

Bioelectric Smartwatch



Group 1

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EE

EE

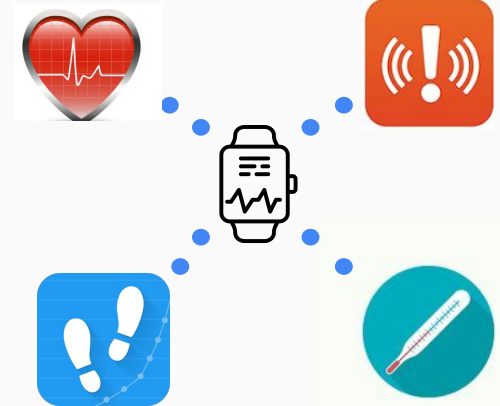
Motivation

- Integrating lifestyle improving characteristics and emergency GPS system
- Assist elderly and people with **chronic** illnesses maintain a healthy lifestyle
- Market Audience:
 - Elderly
 - General public



Goals and Objectives

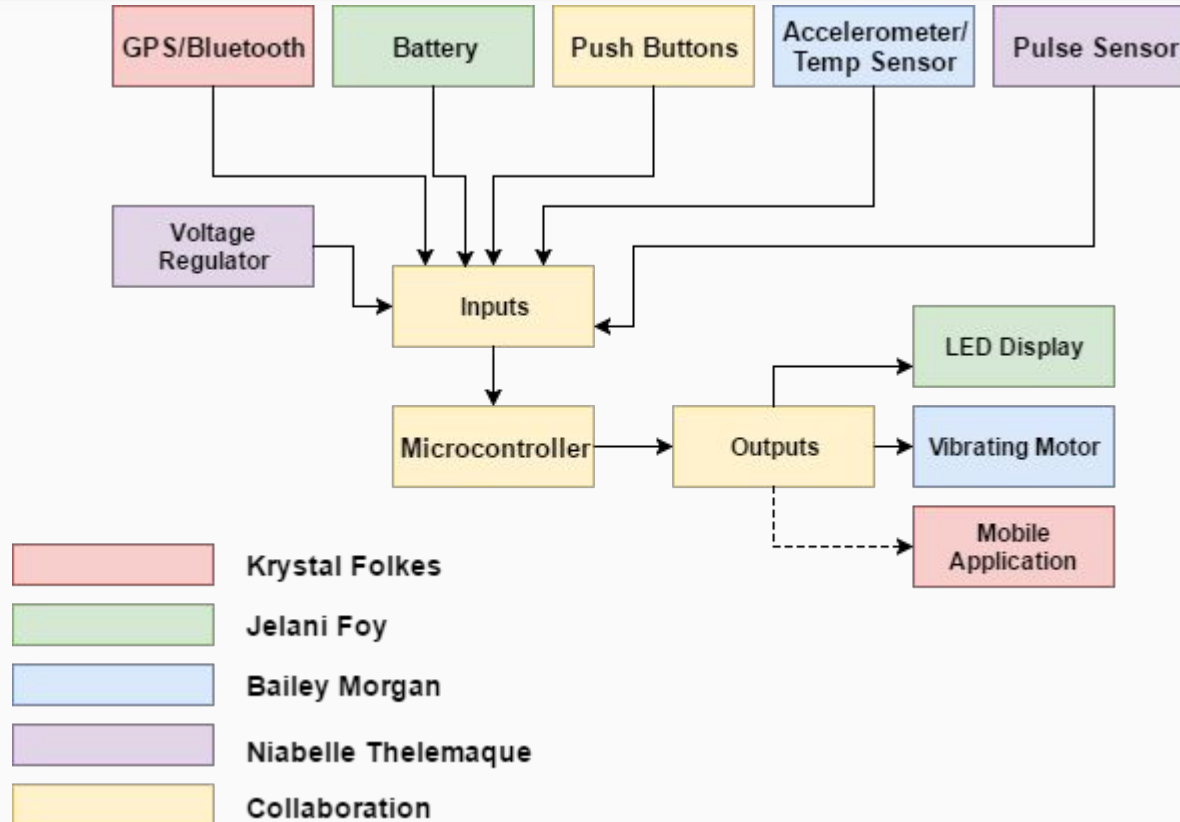
- Bioelectric Smartwatch will measure:
 - Pulse
 - Steps taken
 - Skin temperature
 - Also features emergency beacon
- A mobile web application
 - Saves activity progress
 - Send alerts and notifications to authorized personnel



Specifications

| Component | Parameters | Design Specification |
|---------------|-----------------------|----------------------|
| Battery | Charge/Discharge Time | 2hrs/12hrs |
| GPS receiver | Accuracy | 3m |
| Bluetooth | Range | 5m |
| Pulse | Accuracy | +/-3 bpm |
| Temperature | Accuracy | +/- 1 °F |
| Accelerometer | Accuracy | +/- .1g |

Overall Block Diagram



Components

Microcontroller- ATmega 168

Purpose: Synchronizes all of the peripherals and performs computations

- Raspberry PI used for prototyping
 - Broadcom BCM2835
- ATmega168 for final design
 - Easier to obtain than Broadcom
 - 28 Pins Total

