HearTouch: Android Hearing Aid for Tactile Communication

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Abstract

HearTouch is a portable electronic device that uses the sense of touch to help the deaf and hard of hearing communicate. Our product has a very small footprint and is meant to fit snuggly in an armband pouch - the same ones used for holding MP3 players while exercising. This comfortable and unobtrusive design allows for high ease of use. A small, rechargeable lithium-ion battery provides the power. To deliver the translation to the end device, we have developed an Android application that converts incoming speech to Morse code and then sends this to a microcontroller, which vibrates the patterns on the user's arm.

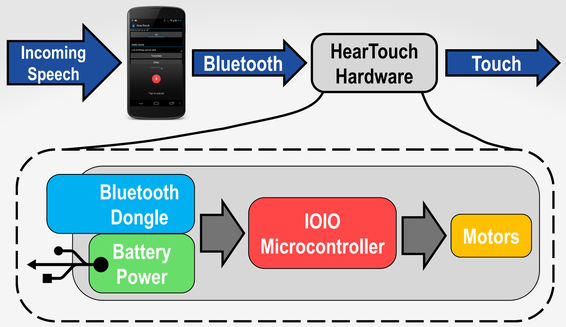
Due to its flexibility, other applications can be designed for the HearTouch hardware that utilize touch in order to help those with other disabilities. For instance, we envision a GPS-based Android application that can provide turn-by-turn walking directions from vibrational motors. This could be integrated into white canes used for the blind. The versatility of this device can offer a range of products and open a whole new market for affordable solutions to sensory loss.

Background and Motivation

Hearing loss is a serious problem affecting millions of individuals worldwide. Existing solutions for hearing loss include hearing aids and cochlear implants. These, however, can be very costly and may require invasive surgery. HearTouch is radically different. While other devices attempt to repair or recover a lost sense, we seek to take advantage of an entirely separate sense – touch.

Source: canadadrugpharmacy.com

System Overview



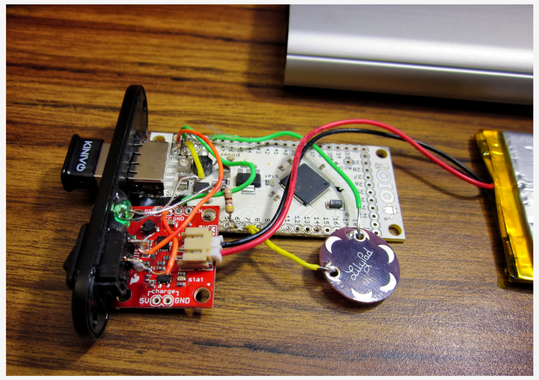
Hardware

IOIO Microcontroller
- Designed for Android
- Bluetooth support

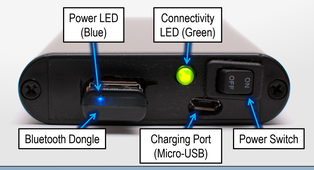
LilyPad Vibe Board
- Vibrational motor
- 20 mm outer diameter

Polymer Lithium Ion Battery
- Rechargeable 3.7 V, 2000 mAh battery
- Over 10 hours of estimated usage per charge

Power Cell - LiPo Charger/Booster
- Boosts voltage from 3.7 V to 5 V
- Charges battery via micro-USB



Physical dimensions: 2.8" W x 4.8" L x 0.75" H
Weight: 170 g / 0.37 lb.

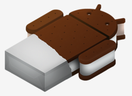


Software Details

1) Convert incoming speech into text with Android's Voice Typing feature
2) Tokenize words into constituent letters and then into Morse code
3) Send patterns to IOIO microcontroller over Bluetooth
4) Output signal to motor (IOIO code)

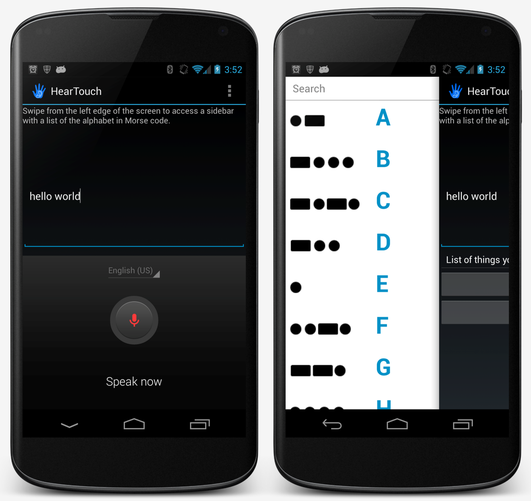
Morse code chosen for several reasons:
- Easy to learn
- Less complicated and more compact hardware
- Possible to change speed for varying levels of experience

ANDROID APP ON Google play



Requires Android 4.0 (Ice Cream Sandwich) or above

User Interface

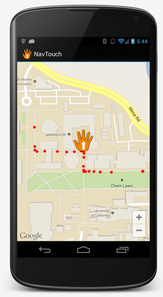


From the main interface, the user can read the incoming speech from the text box as it is being converted into Morse code on the motors.

The user can also swipe from the left to open a side menu with all of the translations in Morse code. By pressing on a letter from this menu, the user can preview how it feels.

NavTouch

- Tactile turn-by-turn directions
- Google Directions API for GPS navigation
  - This allows for custom path creation
  - Google's servers provide turn information as text in JSON format
- Same fundamental hardware as HearTouch
- Can be integrated into a white cane for the visually impaired
- This shows that our product can be expanded into a brand with numerous applications for those with hearing and sight impairments



Future Work

- More efficient voice recognition
- More robust microcontroller
- Filter out background noise
- Smaller physical size
- Stronger and faster motors
- Usability testing
- Expand to other senses

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