AlarmBand

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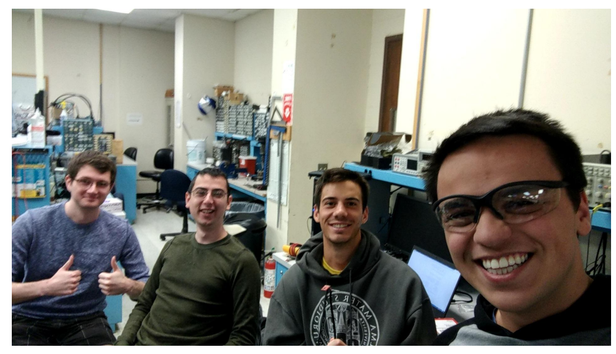
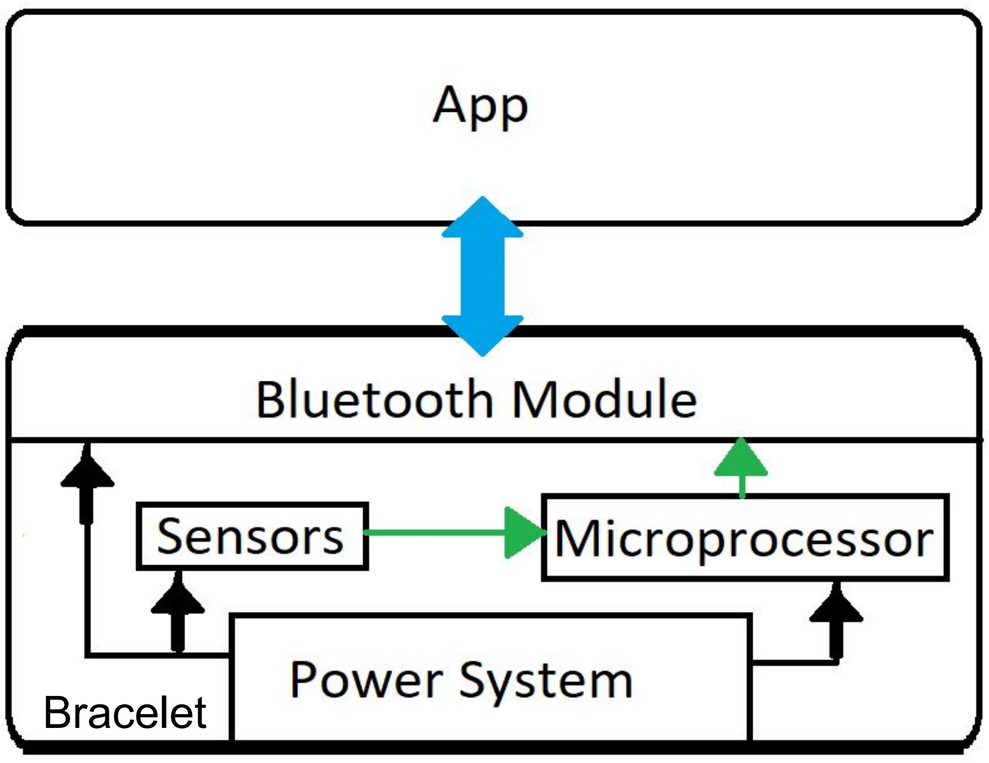


Abstract

Many individuals worry about personal safety in uncomfortable situations, like walking alone at night or through unfamiliar areas. If these people had access to a subtle silent-alarm they could use to quickly, discreetly, and reliably contact either the police or an emergency contact, they will feel more secure. AlarmBand seeks to remedy this by combining a 6-DOF sensor with signal processing software packaged in a bracelet to detect when the user makes a specific motion in order to issue an alert SMS sent to an emergency contact via an Android application running on the user's phone.

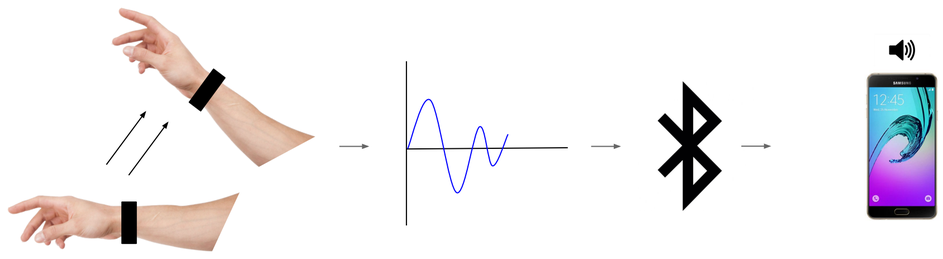
Block Diagram



Specifications

Specification	Target	Result
Need to detect only desired motion	MCC score of at least 0.9	MCC = .9868
Want system to be discrete	System should fit in a bracelet	System fits in a large bracelet
Bracelet should work in relative proximity of phone	Wireless communication distance of at least 10m	Distance =
Bracelet should last a long time before needing to be charged	Minimum battery life of 12 hours	Minimum Battery Life = 40 hours