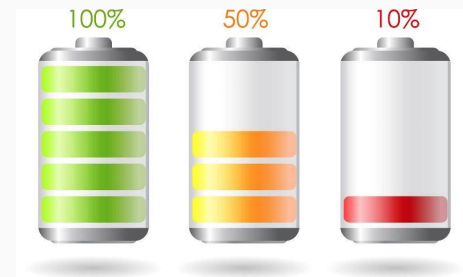
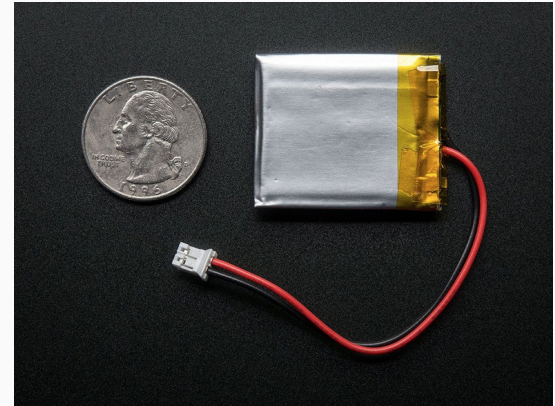


| Specs | |
|---------------------------|----------------|
| Number of I/O Pins | 14 |
| Operating Voltage | 1.8-5.5V |
| Communication Peripherals | SPI, I2C, UART |

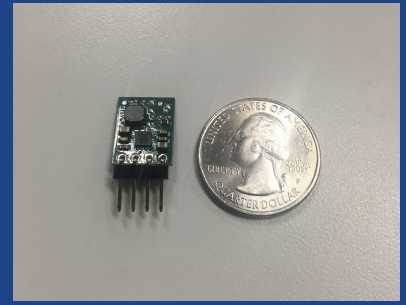
Lithium-Ion Battery

Purpose: Supply power to the smartwatch

- Benefits: Thin, Light and Powerful
- Voltage: Output ranges from 3.2V to 4.2V
- Battery Capacity: Capacity of 500mAh
- Dimensions: 1.15" x 1.4" x 0.19"
- Weight: 10.5g



Voltage Regulator-U1V11F3



Purpose: Provides voltage for all peripherals

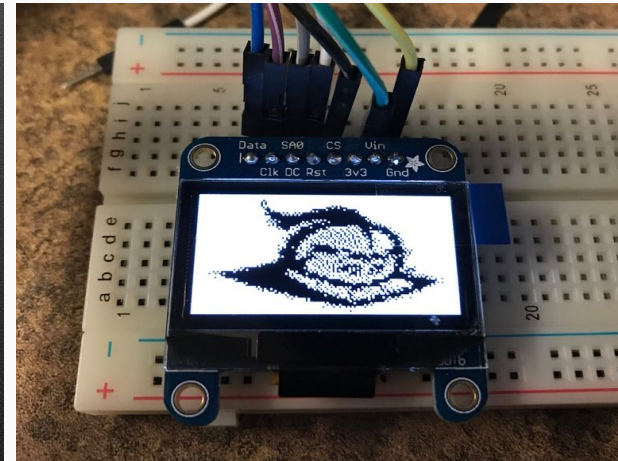
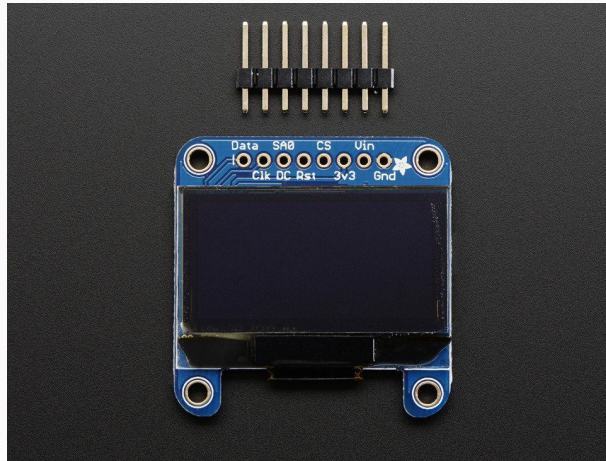
- Microcontrollers and all peripherals require a constant input of 3.3 Volts
- Input Voltage Range: 0.5-5.5V

| Cases | Voltage Supply | Input Voltage | Output Voltage |
|-------|----------------|---------------|----------------|
| 1 | 1.02 | 1.02048 | 3.32781 |
| 2 | 2 | 2.04 | 3.32832 |
| 3 | 3 | 2.96 | 3.32714 |
| 4 | 4 | 4.01 | 3.33810 |

