DreamRide

The BikeSmart System

April 15, 2014

Introduction

The DreamRide Team

- Jason Coo – Chief Executive Officer
- Nadia Tehranchi – Chief Communication Officer
- Stan Yang – Chief Operating Officer
- Conrad Wang – Chief Technology Officer
- Paul Chen – Chief Financial Officer

Outline

- Motivation
- Features
- Design
- Budget and Scheduling
- Future Work
- Acknowledgement
- Questions

Motivation

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- An average of 19,000 cyclists injured or killed every year across the US
- Lack of vision
- Lack of communication

The BikeSmart System

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Visibility is the Key!

Features

1. Left and Right Signal

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2. Braking Light

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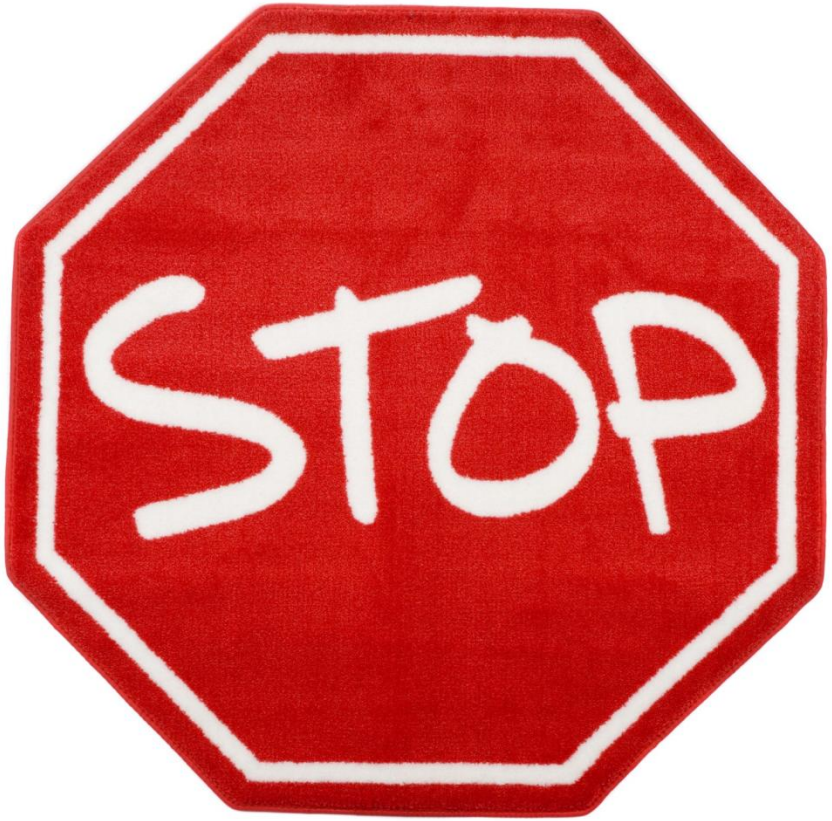

3. User Feedback

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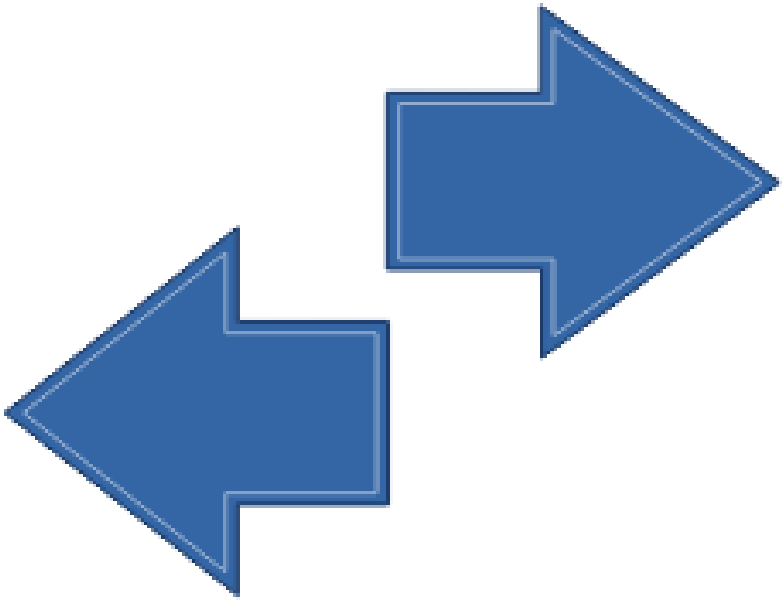

