CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

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Project Number

S1417

Project Title

A Novel Approach to Sound Steganography through Pseudorandom Sequences and Recombination Techniques

Abstract

Objectives/Goals

To produce a novel device that would allow secure and protected transmission of a secret audio message between a sender and a receiver through the use of a publicly available sound file. While everyone would be able to access the sound file with ease, only the intended recipients would have the ability to access the secret audio message. This device could be used for many important tasks and make secret communication easier than ever before. Some potential users include the CIA/FBI, corporate divisions, or any other sector requiring secure and discrete communication.

The publicly available sound file must not be audibly suspicious in any way (must sound like the original music file). The intended recipient must be able to receive a comprehensible secret message from the sound file. The device must be able to work with common sound file formats. Security should be maximized through various means.

Methods/Materials

The first few stages of development involved actually writing the code for the device. Matlab was used to both write the code and analyze results, and flac files were used for their capability to record at high sampling frequencies. After the program demonstrated success, variables used in the program such as sampling frequency or "ampdec" were optimized through experimentation. After optimal values were found, the device was refined in various ways, such as adding a passcode or correcting for bad user inputs.

Results

Preliminary tests on the prototype code revealed that although the theory behind the work was solid, additional measures needed to be taken to ensure success of the device. Hence, "ampdec", or an amplitudinal decrease, was implemented into the device. After the device demonstrated success, the code was run with different values for sampling frequency, "ampdec", and "randmax". It was found that the optimal values for the above three variables were 100,000 Hz, 50, and 25, respectively. Afterwards, the code was refined furthermore, with the result of higher security and ease of use.

Conclusions/Discussion

The goal of this project was to create a device that could encrypt a secret message into a music file and have the ability to decrypt such files as well. The device made accomplished these goals, and the project was a success. All six design criteria were met. This device paves the path for countless future developments and applications in the field of communications.

Summary Statement

The goal of the project is to create a novel device that would allow secure and protected transmission of a secret audio message between a sender and a receiver by encrypting the message in a public music file.

Help Received

Dr. Inhwan Oh provided software and helped with conceptual understanding of signal processing techniques; teachers at school gave advice and feedback from a layman's perspective.