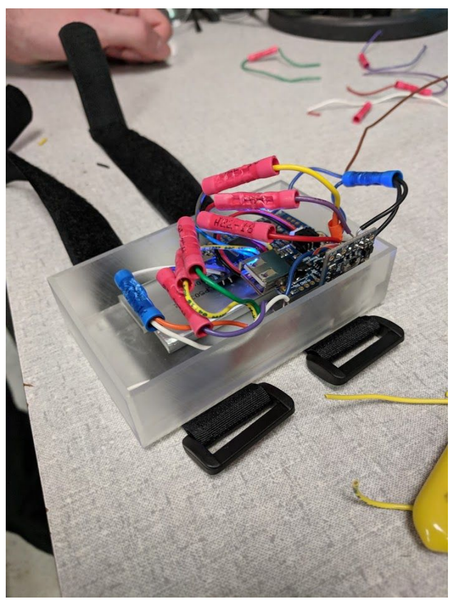
System Overview



- Desired motion stored as internal array of accelerometer/gyroscope data over time
- User opens phone app, automatically connects with bracelet
- User makes desired motion:
  a. Live motion data compared to internal array
  b. If comparison satisfies internal threshold, detect the motion
  c. App sends SMS to phone number specified by the user requesting assistance

Results

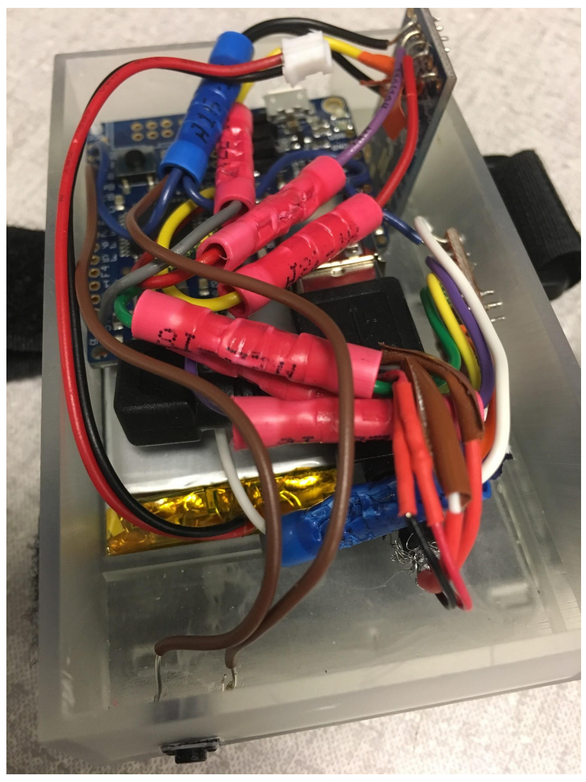
AlarmBand is a completed system which accurately and quickly detects a predetermined discrete arm motion. It is programmed to sample data 50 times per second and analyse the data in real time. The algorithm used for detecting this motion is rated with a .9868 MCC score. The low energy bluetooth functionality works within our target range and its measured and maximum power draw of 20mA and 30mA respectively allows for much longer battery life than our target minimum. The battery will last 60 Hours in normal use and 40 Hours in its worst case scenario.



Acknowledgement

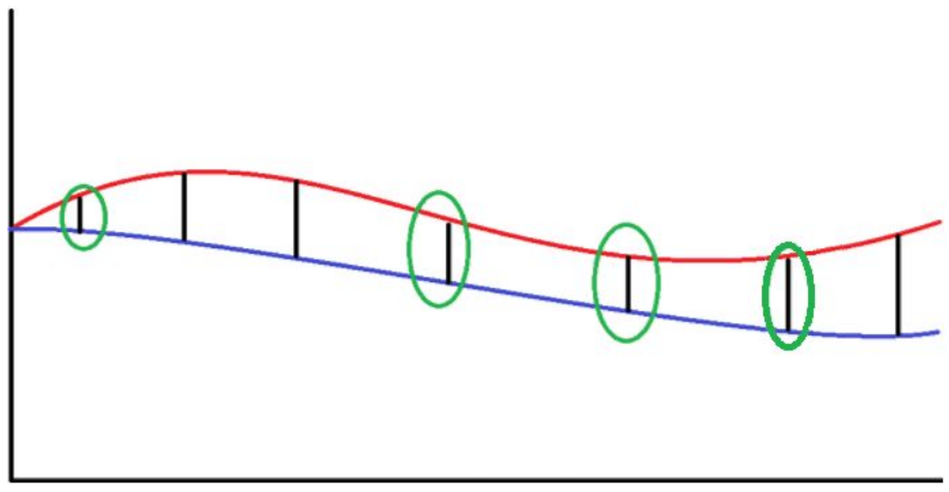
We would like to thank our adviser, Professor Irwin. We would also like to thank our evaluators, Professor Siqueira and Professor Xia. Additional thanks to the SDP advisers, Professor Hollot and Professor Soules, as well as to Francis Caron.

