

Transmission of a Signal

Principles of Digital Communication

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May 21, 2015

1 Introduction

During our last semester of bachelor, we have taken a course in digital communication. We have learnt many interesting topics such as Hypothesis testing and discrete time receiver design, continuous time receiver design, signal constellation design, waveform design, coded transmission. We were asked to complement the theory with a hands-on experience to communicate. We choose to do it on matlab.

2 Goal of the project

The purpose of this PDC project is to implement a transmitter and receiver using sound waves using 2 laptops. The first one send read a text file and convert it to bit before transmitting it using 4 different frequencies. 3 meter away from this, the second one record the song, analyse the file, and reconstruct the text from the bit

3 Description of the project

The first laptop read a text file and convert it to bit before transmitting it using 4 different frequencies. 3 meter away from this, the second one record the song, analyse the file, and reconstruct the text from the bit. The main problem which came up was the synchronisation. We decided to use one signal to know where the signal start and then using the correlation when we analyse the file to find the beginning with precision then we know that each slot last 0.06 sec. then we just analyse each slot independently.

4 Choice of time and Frequencies

For this project, we decided to use five different frequencies. Four for each couple of bit, 00, 01, 10 and 11, respectively 10000Hz, 12000Hz, 11000Hz and 9000Hz. One for the beginning and the end of the signal 18000Hz. For the time of our frequencies, we choose 0.06s, because it short enough to reduce the possibility of noise.

5 How to run the Project

To run the project, you need tow computer and Matlab installed on each of them.

The computer which will transmit the sound need to open transmitter.m. Then the bits that need to be send have to be written in the "transmission.txt" file. the second computer need to open the receiver.m file. To start the transmission, the two scripts need to run at the same time.

6 Functions and Scripts

createFreq.m The method is used to create .wav of the frequencies we need.

transmitter.m This is the script that the computer which need to transmit the sound has to run. It calls the createSound method.

receiver.m This is the script that the computer which need to analyze the sound has to run. This script will start by recording, during 30 seconds, which let's enough time to record a signal created from an average of 150 characters. Then, it will called the conversion function.

text_to_bits text_to_bits is a simple function that reads a text file, and convert the text in bits using the ASCII format. This method is called in createSound.

extractor.m extractor is a simple function that reads a text file, extract every bit it contains, and store them into an array two by two. This method is called into the text_to_bits method.

createSound.m create sound is our method which create the wav file containing the signal we want to send. It runs through the array of bit, and for each one of them assigns a frequency and adds the corresponding signal to our wav file.

synchronization.m Once we have or recorded signal from the receiver, We need to analyze it. But first, we have to synchronize the signal we recorded to be sure to analyze only the signal.

For this we create a signal from our start frequency and we make the auto-correlation between this signal and our recorded file. This permit us to keep only the part of the recorded file starting at the beginning of the signal. This method is called into the analyzation method.

analyzation.m This method analyze each samples of the signal synchronized, and assigned them the right frequency.

conversion.m Once we have our frequencies stores into an array, we just need to convert them back in bits and to write them into a text file. That what's the conversion method do.

bits_to_text.m This method take the text file created by conversion.m and convert the bits in character with the ASCII decodage.

7 Conclusion

We had some error first and decide to send 5 times each bit and take an average, with this we have error free. that is for sure not the best things to do but it works. every proper transmitter/receiver device must verify the correctness about what we receive and the receiver has to ask to resend the data in case of error. In our case we did not have time to do so and our system is sure because the few times we had mistake we were able to recover the error by just reading. We had 1 char uncorrected over 150 and we can accept this error for text. if it about number it could be a big problem for reliability so we would just increase the number of time to transmit to make sure. and also we could have add a header at the file and use a checksum to guarantee the correctness If we had more time to work on this project, we would have preferred to do in real time