4. Speedometer

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5. Wireless Communicatio

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6. Voice Recognition

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Feature Diagram

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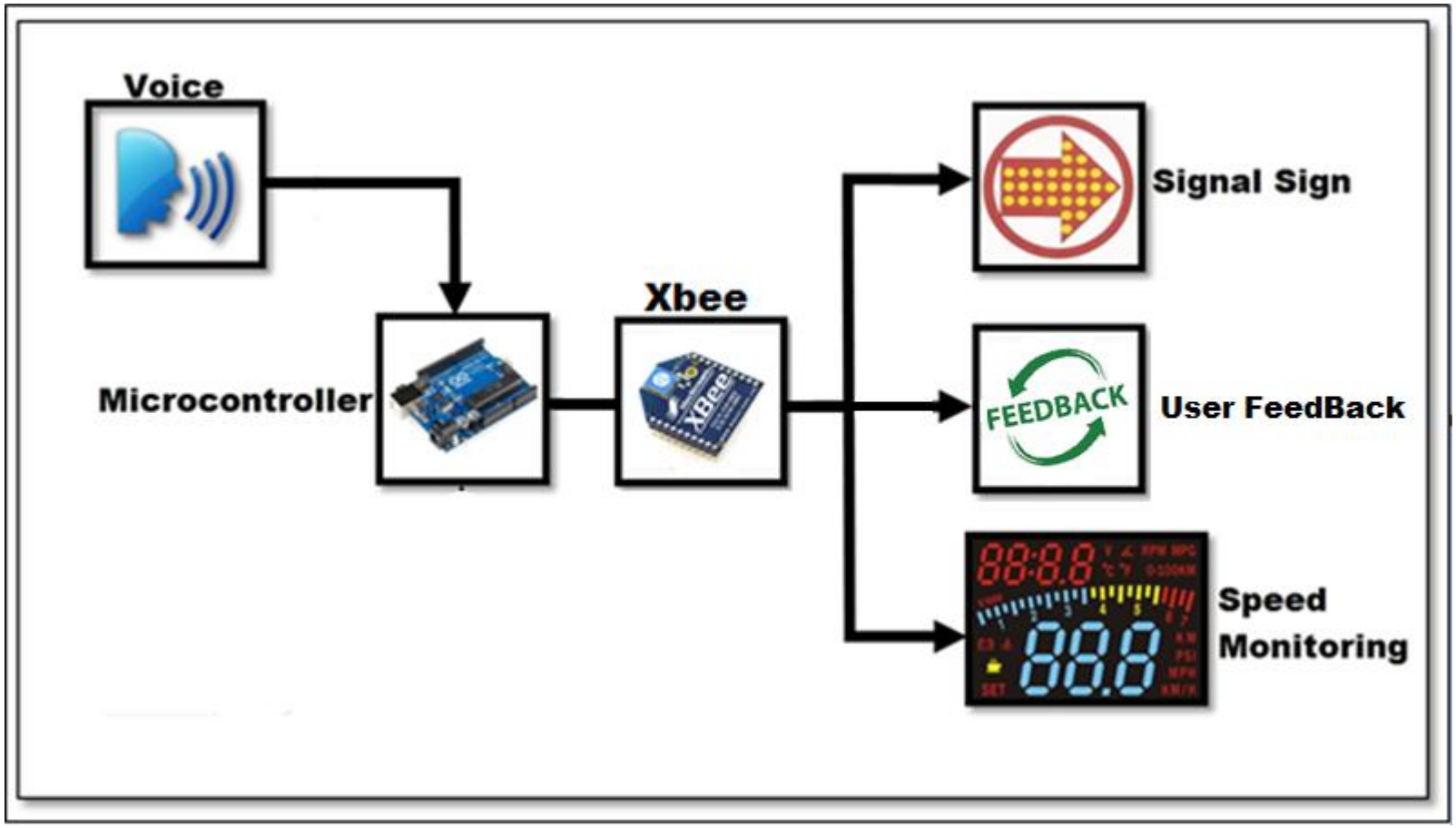

Design

LED Display Panel (Hardware)

