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IPRO 344

Improving Audio Efficiency in Mobile Devices and Intercoms

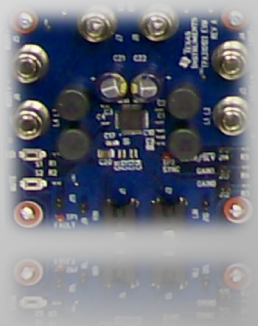
iFidelity

Objective

The fall 2009 IPRO 344 team had set forth the following goals to achieve throughout the semester:

- Reconstruct Server Side Module (SSM) to be more user friendly
- Improve testing methodology
- Evaluate performance by determining the speech transmission index (STI) through the system
- Collect comparative real-world sample from local fast food chain
- Conduct several ambient noise tests using ANAA

Class D Amplifier



Class D audio amplifiers are highly efficient due to their rapidly changing states. At any given moment, a class D amp is either switched fully on or off, in which the amp does no drain energy from the source. Energy is used during the transition period between states, thus reducing the overall power consumption. This has allowed high-power amps to be constructed without the need for a heat sink. This also allows for a reduction in size of the amplifier. Class D amplifiers are desirable for use in our application since they are low cost, produce excellent sound quality, and are energy efficient.

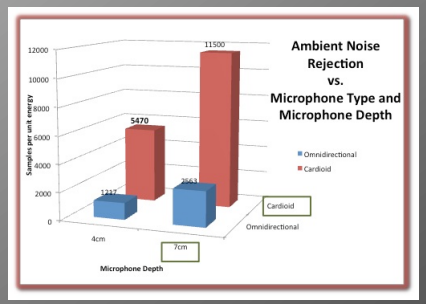
Testing

The biggest improvement over previous semesters work is the testing methodology. This semester, the group has utilized LexSTI as well as creating a MATLAB script, which enabled us to run speech transmission index (STI) tests automatically. The STI value ranges anywhere from 0 to 1, where 1 means a complete understanding of the signal and 0 means no understanding.

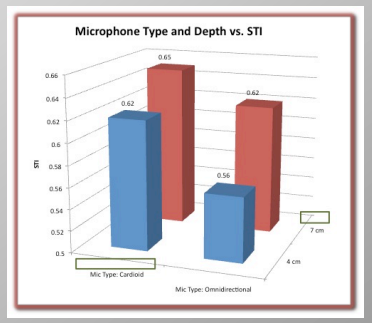
Several different tests were executed regarding STI. The tools and media team tested several parameters and how they affect STI. These parameters included distance of the noise source to the kiosk, angle of the kiosk, microphone depth inside the kiosk, and whether the kiosk contained insulation foam or not. This methodology was conducted using both a cardioid and omnidirectional microphone.

Several tests were also conducted using ANAA, which is a technique used to determine the effects of ambient noise on STI. Variables for these tests were the same as previously mentioned, with the addition of various ambient noise samples.

Results

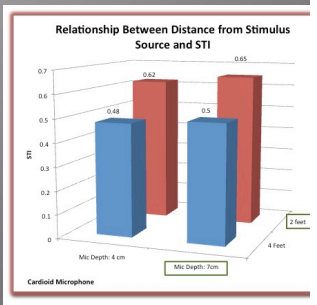


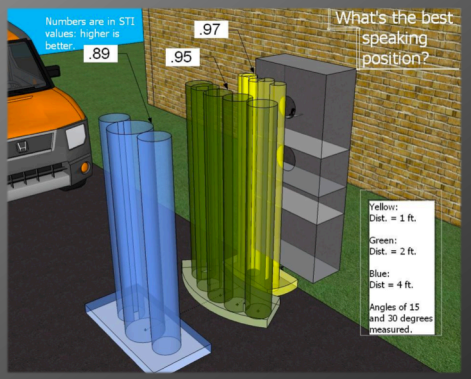
After analyzing the STI and ANAA tests, there are specific relations between the sound quality and variables tested. Some of the more interesting results are represented in the following graphs. The graph above shows how ambient noise rejection is affected by microphone type and depth. It is easily seen that the cardioid microphone at a depth of seven centimeters rejected the most ambient noise.



The graph to the left shows how microphon type and depth affec the STI value of the incoming signal. From the results obtained, the cardioid microphone at a depth of seven centimeters had the highest STI value, while the omnidirectional microphone at a depth of

To the right, this graph represents the relationship between the distance of the microphone and kiosk with respect to the sound source.





The image above shows how distance and angle with respect to the kiosk affect speech transmission. At each kiosk distance, the greatest STI value was found at zero degrees and declined as the distance increased.