IPRO 315
Improving user experiences with Mobile Devices and Intercoms: Optimizing audio quality & energy efficiency

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Sponsor: Shure Inc.

Team:
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Jaime Rodriguez   Joseph Taylor   Tom Tsai

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The Problem

Drive through order miscommunication costs the fast food restaurant industry both time and money.
The History of IPRO 344, iFidelity

- Constructed and improved kiosk and audio electronics system (class D amplifier)
- Extensive testing for ideal microphone type (cardioid), pre-amplification, and position
- Hardware encasement and physical interface

- Goal achieved: an increased probability of a correct order
- System left open for upgrades in future IPROs
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Voiceless

- Utilizes a mobile device application
- Removes a degree of human error from the order-taking process
- Speeds up the order-taking process by allowing preset menu choices and eliminating the server/customer dialogue
- Perfect for hearing-impaired drivers
Voiceless: Problems

- Preventing ordering while driving
- First In, First Out Queue
- Simple and affordable database
Voiceless: Solutions

- Using kiosk as a synchronization point
  - Bluetooth proximity sensor
  - Proximity limit controls location of ordering

- Proximity limit controls queuing order

- Leverages Amazon Web Services
  - Low cost, high scalability, reliable database
Voiceless: Layout

Drive Through Window

Restaurant

Wi-Fi Transceiver

Kiosk with Bluetooth Transmitter

Drive Through
Voiceless: Future IPROs

- Additional platforms (Android, etc)
- Automatic Bluetooth range adjustment system
- Point-of-sale system integration
- Remote menu updates/multi-restaurant support
- In App payment
Voiceless: Ethical Considerations

- System caters to deaf community
- User information confidentiality
- Ordering while driving
- Not eliminating voice system entirely
  - For those without ability to use voiceless system
Wireless

- Create a Wireless link between the Server Side Module and the Kiosk
- Eliminate any errors that could result from faulty wiring or line interference
- Lower installation costs
Wireless: Layout
Shure, Inc. provided IPRO 315 with two sets of PGXD transmitters and receivers as well as a headset, which complemented previous semesters’ Shure microphones.
Wireless: Design Considerations

- Previous design required modification
  - New Shure equipment needed different audio levels than previous design
  - Fabricated a headphone amplifier
  - Built a new server-side module

- Wireless Module Mounting
  - Preventing signal attenuation from within the Kiosk and Server Side Module
Wireless: Challenges

- Audio Testing
  - Recreated previous semesters’ audio quality tests ensuring no signal quality deterioration

- Documentation
  - Provide documentation so that all of the tests of our system can be faithfully reproduced by following semesters
Wireless: Test Results

Microphone Depth 4 cm

Microphone Depth 7 cm

Speech Transmission Index (STI) Summary
Wireless: Future IPROs

- Push to talk
- Dynamic range compression
- Re-implementing equalizer
- Laying out PCB for headphone amplifier
Questions?