Final Project Review

Team Toccando
April 20, 2016

Toccando

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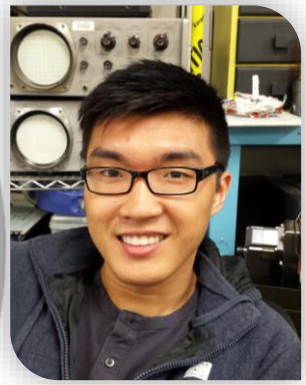


William Young, CSE

Esther Wolf, CSE

Toccando: A Tactile Feedback System

Problem

- With the invention of touch screens, much of the tactile user interface has been lost

Solution

- Tactile display that provides distinctive haptic feedback to the user

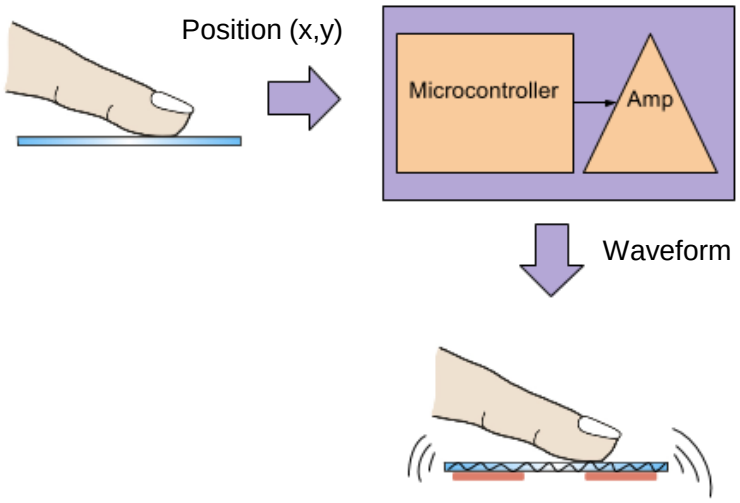
Technology

- Use of vibration to dynamically create low and high friction areas that are experienced as force on the user's finger when the finger is moving.

Design

Four Main Components:

- Android Phone
- Microcontroller
- Amplifier
- Glass with piezos



Why Toccando?

Adding another dimension

- Touch!

Bringing technology closer to reality

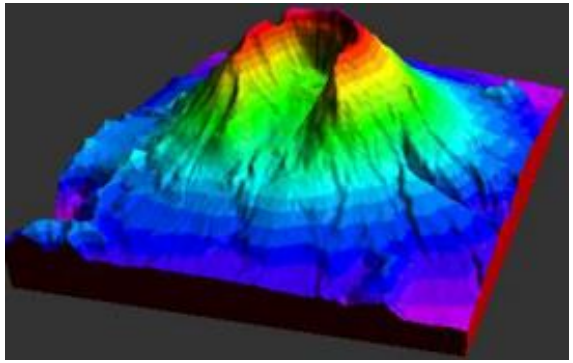
- The shape and texture of objects is important to the way we interact with the physical world

Education

- Allows the development of educational tools such as interactive maps
- Teaching the visual impaired; Shapes, Objects, and Letters

Marketing

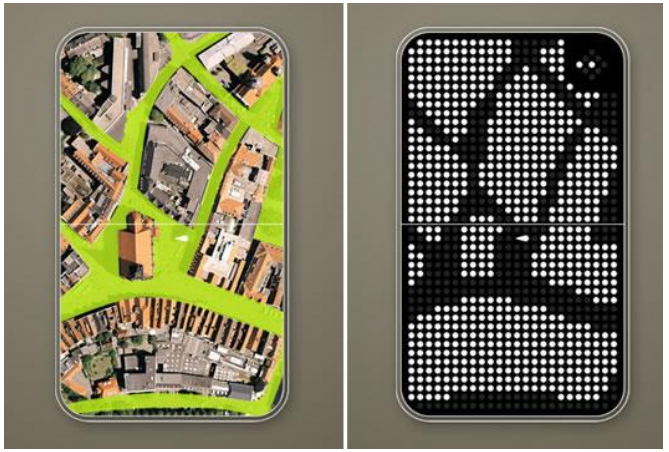
- Clothing texture could be displayed to the consumer