OLED Display

Purpose: Exhibits various outputs of the device

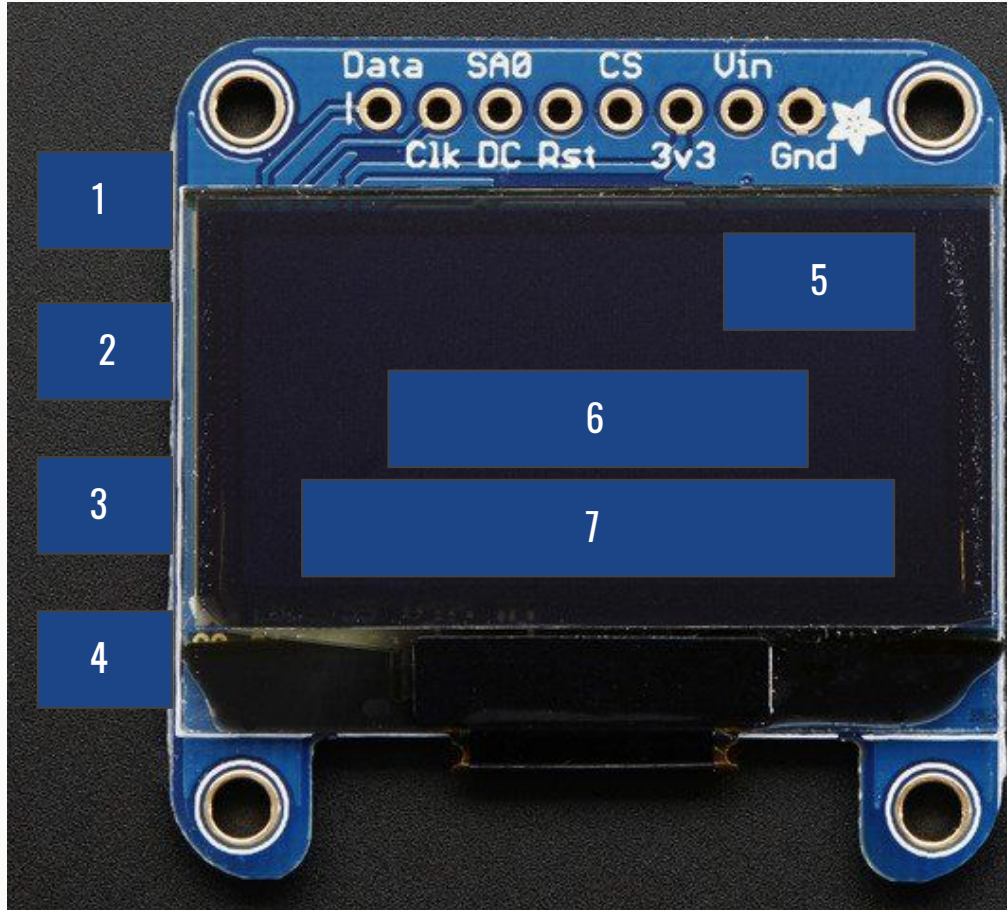
- About 1.3" diagonal
- Easily readable due high contrast
- Uses about 40mA on average



Home Screen Layout

Table

| | |
|----|---------------|
| 1) | Button #1 |
| 2) | Button #2 |
| 3) | Button #3 |
| 4) | Button #4 |
| 5) | Battery Gauge |
| 6) | Time |
| 7) | Day / Date |



Button Functionality

Button #1: Power / Sleep

Once the button has been pressed and held down for three seconds, the OLED screen will turn on or off
If the button is pressed one, the OLED will turn on to briefly display the default screen

Button #2: Scroll

Used to display to scroll through functions menu

Button #3: Select

Used to choose function from menu. After a certain period of time, the OLED screen will turn off

