

Project Proposal

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ECE 531

Adaptive Frequency Hopping

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For our project, we would like to implement an adaptive frequency hopping (AFH) algorithm using two PlutoSDRs. The idea behind adaptive frequency hopping is that when transmission interference on a particular frequency channel is high, devices using AFH will move to another frequency channel. In order to accomplish this, first we will implement a form of digital communications (BSK, QAM, etc) with two PlutoSDRs, one for transmit and one for receive. The form of digital communication will be chosen as we gain experience and complete our future labs. After the digital communication protocol is completed, we will implement an adaptive frequency hopping algorithm. There are many ways to perform adaptive frequency hopping such as using channel estimation. In channel estimation, the parameters of a wireless channel are estimated (such as gain, fading, and spatial correlation). This can be done by looking at the impulse response of the channel, or through statistical means by looking at the channel over time and using something like least squares estimation.

We will be using MATLAB to implement our project. Our reasoning by choosing MATLAB is that we feel implementing the signal processing algorithm (adaptive frequency hopping/channel estimation) will be more straightforward than creating our own GNU Radio blocks. To test our algorithm, the PlutoSDR that is receiving will also be transmitting interference at specific frequencies. The type of interference that we would like to introduce into the system is noise interference using a gaussian white noise source. Another type of interference might be crosstalk interference where one device transmits a signal on a neighboring channel creating interference on the current communication channel. With this, we can observe the transmitter and see if the AFH algorithm changes frequencies as expected. Some quantitative measures we will take are Bit Error Rate (BER), Signal to Noise Ratio (SNR) and Signal to Interference Ratio (SIR). A predetermined message will be transmitted repeatedly using the digital modulation chosen.

One aspect of this project that has not been determined is whether to use the impulse response or a statistical means for channel estimation. Another is whether to use an existing AFH algorithm, or experiment with coming up with one ourselves. Any guidance/suggestions with these aspects of the project will be appreciated.