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Direction Part

RGB LED Matrix 6*6cm

Colorduino V1.3

Braking Light Part

ADXL 335 Accelerometer

Super Red LED (Braking Light)

LED Display Panel (Firmware)

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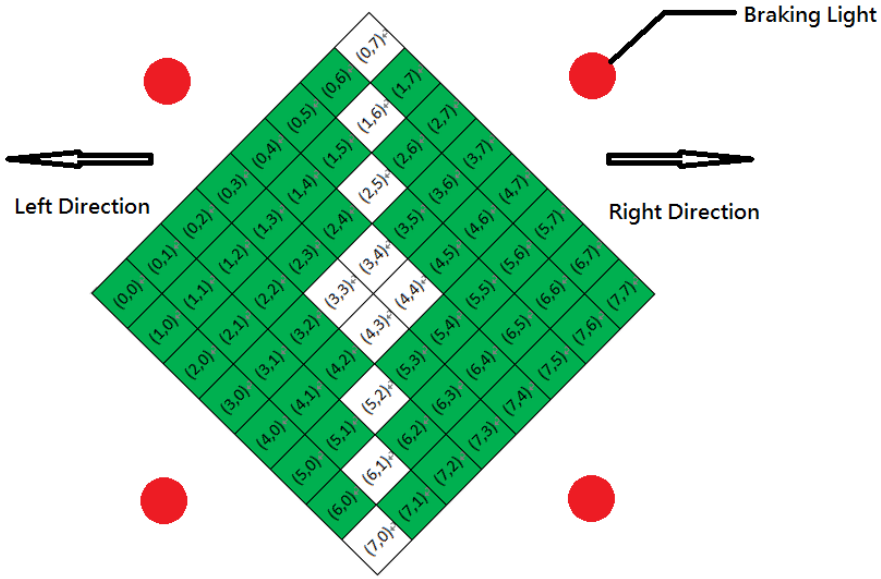
Firmware

- **Colorduino Library**
- **The algorithm of sensing the deceleration of the bike.**



Wireless Communication

- Xbee S2 2mW Zigbee
- X – CTU (Configuration)
- BoardCast Mode

Voice Control
(Coordinator)

Front LED Feedback
(Rounter1)

Back LED Display Panel
(Rounter2)

Feedback Display Box

Feedback display LED array

- MUX (MAX7219)
- LedControlMS Library
- RED LED Matrix 2.5*2.5cm

(0,7)	(1,7)	(2,7)	(3,7)	(4,7)	(5,7)	(6,7)	(7,7)
(0,6)	(1,6)	(2,6)	(3,6)	(4,6)	(5,6)	(6,6)	(7,6)
(0,5)	(1,5)	(2,5)	(3,5)	(4,5)	(5,5)	(6,5)	(7,5)
(0,4)	(1,4)	(2,4)	(3,4)	(4,4)	(5,4)	(6,4)	(7,4)
(0,3)	(1,3)	(2,3)	(3,3)	(4,3)	(5,3)	(6,3)	(7,3)
(0,2)	(1,2)	(2,2)	(3,2)	(4,2)	(5,2)	(6,2)	(7,2)
(0,1)	(1,1)	(2,1)	(3,1)	(4,1)	(5,1)	(6,1)	(7,1)
(0,0)	(1,0)	(2,0)	(3,0)	(4,0)	(5,0)	(6,0)	(7,0)

Left Feedback

(0,7)	(1,7)	(2,7)	(3,7)	(4,7)	(5,7)	(6,7)	(7,7)
(0,6)	(1,6)	(2,6)	(3,6)	(4,6)	(5,6)	(6,6)	(7,6)
(0,5)	(1,5)	(2,5)	(3,5)	(4,5)	(5,5)	(6,5)	(7,5)
(0,4)	(1,4)	(2,4)	(3,4)	(4,4)	(5,4)	(6,4)	(7,4)
(0,3)	(1,3)	(2,3)	(3,3)	(4,3)	(5,3)	(6,3)	(7,3)
(0,2)	(1,2)	(2,2)	(3,2)	(4,2)	(5,2)	(6,2)	(7,2)
(0,1)	(1,1)	(2,1)	(3,1)	(4,1)	(5,1)	(6,1)	(7,1)
(0,0)	(1,0)	(2,0)	(3,0)	(4,0)	(5,0)	(6,0)	(7,0)