Applications of Tactile Feedback in Maps

Maps

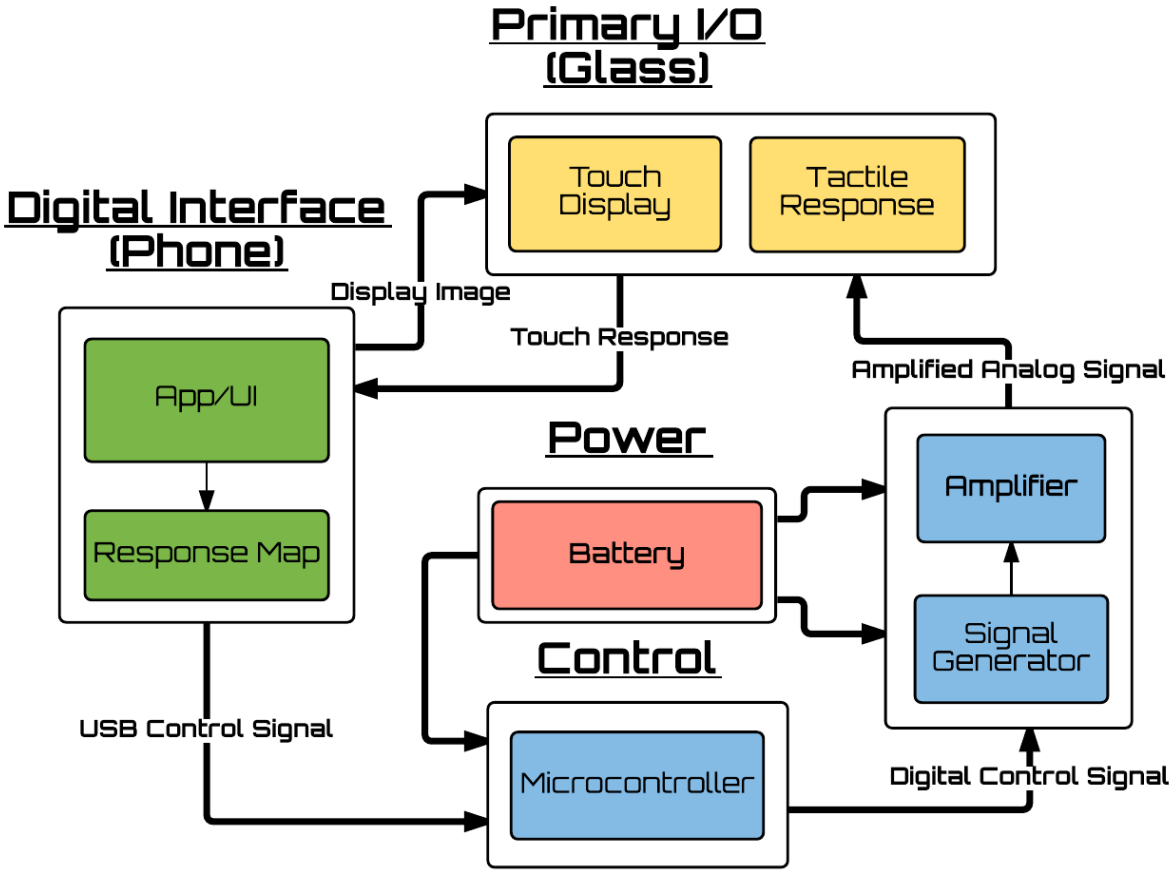
- Dimensionality of a map is modular, 2d or 3d options
- Allows visually impaired to experience electronic maps
- Gives tactile cues when visual cues may be distracting (eg. when driving)



Education

- Introduces letters to the visually impaired

Our Block Diagram



Glass Touch Surface (Primary I/O)

Working Configuration

- 120mm x 92mm x 1.1mm soda lime
- 4 Piezos- 35mm OD x 25mm ID brass backed Murata 7BB-35-3
- Presently running at 37 kHz with variable PWM
- Provides a tactile sensation to the user
- Power output is ~1W

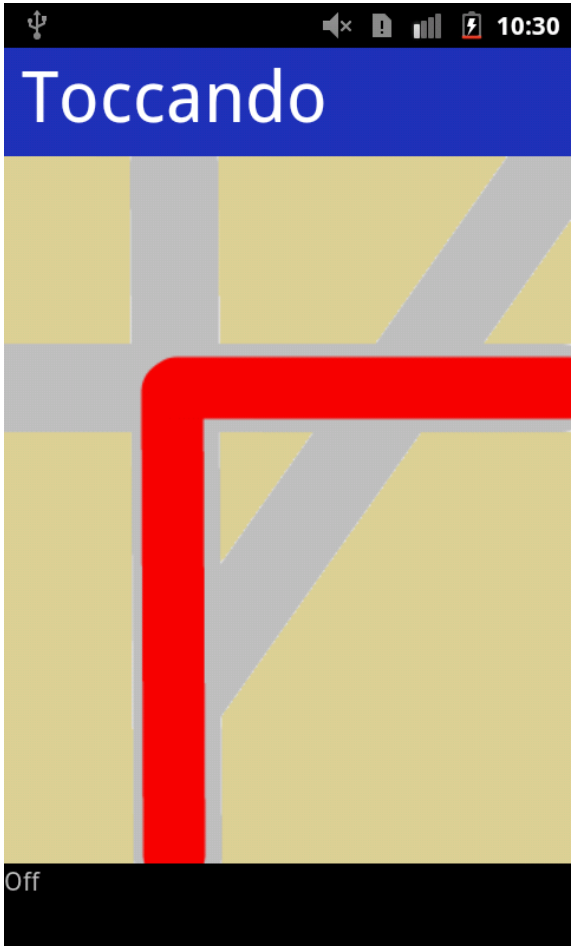
Phone (Digital Interface)