Button #4: Emergency

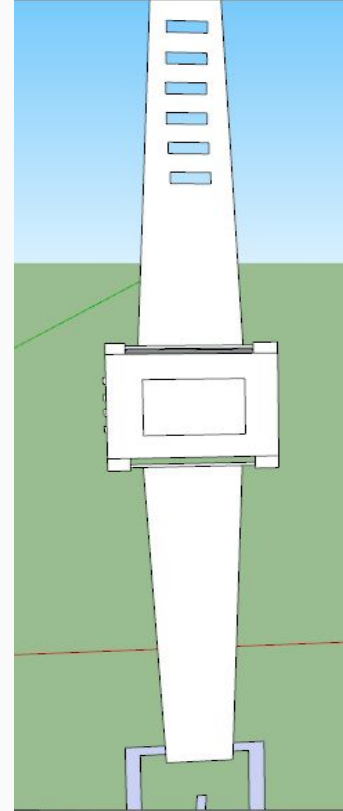
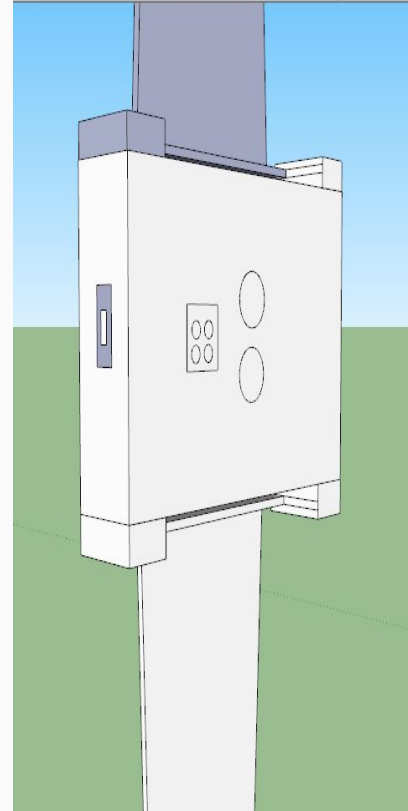
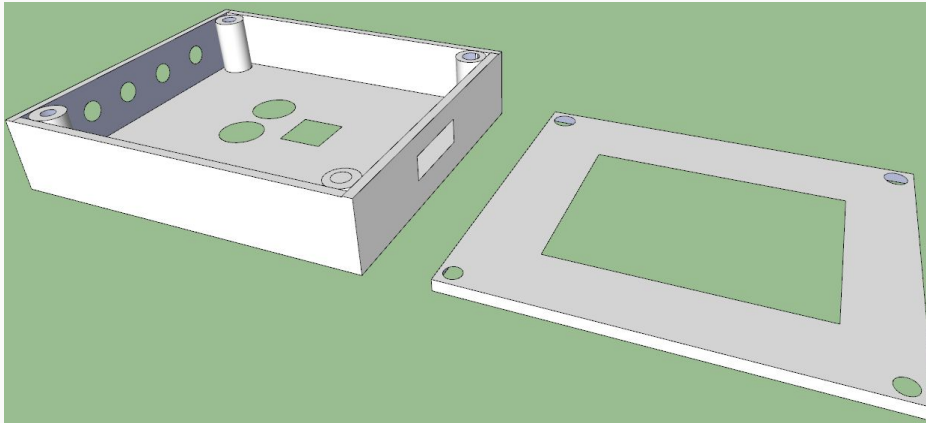
When pressed three times in rapid succession, emergency system that will send the user's location information to assigned/ authorized personnel



Watch Casing

Material: 3D printed watch case

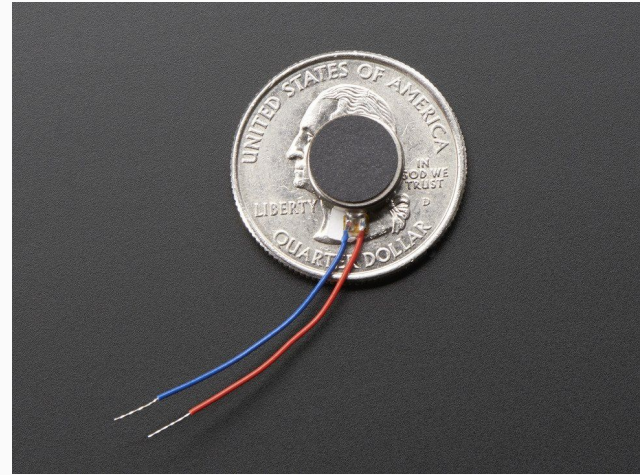
- Holes on bottom of case
 - Direct contact with skin- Pulse and Temperature Sensors
- Holes for USB and buttons
- Comfortable strap



Notification System

Purpose: Vibrates to alert the user

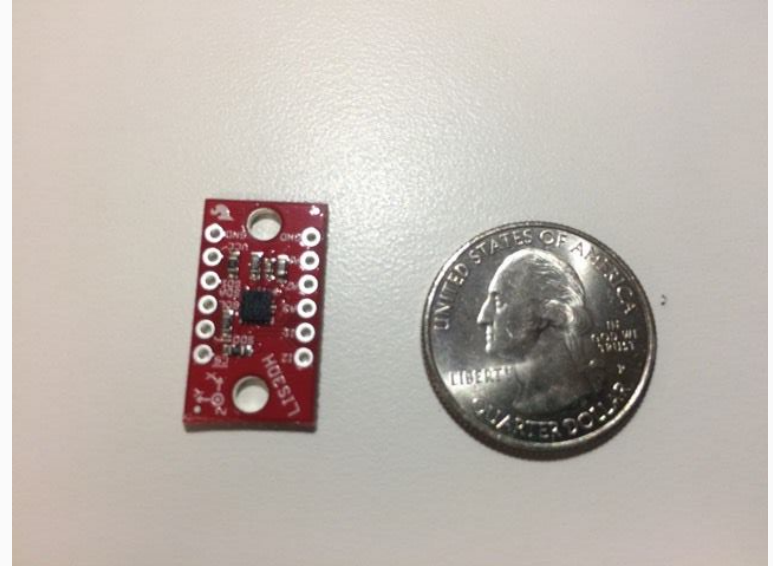
- Operating Voltage: 3.5V
- Vibrates when watch turns on
- Vibrates for target heart rate
- Vibrates at another frequency when emergency beacon is activated



Accelerometer and Temperature - LIS3DH

Purpose: Count user's steps, track if user is active, and measure body temperature

- 3-axis measurements to provide to detect user's arm swing, and whether they are standing or sitting
- 3 Different power modes help conserve battery
- Embedded temperature sensor to measure user's temperature