Right Feedback

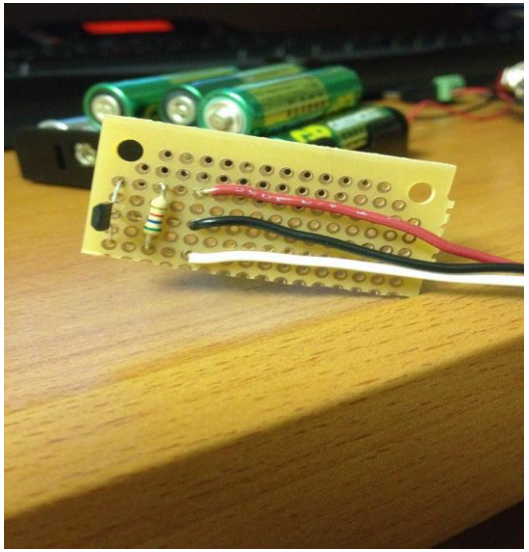
Speedometer

Original plan: 4 digit - 7 segment LED display (discard - used too many pins)

Final decision: 16x2 LCD display with blue backlight (significantly reduced pin usage)

Hall Effect Switch

- Attaching a magnet to the wheel, switch closes every time it passes the Hall effect sensor.



(Speedometer equation)

wheelCircumference = π * wheelDiameter

Speed = wheelCircumference / timePerCycle

(Odometer equation)

Distance = rolation * wheelCircumference

Speedometer

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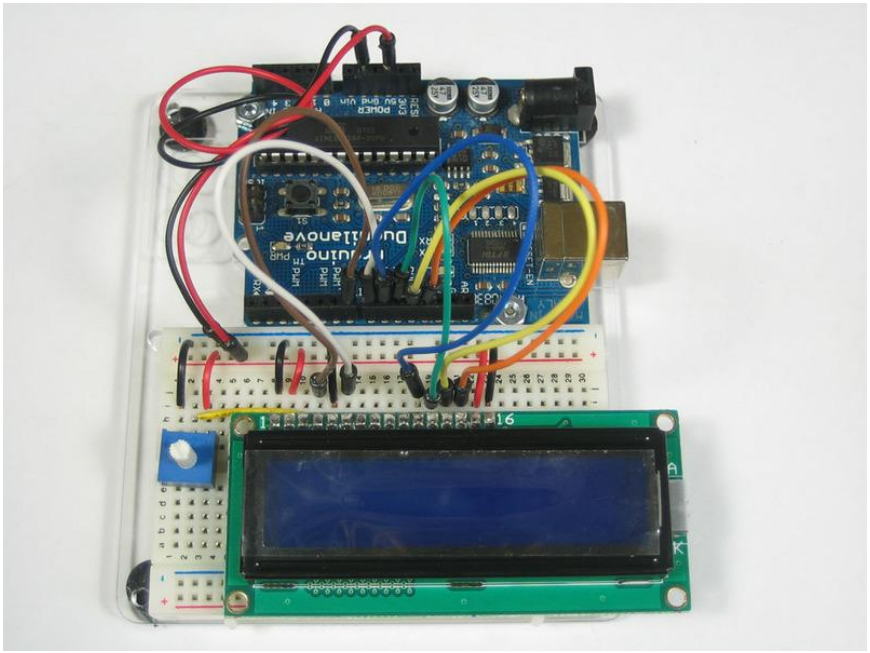
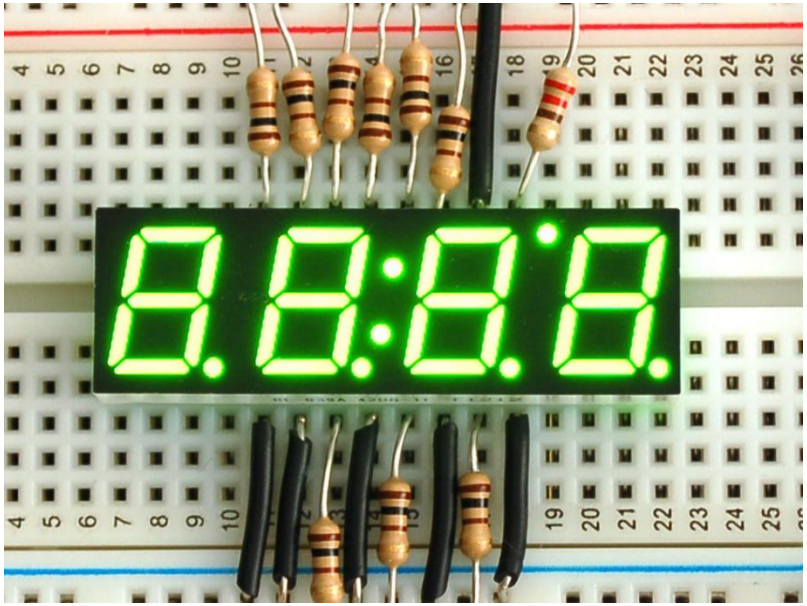