Application/User Interface

- User Interface is able to recognize finger positioning
- Fast and smooth usability
- Multi-threaded socket listening

Response Map

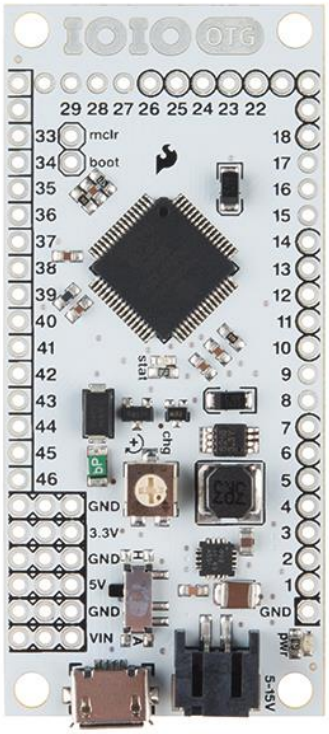
- Rudimentary Geometry (Basic Shapes)
- Example Map Interface
- Letters



Control (Microcontroller)

IOIO OTG Board

- Operating Voltage Range of 2.2V to 3.6V
- Lightweight, Energy Efficient
- Capable of both host and accessory modes (USB OTG)



Control (Signal Generator)

PIC32MX220F032B

- Signal Generator – 37 kHz with variable PWM to achieve desired waveform
- 32 bits vs. 8 bits of the ATmega32
- Higher frequencies than the originally proposed ATmega32

Power

- The circuit draws 200mA at 5V

$$(200mA) \cdot (5V) = 1W$$

- 1W of power is required

- Battery has a capacity of 5000mAh

$$\frac{5000mAh}{200mA} = 25hours$$

- 25 hours of runtime

Challenges and Solutions

Challenges

- Not Enough Power
- Trouble finding correct frequency
- Interfacing the microcontroller with the phone
- Generating the correct signal from microcontroller

Solution

- Inductor wrapped with magnetic wire acting as a transformer
- Found resonance frequency with salt experiment
- IOIO Board and OTG cable allows for the phone to be host mode
- Used the PIC32MX220F32B to solve timing problems with waveform generation

Individual Responsibilities

Esther Wolf (Oo)
- Responsible for interfacing the hardware, software and top level of the application

William Young (Oo)
- Responsible for hardware testing, signal generator (PIC32MX220F032B), and amplifier subsystems

Ygorsunny Jean (Oo)
- Responsible for power system, touch display subsystem (glass and piezos) and web content management

Casey Flanagan (Oo)
- Responsible for hardware testing, case design/fitting, and final construction

FPR Deliverables

Bringing Everything Together

- ~~Increase vibrational feedback~~
- ~~Meet power requirements~~
- ~~Build a case to fit all necessary components~~
- ~~Finish map application~~
- ~~Fully interface the hardware and top level of the application~~

Costs

Development		Production (1000)	
Part	Price	Part	Price
IOIO Board	$39.95	*IOIO Board	N/A
Piezos (4)	$4.72	Piezos (4)	$2.18
M8297-ND (Inductor)	$1.10	M8297-ND (Inductor)	$0.52
IXDN604PI Driver	$1.80	IXDN604PI Driver	$1.80
Voltage Regulator	$0.75	Voltage Regulator	$0.75
8 MHz CLK	$1.00	8 MHz CLK	$0.112
Battery	$25.99	Battery	$25.99
3D Case	$36.83	3D Case	$30.00
PIC32MX220	$3.10	PIC32MX220	$3.10
IRF520NPBF	$1.14	IRF520NPBF	$0.525
Misc. (RC)	$0.40	Misc. (RC)	$0.04
Total	$117	Total	$64

Thank You