Pulse Sensor- SEN0203

Purpose: Measures the user's pulse periodically

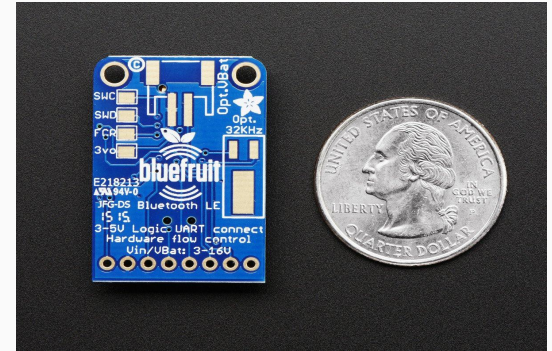
- Dimensions: 28 x 24mm
- Placed directly on user's wrist
- Pulse Oximetry technique
 - Sensor illuminates the skin and measures changes in light absorption



Bluetooth - Bluefruit LE UART

Purpose: Sends and transmits data information from the watch to the mobile application

- Enables connectivity between microcontroller and mobile phone via Standard Nordic UART RX/TX
- Low Energy
- SAFER+ Encryption





Mobile Application

IOS vs Android

Software Environment



- Communicate through the cloud to an iOS and Android apps to control Arduino, Raspberry Pi and other microcontroller like devices
- Open Source / Free
- IOT Capabilities
- Language -Java

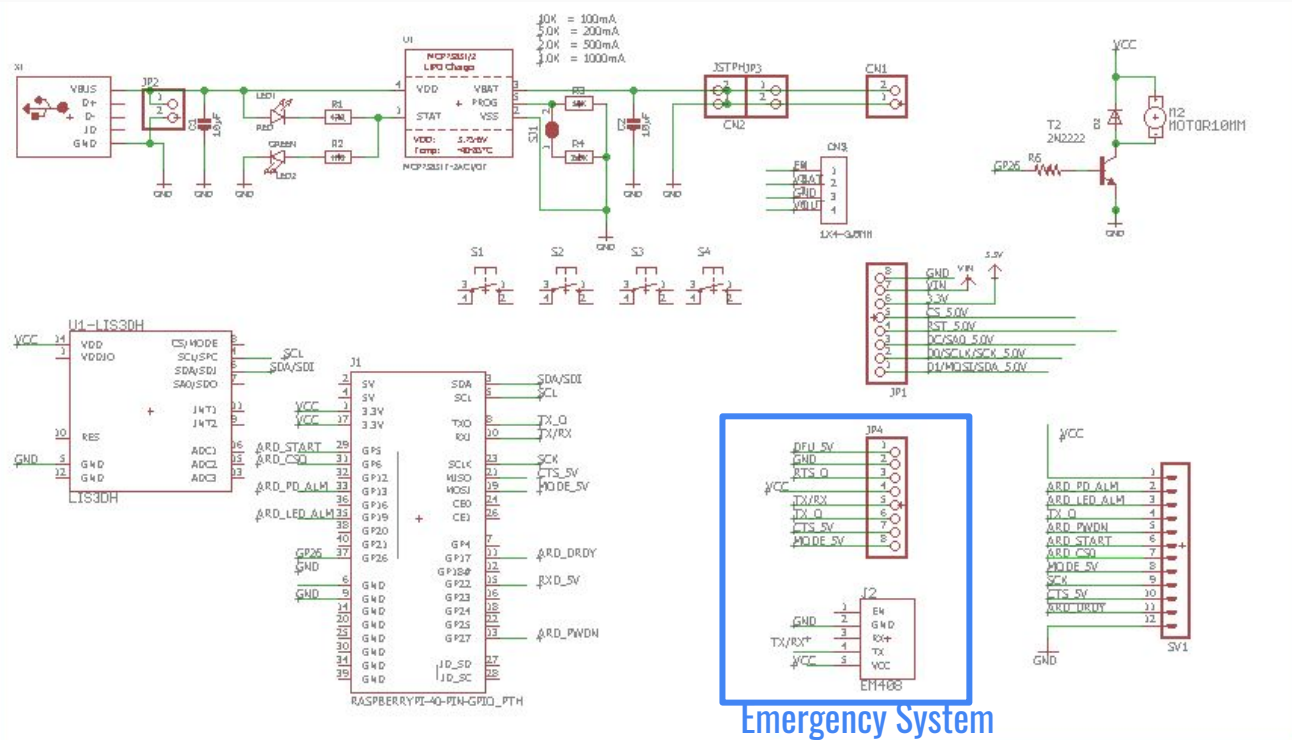


- Used to create web to mobile native cross platform
- Open Source / Free
- Cross Platform IOS / Android
- Well Documented
- Language - Node.js, Angular.js, HTML, CSS



- Created for similar mobile functionality and have nice sleek look on for the users to look at data
- Language - HTML, CSS, Node.js, Angular.js