- Only 8 pins are used on the Arduino
- Pin usage gone down from 16 to 8
- Simplified coding complexity (Library with LCD functions already exist in Arduino IDE)



Battery + Charger

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Rechargeable Lithium Polymer battery:

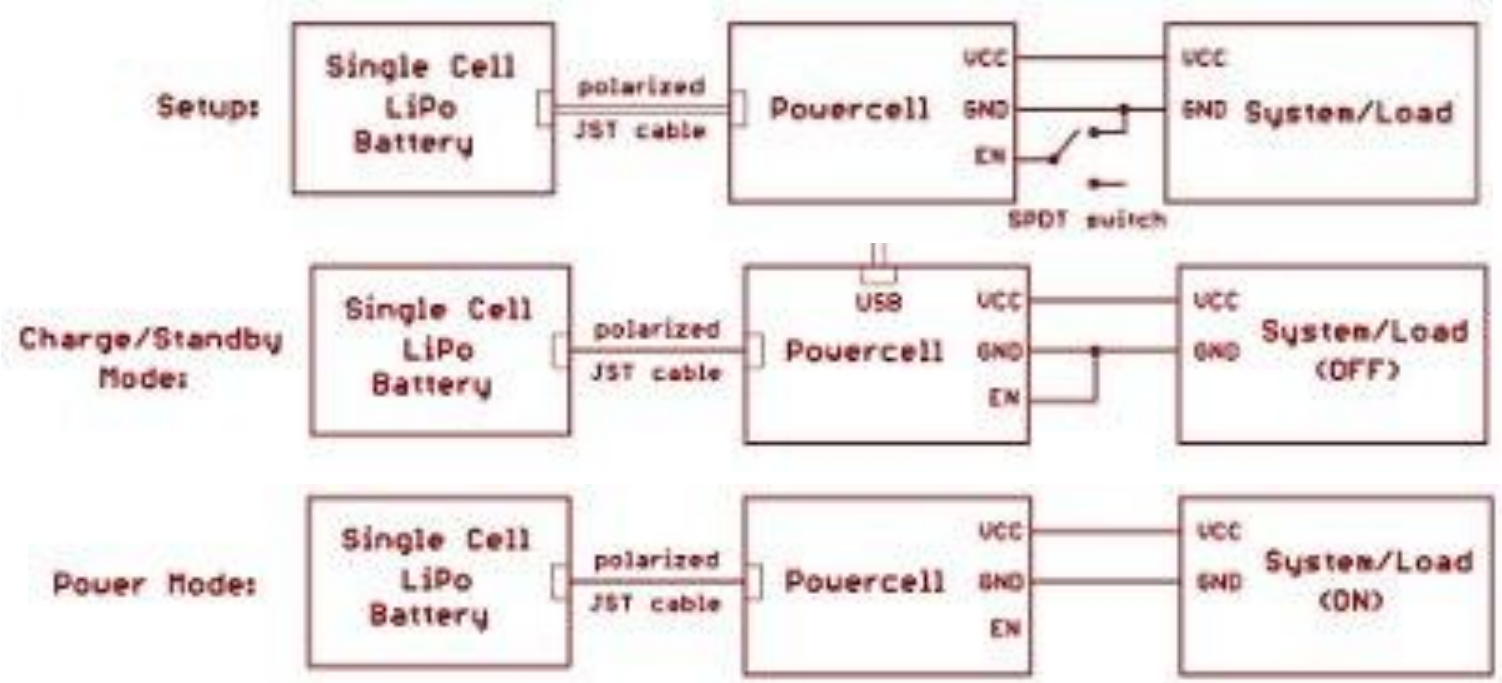
- 3.7V
- 2000mAh
- Standard JST connecter

