ADDIS ABABA UNIVERSITY

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Digital signal processing Project

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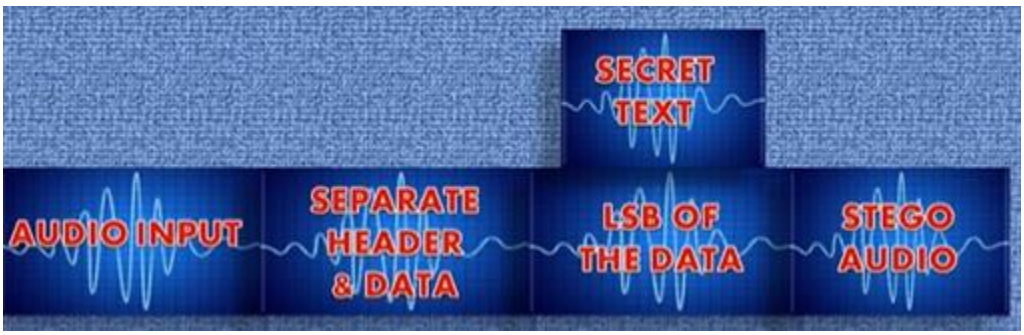
1) Introduction

Since the dawn of time information in the form of letters, art, sculptures etc. has always be sent and received through a third party. Since the sender has no guarantee the third party won't intermingle the information they are sending. People have developed a way to sign a piece of information with a feature called watermark so that the third party (the information transmitter) won't know it is there but the receiver can identify and hence the moment the receiver identifies the water mark they will know the information received is the information sent.

But now a days more information is transmitted in a digital format now than ever, and the growth in this trend will not plateau in the foreseeable future. Digital information is susceptible to having copies made at the same quality as the original. A watermark is pattern of bits inserted into a digital image, audio or video file that identifies the file's copyright information (author, rights, etc.). The name 'watermark' is derived from the faintly visible marks imprinted on organizational stationery. Unlike printed watermarks, which are intended to be somewhat visible (like the very light compass stamp watermarking this report), digital watermarks are designed to be completely invisible, or in the case of audio clips, inaudible



2) Problem statement

The problem of copy write and theft of intellectual Property is increasing with the increasing of technology in the digital world. So it is important now more than ever to protect ones intellectual property from copy writers.

There is also the problem of mischiefs' tainting with original data for one's gain, like the case of photo shops, deceptive people now a days edit original data of other people to the choice of their desire to con and trick other people.

So it has become imperative to make sure the original data, data-creators send is received in the receivers end in the pure form it is sent.

3) Objectives

The objective of this project is to implement simple digital data processing techniques using mat lab and Simulink.

We have chosen to implement Audio data watermarking with simple image files to give indistinguishable data from the original digital data.

And finally to extract the water mark from the water marked data. Hence receive the secret message and make sure the data is not stolen.

4) Methodology

To build our Data hiding in audio signals also known as water marking project we use the following 5 steps

1) Accept the audio signal input, the audio input has to be large enough file to hold the secret data and still maintain its original information. And also accept the message data which should be small enough to fit through the carrier audio signal.
2) Then we have to separate the header of the audio signal which is usually the first 50 bits, this is done mainly because the header of a signal should not be tainted with in anyway, since it defines the whole audio signal.
3) We swap binary version of the message data with the least significant bits of the the audio data. Still the original audio message will be changed, but if we change only the least significant bits, it will only change to a degree that will not be recognizable by humans.

Sample No.	Binary values of corresponding sample	Binary value to be embedded	Binary values after modification
51	01110100	0	01110100
53	01011110	1	01011111
55	10001011	0	10001010
57	01111011	0	01111010
59	10100010	0	10100010
61	00110010	0	00110010
63	11101110	0	11101110

In the above watermarking we can the the secret data is [0100000]

4) Finally we change the encoded binary data to audio signal

Procedure to extract message data from watermarked audio signal

1) Accept the watermarked audio signal
2) Extract the header since it is not watermarked
3) Extract the least significant bit from the beginning of the watermark to the end of the watermark.
4) Turn that extracted array of bits into the appropriate data file

5) Simulation and discussion

We implemented each parts of the methodology with the appropriate functions in mat lab.

The main points for the smooth operations of the program was

a) The input audio was a .wav file
b) And the image was .png file
c) The input image has to be less than 3 kb for less 2 minute of input video- to avoid distortion.
d) In the extraction process in some trials distortion of the message data occurs

For example for the given message data

The extracted output was

However In overall series of trials original water mark was recovered.

For input output

After we were done with the mat lab code we turned the watermarking code into a block in Simulink with two inputs (audio and image) and audio output; so that others could use our code easily. We also did the same thing for the inverse watermarking code.

6) Conclusion

Throughout this project we have seen uses and implementations of different mat lab and Simulink libraries and function. In prier attempts to build the project with only Simulink we have also seen analog signal digitalization and quantization and encoding and decoding to and from binary data.

We have also notice for appropriate watermarking the audio data has to be at least 2,500 times the image in size. Meaning only small information can be stored in large amount of carrier data.

Finally we have seen the advantages of water marking which are: secrecy and indistinguishability form the original signal. How even it is not without its disadvantages which are: due to distortion original signal may be lost, increase in size of data, of if the algorithm of the watermarking is known the watermarked data will render useless.

7) Reference

1. Mathworks.com

2. YouTube tutorials

3. Simulink library help center