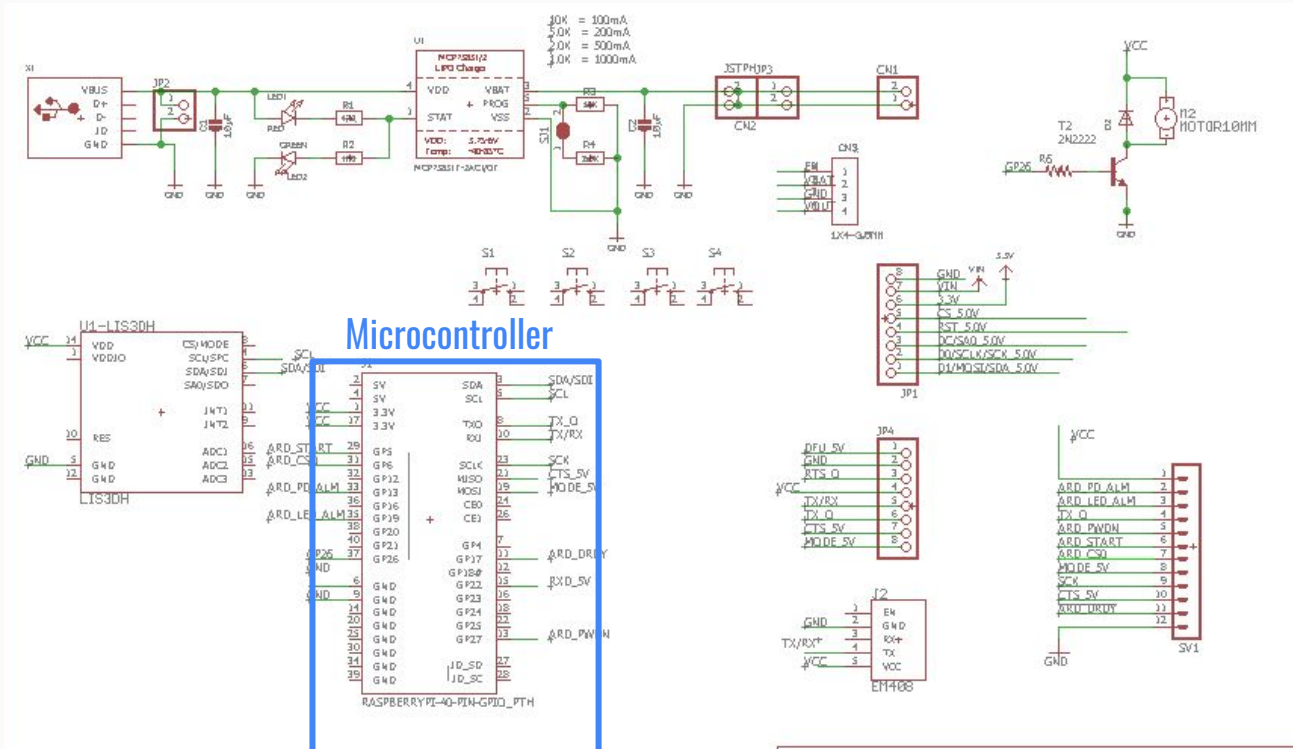
Schematic Diagram



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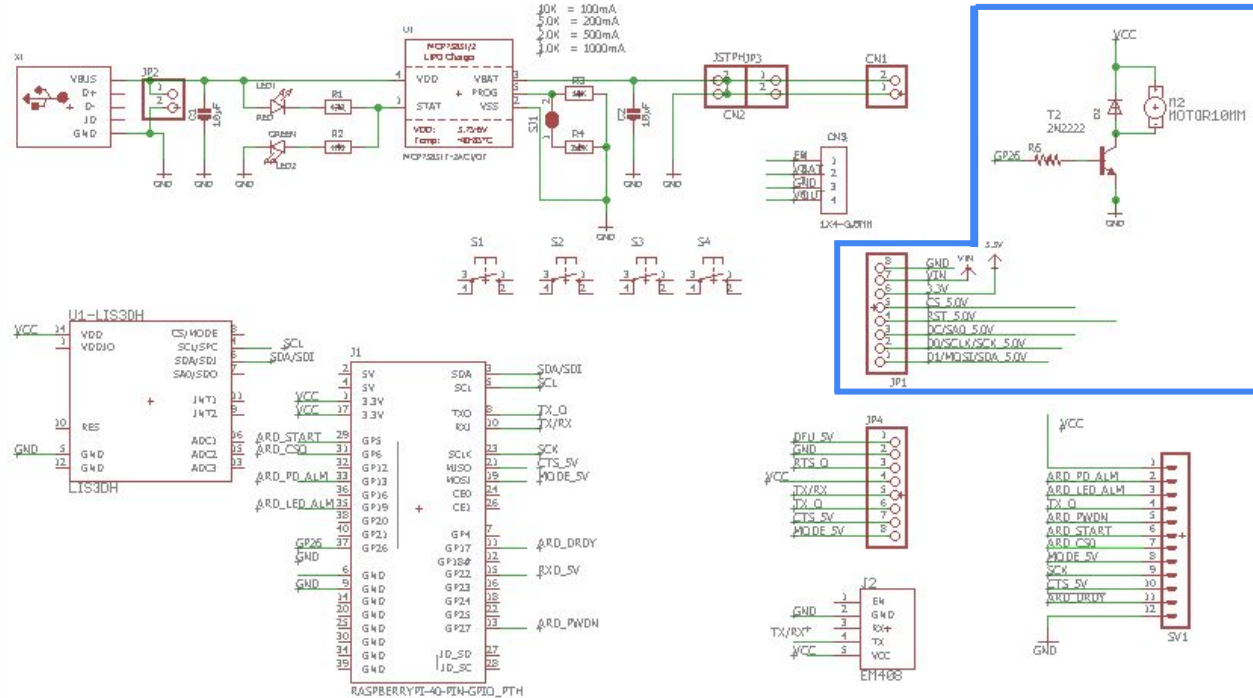
Schematic Diagram



