Name(s)

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Project Number

S0811

Project Title

JENKII: A Wireless Data Transmissions System through Sound Waves with the Use of OFDM

Abstract

Objectives/Goals

The objective for my project is to provide an alternative method for wireless data transmissions to the radio waves that are currently being used. People are becoming more concerned about growing evidence of radio waves causing health problems. With JENKII, this worry will cease to exist because it uses sound waves, instead of radio. It will also utilize the concept of OFDM (Orthogonal Frequency-Division Multiplexing). With this technique, one makes full use of the orthogonal property of waves to save bandwidth and insert more data. Also, the use of OFDM cancels out any multipath distortion. The cyclic prefixes make sure there is no incorrect data due to echoes or fading. I also wanted to create an easily accessible system, and JENKII fits this category perfectly because it only needs a speaker and a microphone to transmit and receive sound.

Methods/Materials

To develop this system, I created transmission and reception programs in C#. I utilized FFT algorithms to calculate the information as quick as possible and the OFDM technique to send as much data as possible. I also had an error-correction algorithm to fix any lost data. I used an interleaver to make sure only random data in the middle, which would be easy to guess at, would be lost. I used my laptop computer speaker and microphone, in conjunction with another, to generate and capture sounds respectively. Then I ran several tests and looked at the amount of incorrect data or data lost.

Results

Up to 2 meters, the average amount of error is less than 5%. I may be able to improve the results in the next several weeks.

Conclusions/Discussion

Up to 2 meters, JENKII allows for an almost perfect wireless data transmissions system, and is completely safe. OFDM is already being used with radio waves. With JENKII, I have shown that OFDM can be applied with other types of waves, such as sound waves. Now, it could potentially be extended into lasers and satellite data transmission could be improved.

Improvements:

1. Ultrasounds will improve data transmission rate with its wider bandwidth. However, it requires ultrasound devices which should be added to computer.

2. With a low data rate application, we can increase the distance by adding extra error correction codes to recover the errors or by increasing processing gain with repetitive codes (like direct sequence spread spectrum codes which is used in deep space communication).

Summary Statement

The goal for my project is to create a relatively cheap and easily accessible alternate method for wireless data transmissions to the potentially harmful radio waves that are currently being used.

Help Received

Father helped to introduce the topic of OFDM and sound communication theory; Mother helped to create presentation board.