Battery + Charger

The Powercell – Lipo. Battery Charger/Boost

- Boost or buck a 3.7V Lipo battery to 5V or 3.3V
- Charge Lipo Battery via micro-USB

Charger Circuit



In summary:
- EN is high (not grounded) -> Powercell is ON
- EN is low(grounded) -> Powercell is OFF

Voice Recognition

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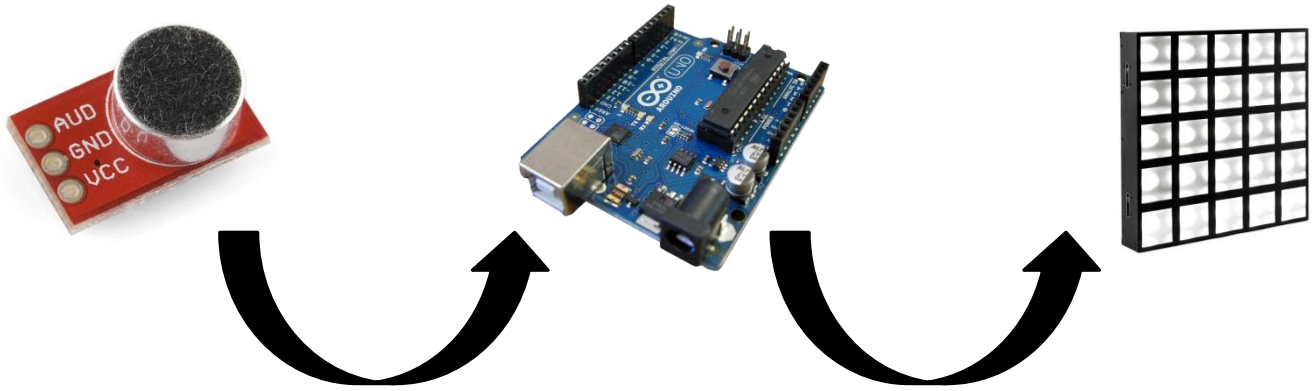
- Arduino Uno
- uSpeech library



Voice Recognition

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- Phoneme

Phoneme	Literal
e	The ‘e’ sound.
h	The ‘/sh/” sound.
v	The ‘v’ sound
f	The ‘f’ sound.
s	The ‘s’ sound.
o	‘a’,’o’,’I’,’r’,’l’,’m’,’n’ and ‘u’ sounds.
‘ ‘	No sound.