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Schematic Diagram

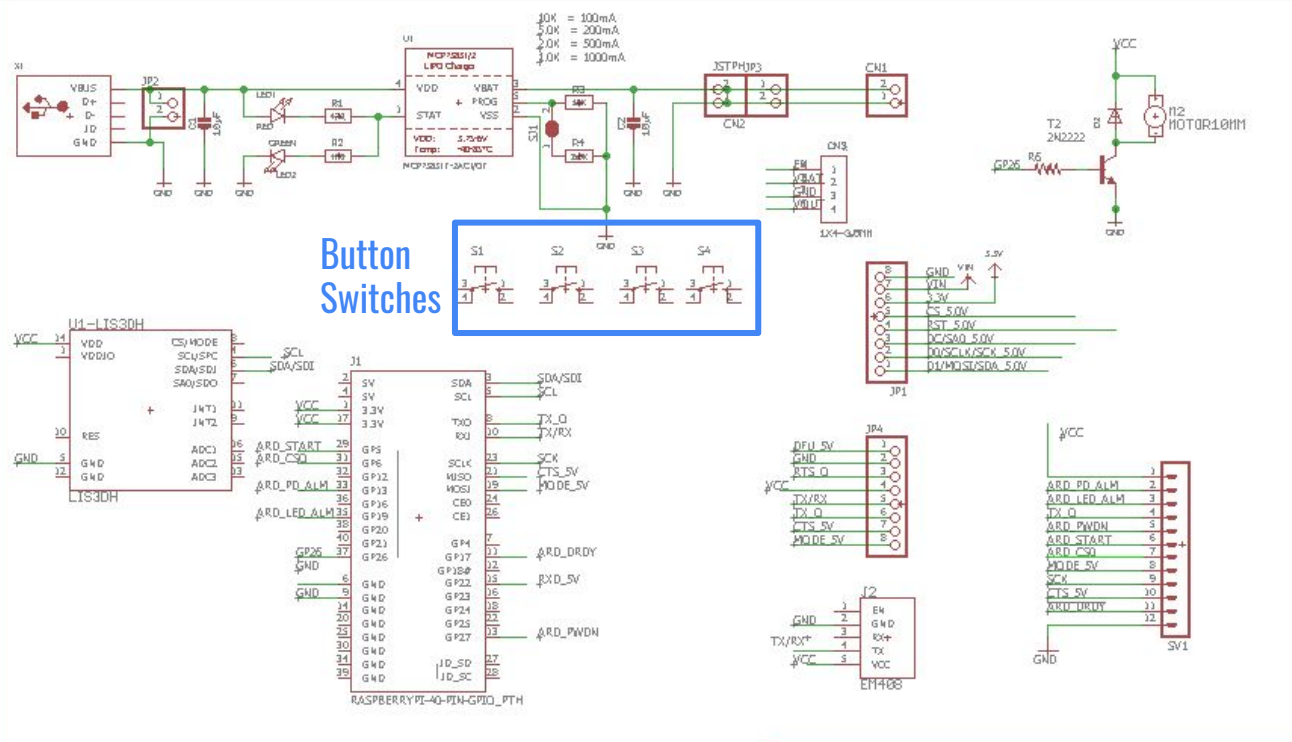


Display and Notification System

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TITLE: First_Schematic

Schematic Diagram



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Administrative Content

Work Distribution

| Legend | |
|----------|-----------|
| X | Primary |
| 0 | Secondary |

| Name | Power System | Display/ Notification | PCB Design | Pulse Sensor | Accelerometer | Temp. Sensor | Mobile Application | Emergency System |
|----------|--------------|-----------------------|------------|--------------|---------------|--------------|--------------------|------------------|
| Bailey | 0 | | | 0 | X | X | | |
| Jelani | X | X | 0 | | | | 0 | |
| Krystal | | | | | 0 | 0 | X | X |
| Niabelle | | 0 | X | X | | | | 0 |

