduce the noise of the audio signal of interest.

3. A graphical interface was designed that is easy to use for the user.

4. Tests were carried out to establish the efficiency of the system.



Thank you!