Voice Recognition

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```
//Calibrate these values
voice.minVolume = 1500;
voice.fconstant = 400;
voice.econstant = 1;
voice.aconstant = 2;
voice.vconstant = 3;
voice.shconstant = 4;
voice.calibrate();
Serial.begin(9600);
```

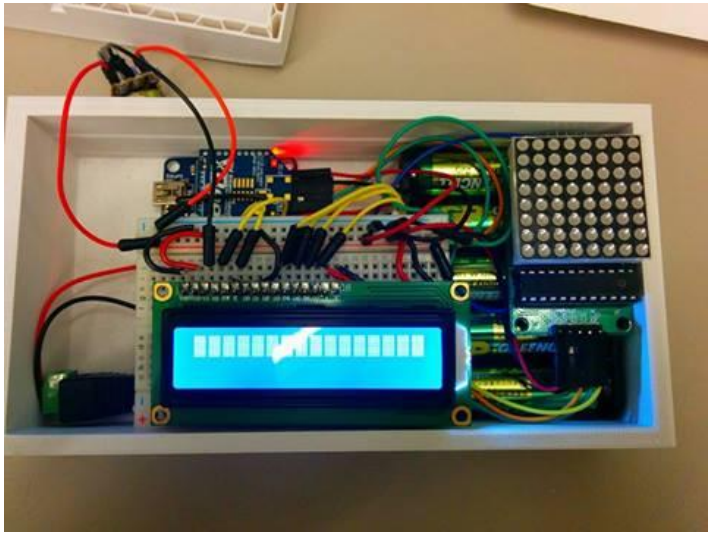
Packaging

3D Printer
MakerBot Replicator 2X model

Material: ABS Plastic (Arylonitrile-butadiene-styrene copolymer)
CAD software: SketchUp

3D printer design of Feedback Display

Open Box of Feedback Display



Dimension of our Packages

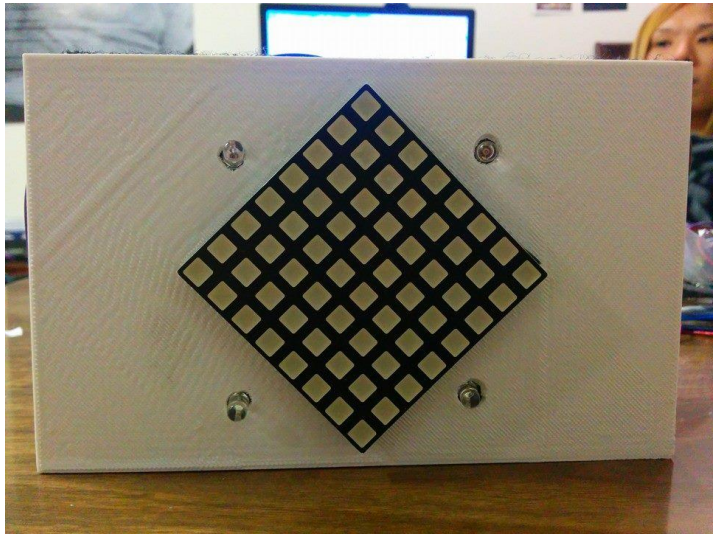
Voice Recognition:

3.5X9X6.5 cm

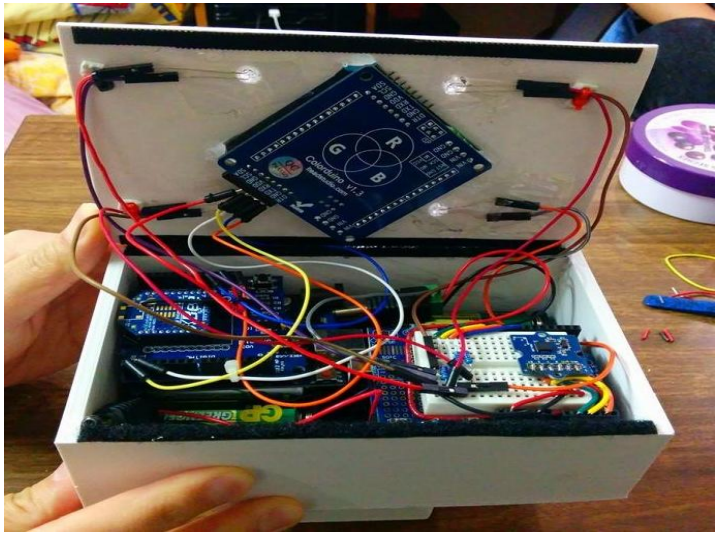
Feedback Display:

3.5X17X9 cm

3D printer design of LED Light



Open Box of LED Light



Dimension of our Packages

LED:

5X16X10 cm

Budget and Scheduling

Budget

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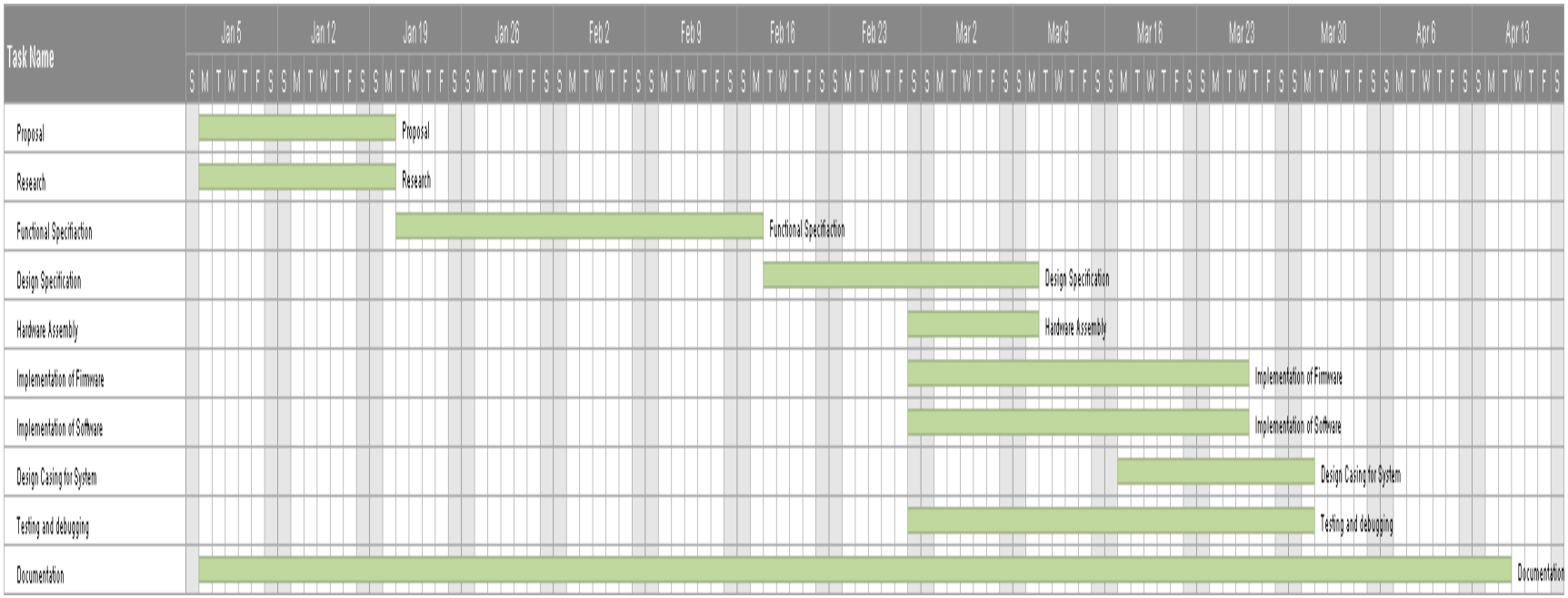
Equipment List	Estimated Cost (CAD)
Arduino Uno *2	$80
RGB LED Matrix 60mm *2	$60
Red/Green LED Matrix 60mm	$10
Red/Green LED Matrix 20mm	$5
Sensor (Speed)	$16
Sensor (Slope)	$20
Sensor (Heartrate)	$30
Breadboards	$30
Bicycle glove	$30
Xbee wireless sender	$30
Xbee wireless receiver *2	$50
Accelerometer 3 AXIS ANAG	$16.8
Slice switch DPDT OFF 1A	$1.45
Pocker DPDT 15A ON-OFF-ON	$12.67
Battery	$50
Microphone	$11.5