Bracelet



- Microprocessor: Atmega32u4
- Sensor: MPU-6050 (6-DOF)
- Bluetooth: Bluefruit LE UART Friend
- Battery: 1200 mAh LiPo
  - 0.5 C rating = 600 mA
  - Charger: Adafruit Powerboost 500C
- Enclosure: 3D printed
  - Printer: FormLabs 2 stereolithographic printer, clear resin
  - Design: AutoCAD Fusion 360

Algorithm

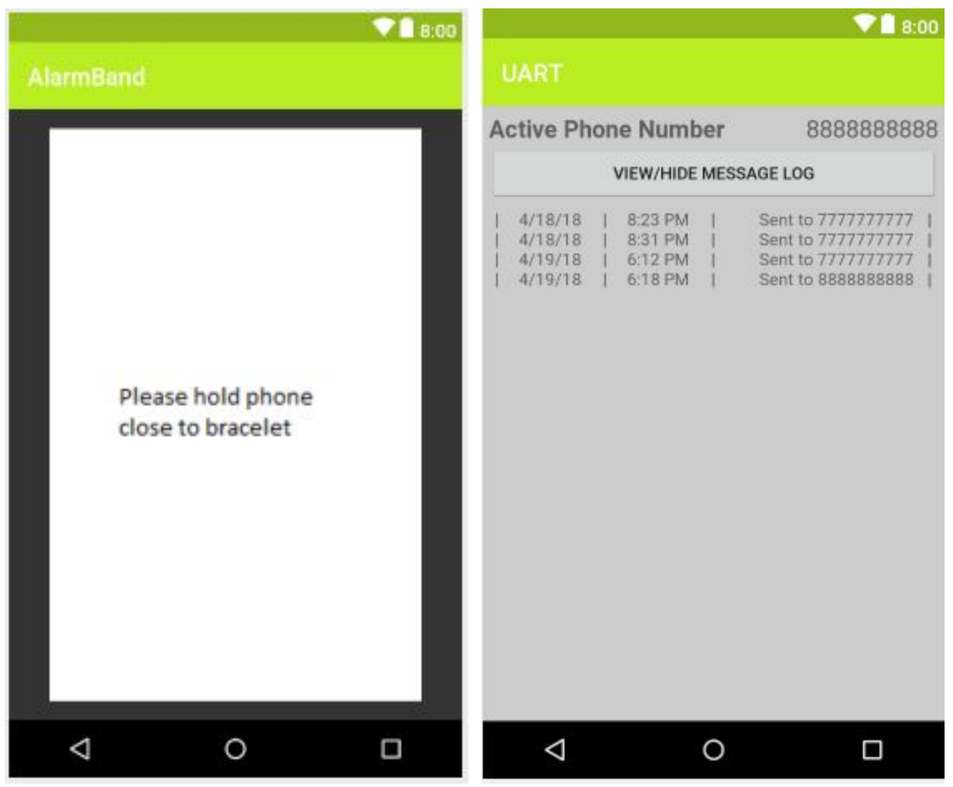


- An array of values corresponding to the signal of the correct motion is stored internally
- Live data is compared to this stored array, and if it is found similar enough, a motion is detected.
- Algorithm is easily adjustable for alternative motions
  - Replace array with values for new motion

Cost

Item	QTY	Development Cost ($)	Per Piece (100+) ($)
MPU 6050	1	39.95	4.07
Atmega32u4	1	19.90	3.49
BLE	1	17.50	14*
Button	1	1.90	0.32
Battery	1	9.95	8.69
Charger	1	14.95	11.96
PCB	1	-	0.20
Total	-	104.15	42.73

Mobile App



- Sends SMS message when motion detected
- Emergency contact easily changeable
- Consumer-friendly interface

Power

Current Draw	Atmega	Bluetooth	Sensor	Total	Measured
Operational	10 mA	1.86 mA	3.9 mA	~16 mA	~20 mA
Maximum	40 mA	15.2 mA	???	45+ mA	30 mA

$$\frac{1200\ \text{mAh}}{30\ \text{mA}} = 40\ \text{Hours Battery Life Minimum}$$

$$\frac{1200\ \text{mAh}}{20\ \text{mA}} = 60\ \text{Hours Battery Life Expected}$$

Prototypes