Prelude: Our Prior (Failed) Idea

Object Detecting Long Cane

- Meant to augment the cane
- Could give notification of objects outside the cane's range
- Could give alerts to objects that are difficult to detect with cane (such as a car in motion)
- Planned to allow better sense of depth, such as when going down a flight of stairs
- Would easily fit into existing long cane training
Why Did We Discontinue This Idea?

Insufficient demand

- Blind community resistant to changing design of the white cane

However our research into signal processing and feature detection led us to a new idea...
New Idea: Speaker Identification System

**Speaker Identification System (SIS):** A system that can verify the identity of the speaker by analyzing a sample of their voice.

- Generate a “voiceprint” from a voice sample
- Replace/Supplement traditional password
Multi-step verification greatly improves access security. But it has drawbacks:

- More passcodes to remember
- More complicated interface

Biometrics help solve the above problems but:

- Certain types not usable by all
- May be seen as invasive/obtrusive
Context: Voice Biometrics

How do voices differ?

- Pitch (spectrum)
- Timbre (envelope, harmonic groupings)
- Loudness (amplitude)

Why do voices differ?

- Shape of mouth, nose, throat, etc.
- Gender, age
- Accents
Alternatives

Intelligent Personal Assistant

ex.) Cortana (Google), Siri (Apple)

- Recognize certain words to process commands
- Designed to recognize words and phrases despite different accents, dialects
- Our project differs in that we aim to recognize specific people from commands, rather than commands from people.
Alternatives

STRAIGHT

- Wakyama University (Japan) project
- Analyzes voice signals in depth (timbre, pitch, speed, quality)
- Capable of manipulating these attributes
- Originally intended to help conduct experiments on speech perception
Requirement Analysis: Specifications

1. Record human voice in a digital format with reasonable quality

2. Database of name-voiceprint pairs
   - Relates known user

3. Identify speakers with high degree of accuracy
   - Compare stored
   - Probability of “false positive” less than 0.05
Requirements Analysis: Inputs/Outputs

Inputs:

- Human voice
- User identifier (if new DB entry)

Outputs:

- UI feedback (positive or negative ID)
Block Diagram

Microphone

Voice Recording
- ADC
- Data Compression
- TX/RX

Voice Processing
- Signal Processing
- Data Processing
- TX/RX
- Database

UI
Subsystem: Voice Collection

Requirements:

- Convert analog audio signal to digital
- Transmit digital signal to data processing unit

Inputs:

- Analog audio signal

Outputs:

- Digital audio signal
Subsystem: Voice Processing

Requirements:

- Process audio signal and generate “voiceprint”
- Match voiceprint-ID pair to database entries, if any

Inputs:

- Digital audio signal
- UI input (e.g. PIN, name, ID number)

Outputs:

- Database entries/queries
- UI feedback
MDR Deliverables

1. Demonstrate ability to record voice sample in digital format

2. Demonstrate communication between Voice Recording and Voice Processing subsystems

3. Implementation of signal processing components in MATLAB