Microphone & Speaker

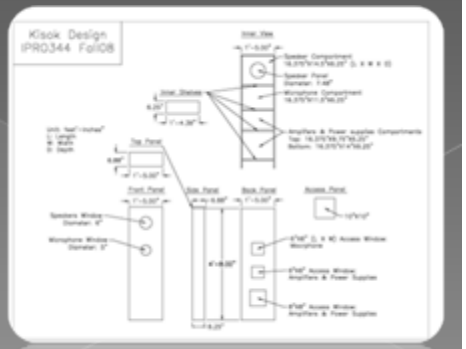
Speaker
- Polk Co.
- Audio db401

Microphone
- Shure Inc

Kiosk

- Replicated size of most modern kiosks
- Constructed of wood
- Microphone and speaker chamber acoustically conditioned
  - Used professional grade sound deadening material to prevent reflections
  - Microphone suspended to isolate from vibrations of kiosk
- Access to interior achieved through access panels

Kiosk Layout



Recommendation

- All circuits should be fused for protection
- Consider noise cancellation method
- Consider an AGC (automatic gain control) circuit for the microphone
- Collaboration with IPRO343 to simulate the entire drive-thru experience

Conclusions

IPRO-344 of Fall 2008 has accomplished all of our objectives .

We successfully built a two-way communication system, housed within a typical sized kiosk, that utilizes Class D amplifier technology.

This is the first step towards a solution for improving communication at drive-thru restaurants.

Special Thanks To

- Shure Inc. for a microphone
- Dr. Wong and Tao Shen for assistance

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ILLINOIS INSTITUTE OF TECHNOLOGY

IPRO 344

Improving Energy-Efficiency & Offering Quality Audio in Mobile Devices & Intercoms

Problem Statement

- The demand for faster, reliable service coupled with a competitive market has prompted businesses to seek new and innovative ways to run more efficiently, increase productivity, and strengthen their bottom line

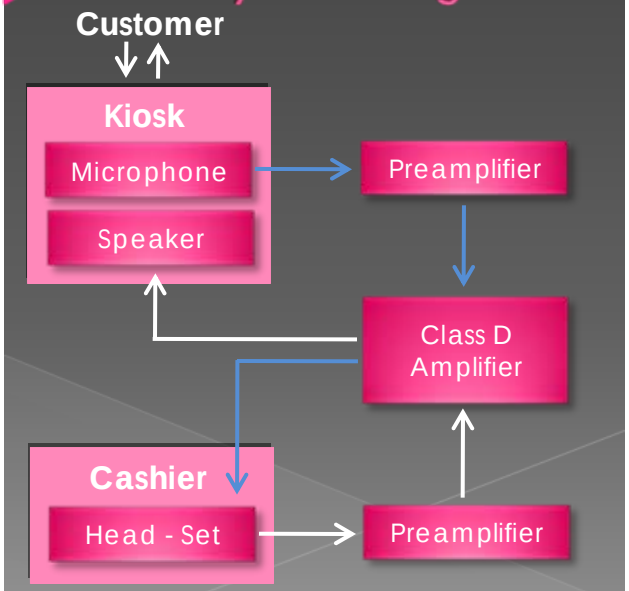
Objectives

- To investigate the potential improvement that Class D amplifiers offer for intercom systems
- To analyze the electro-acoustic aspects of a two-way communications channel
- To simulate and evaluate a drive-thru facility
- To develop guidelines for an acceptable drive-thru system

Background

- Continued work since Fall 2007
- There are commercial interests and values in improving drive-thru systems
- According to McDonald's studies, more than 50% of inaccuracies are during the order taking process
- Implementation of a Class D Amp to improve the sound quality
- Building a prototype of kiosk to test two ways communication in the real environment
- Sponsorship
  - Shure Inc.
    : Provide a high quality microphone

Audio System Diagram



Pre Amplifier

- Consists of three major section:
  - Power Supply Management
  - Operational Amp Configuration
  - Pre-amp Input Protection
- Power Supply Management
  - Astrodyne ASL 40-48 Open Frame Power Supply provides 48V through a 315mA line fuse.
- Operational Amp Configuration
  - The difference amplifier uses ½ of a LM833 amplifier. The LM833 was chosen for its low-noise and large band width performance characteristics.
- Pre-amp Input Protection
  - The op amp input protection serves to separate the circuit from the DC 48V phantom power and any associated transients as well as any possible overloading input signals.

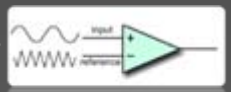
Completed Preamplifier

Class D Amplifier

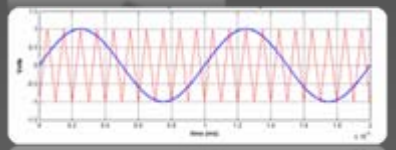
- Class D amplifiers use modulation to amplify signals that exploits the relationship between current, voltage, and power
- Pulse-Width Modulation(PWM) – Method

1. Comparator: Generate a square signal

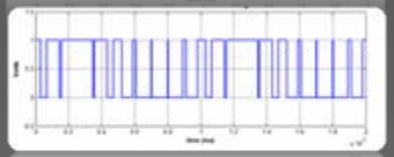
Comparator



Input Signals

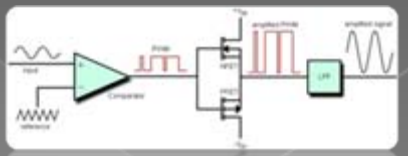


Output Signal



2. Power Amplifier: Amplify the output signal to the desire level

Evolution of Signal within Class D Amp



- Class D Amp consumes energy only during transitions □ Efficiency: 90% ~ 95%
- Class D Amp takes very little space, and requires no heat sinks to expel wasted energy to the environment