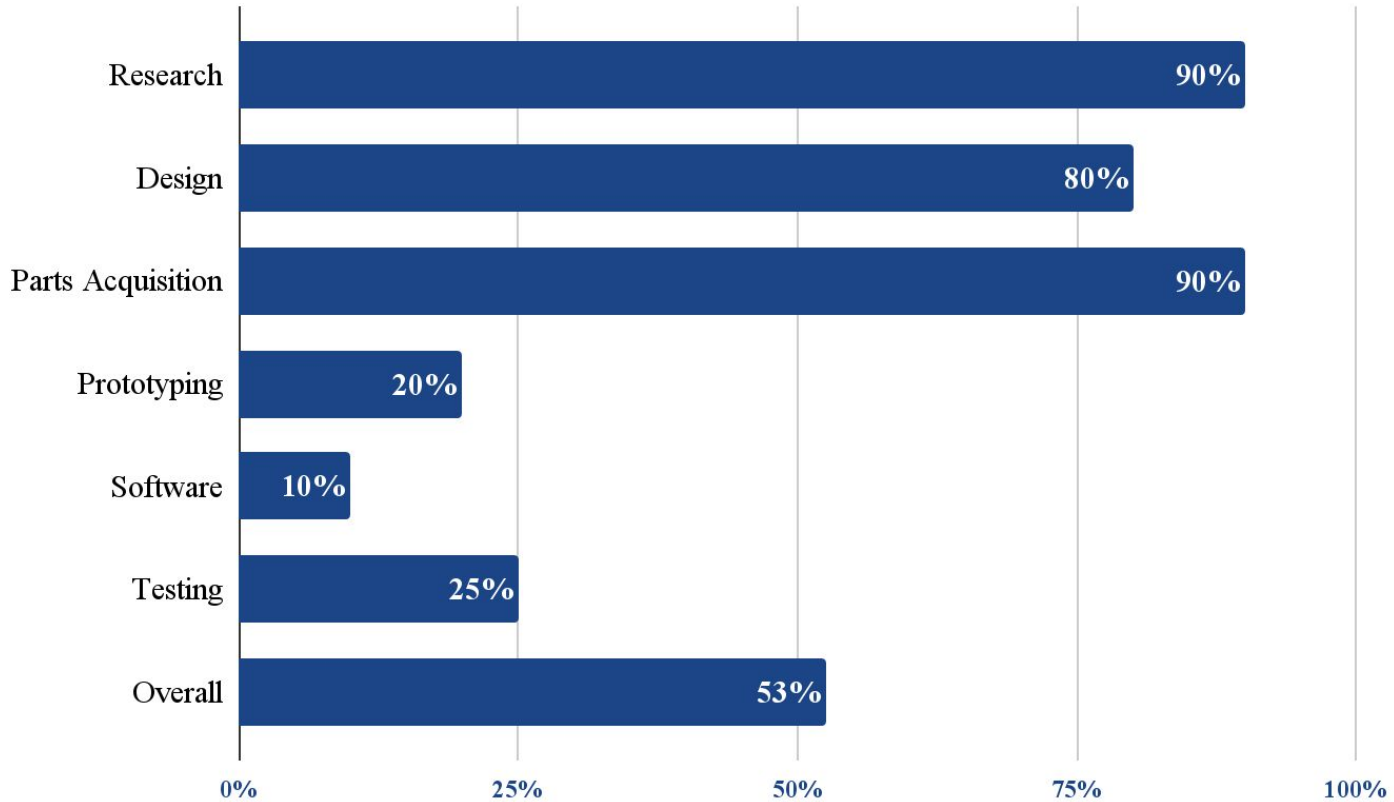
Budget and Financing

| Item | Supplier | Price/Unit | Unit | Total |
|---------------------|----------|------------|------|---------|
| Accelerometer | Sparkfun | \$4.95 | 1 | \$4.95 |
| OLED Display | Adafruit | \$19.95 | 1 | \$19.95 |
| Motor Disc | Adafruit | \$1.95 | 1 | \$1.95 |
| Pulse Monitor | DFRobot | \$16.00 | 1 | \$16.00 |
| Lithium Ion Battery | Adafruit | \$7.95 | 1 | \$15.90 |
| Voltage Regulator | Pololu | \$4.95 | 1 | \$4.95 |
| Button Switch | Adafruit | \$0.27 | 4 | \$2.50 |
| Battery Charger | Adafruit | \$6.95 | 1 | \$6.95 |
| GPS Receiver | Sparkfun | \$15.95 | 1 | \$15.95 |
| Bluefruit LE UART | Adafruit | \$17.50 | 1 | \$17.50 |
| PCB | PCB Way | \$22.00 | 1 | \$22.00 |

| | |
|--------------|-----------------|
| Total | \$128.60 |
|--------------|-----------------|

| | |
|----------------------|-----------------|
| Overall Total | \$194.10 |
|----------------------|-----------------|

Current Progress



Design Issues/Concerns

- Size of the completed device based on the total amount of functions that the PCB has to carry out
- Power Consumption: Microcontroller and OLED display will draw demand the most power
- Coordinating different communication protocols
- Wireless communication



Immediate Plans to Success

- Meeting more frequently
- Setting deadlines
- Holding each other accountable



Questions/Comments?

thank
you!