Helmet	$30
Bicycle	$120
Handlebar mount	$10
Model material	$30
Jumpers	$20
Voice Recognition Shield	$70
Total	$733.42

Equipment List	Estimated Cost (CAD)
RGE LED Matrix 60mm *2	$60
Red LED Matrix with MUX	$20
Hall effect sensor	$2
3.7V 2000 mAh battery	$22
Heat string	$1.50
Bicycle	$100
7 segment	$5
Xbee	$30
USB charger with voltage booster	$22
Helmet	$15
Triple axis ADXL accelerometer 335	$20
Voice shield	$70
AA battery *16	$8
AA battery holder *3	$10
Super red LED *5	$10
Power adaptor*3	$6
Velcro (120cm*5cm)	$12
9V battery *2	$3
9V battery holder	$1
Total	$418
ESSEF funding	$300
Exceeded cost	$118

Scheduling


Task Name
Jan 5
Jan 12
Jan 19
Jan 26
Feb 2
Feb 9
Feb 16
Feb 23
Mar 2
Mar 9
Mar 16
Mar 23
Mar 30
Apr 6
Apr 13
1 Proposal
2 Research
3 Functional Specification
4 Design Specification
5 Hardware Assembly
6 Implementation of Firmware
7 Implementation of Software
8 Design Casing for System
9 Testing and debugging
10 Documentation

Future Work

- Improvements
  - More accurate voice recognition
  - Have all signal lights on the same LED panel
  - Improve overall feel of the product
- Additional Features
  - Calories counter
  - Heart rate detector
  - Ability to share on social network (e.g.: Facebook, Twitter)

Acknowledgement

- Andrew Rawicz
- Steve Whitmore
- TAs
- Dr. Bonnie Gray- Micro Instrumentation Lab

Questions?