iFideliity - IPRO 344

Audio Quality & Energy Efficiency for Mobile Devices and Intercoms

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IPRO Team Members

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Teaching Assistant: Tao Shen

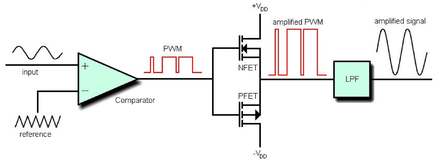
Objective

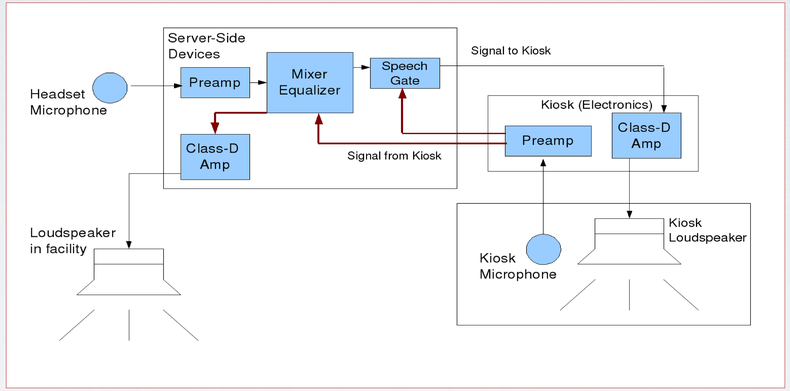
Overall Goals
- Create and industry standard for testing and implementing drive thru systems

Immediate Goals
- Obtain quantitative data on the quality of sound capture for two-way communication systems
- Create a refined prototype Drive-Thru kiosk
- Analyze common sources of noise in the Drive-Thru environment

Class D Amplifier

Class D audio amplifiers are highly efficient due to their rapidly switching states. At any given moment, a class D amplifier is switched either fully on or off. In these states, the amplifier does not drain energy from the source. Energy is used only during the transition periods, thus reducing the total power consumption. This has allowed high power amplifiers to be constructed without the need for a heat sink as well as reduced size. They are desirable to be used within our improved intercom system because they produce excellent sound quality, are low-cost, and energy efficient.

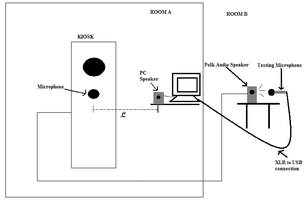




Testing

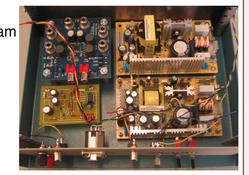
Testing Software:
- LEXSTI: Automated Gaussian Noise and Frequency analysis for STI calculation
- MATLAB: Automated Sync-Note repair for low-STI tests.
- TRUERTA: Octave Band Decibel measurement and Calibration

Major Variables Tested:
- Mic position within kiosk
- Insulation within kiosk
- Omni or Cardioid Microphone Capsules
- Diesel engine interference



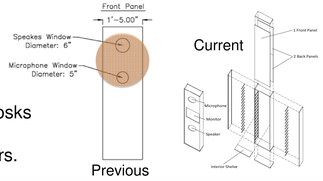
Electronic Circuits

Tasks performed by the Circuits & Signal Processing Team
- Redesign of system layout
- Evaluation of electronic upgrades
- Development of the Speech Gate Controller
- Component selection
- Circuit prototyping
- PCB Layout
- Circuit board assembly
- Module-level assembly



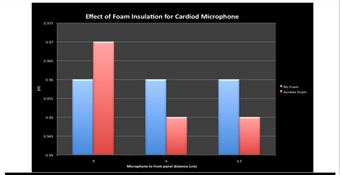
Kiosk

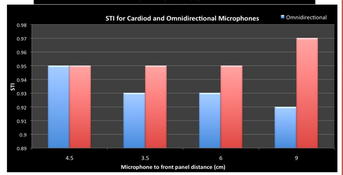
Kiosk Design Goals:
- Model the dimensions of the most common Drive-Thru Kiosks
- Modular construction for variation of testing parameters.



Results

- The Cardioid microphone scored a better STI than the omnidirectional microphone in the majority of tests.
- Microphone has higher intelligibility when placed deeper in the cavity
- Foam insulation decreases intelligibility when microphone is near the front of the kiosk.





Conclusion

- Microphone should be placed well inside the kiosk cavity
- Cavity should have acoustic foam insulation on all walls
- Cardioid microphone performs better than omnidirectional microphone in most tests

Recommendation for Future Development

- More testing needed to verify results
- Test with cheaper insulation alternatives
  - Newspaper
  - R-19 insulation
- Determine effects of various noise sources on intelligibility with and without equalizations

Acknowledgments
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