March 10, 2016

Dr. Andrew Rawicz
School of Engineering Science
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

Re: ENSC 440 Design Specification – Intelligent wearable wristband for personal safety

Dear Dr. Rawicz:

The attached document is our design specification for an intelligent wearable wrist band for personal safety. The purpose of this document is to provide a technical guideline for the Smart Band. Smart Band by Smart Trak is an intelligent personal safety device wearable on the user's wrist and is intended to act as secondary method of safety in case of emergency events.
This document will cover all design aspects concerning the prototype stage and will include detailed explanation on the detection algorithm, sustainability and safety, and how we will meet cradle to cradle. In addition, we will also cover an extensive test plan for the entire system. Our main purpose is to demonstrate the viability of such safety device in a wristband form factor.

The design specification described in this document applies only to the proof of concept model and thus all future iterations and extra features mentioned in this documents are for later implementation and will not be implemented during the current stage of development.
Smart Trak Solutions is founded by five dedicated senior engineering students: Tom Ou Yang, Ashton Novak-Louie, Farah Ishita, Peter Le, and Gifty Quansah. If you have any questions or concerns regarding our proposal, please do not hesitate to contact me at touyang@sfu.ca .
Sincerely,

Tom Ou Yang
CEO
Smart Trak Solutions

Smart Band

By

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Date: March 10, 2016

Executive Summary

The design specifications for Smart Band by Smart Trak provides a detailed description for the design and development process for the proof of concept model. Referring back to the functional specifications, this document will serve only to discuss requirements listed with either I or II.
Smart Trak Solutions' goal is to introduce an intelligent personal safety device wearable on the user's wrist. This document will serve as a guideline to provide a clear measureable outcome for the prototype and will also provide justification on our design choices.
The contents of this document will cover both the software and hardware aspect of the project. It will also include a detailed description of Design Specification for an Intelligent Wearable Wristband for Personal Safety.

The high level system overview and associated state diagrams on the report will reflect how the wristband and mobile application will interact with each other. The design specification will cover hardware choice used for the prototyping stage, the mobile application and the software algorithm used to detect emergency events. Specifically, we will be designing an in-depth algorithm used to detect falling. Due to the stochastic nature of falling and the likelihood of false positives due to wrist movements throughout the typical day, we will be designing an in-depth system test plan to minimize the frequency of false positives and increase the overall accuracy of detection. Because of the limited time constraint of project and the complicated nature of falling, we will only intend to meet an accuracy goal of at least 50% during the proof of concept stage, as referred from the functional specification [R30-I]. Lastly, this document will also cover the associated safety and sustainability factors, as well as the cradle to cradle principles.

Due to the complexity of the fall algorithm and the constraint with time, some initially intended features may not make it to the prototype product. However, our main features are still on schedule and working prototype with the accompanying mobile application is scheduled to be complete and be ready for a live demonstration by April 8, 2016

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Glossary

Smartband Computerized wristwatch, wearable computer

SOS Distress signal acronym for "save our souls"

SMS Acronym for Short message service, more commonly known as text messaging

Java Computer programming language developed by Oracle Corporation

Android Mobile device operating system developed by Google Inc.

BLE Bluetooth Low Energy

1.0 Introduction

Smart Band by Smart Trak is an intelligent wearable device worn on the user’s wrist and is intended to be used for personal safety. The system will be capable of interpreting the sensor data and can intelligently determine if the user is in distress and is in need of assistance. Our system prototype can be broken down into three distinct design functionality, hardware specifications, detection algorithm, and mobile application.
Due to the limited time constraint we have decided to opt with prebuilt hardware. For the prototyping stage, we will be using the Microsoft Band 2. The MS band is prebuilt with many of the necessary sensors such as heart rate monitor, accelerometer, and other useful sensors that will be useful in designing our monitoring application.
Using raw sensor output data, we can design various detection algorithms which will be able to distinguish certain events. One of our main detection feature will include fall detection. Due to the complicated nature of falling, and the possibility of false positives due to constant wrist movement, the detection algorithm will need to be refined to accuracy determine when falling occurs. The core proof of concept component of this project will be based on designing an algorithm for fall detection from data collected from the user’s wrist.
For the prototyping stage, we have decided that the mobile application will be first deployed on the android operating system compatible with devices running android jelly bean version 4.2 or later. The mobile application will be designed with the end user in mind. Therefore, the application should be intuitive and easy to use.
Our main goal is to design a functional wearable device to be used as a secondary response tool in case of emergency events while providing monitoring services different from existing products which are both bulky and stigmatizing.

1.1 Scope

This document specifies the design of the Smart Band and explains how the design meets the functional requirements as described in the functional specifications as described in Functional Specification for Smart Band [1]. The design specification includes all requirements for a proof of concept system and will also discuss some elements required for a production model. Since this is only a proof of concept model, we will only focus on the requirements denoted by [RX-I] or [RX-II] where X is an integer which corresponds to the functional specifications requirement number. The document will also briefly mention productional requirements, [RX-III], which will be used in future implementation. Additionally, this document will contain diagrams of the high level system overview, block diagram, and conceptual diagram used to describe the system.

1.2 Audience

This document is intended to be used by all members at Smart Trak Solutions to assist in the overall development and design process and will act as a guideline to ensure all required design elements are met. Furthermore, this document's test plan will also serve as an outline to ensure that the delivered product functions properly as described in the design specifications.

1.3 Classification

The following syntax from the functional specification will be used in this design specification requirements:

[Rn-p] A functional requirement.

Where **n** is the functional requirement number, and **p** is the priority of the functional requirement as denoted by one of three values:

I: The requirement applies to the proof of concept system only.

II: The requirement applies to both, the proof of conceptual system and the final production system.

III: The requirement applies to the final production system only.

2.0 System Requirements

This section outlines a high level overview of the Smart Band design.

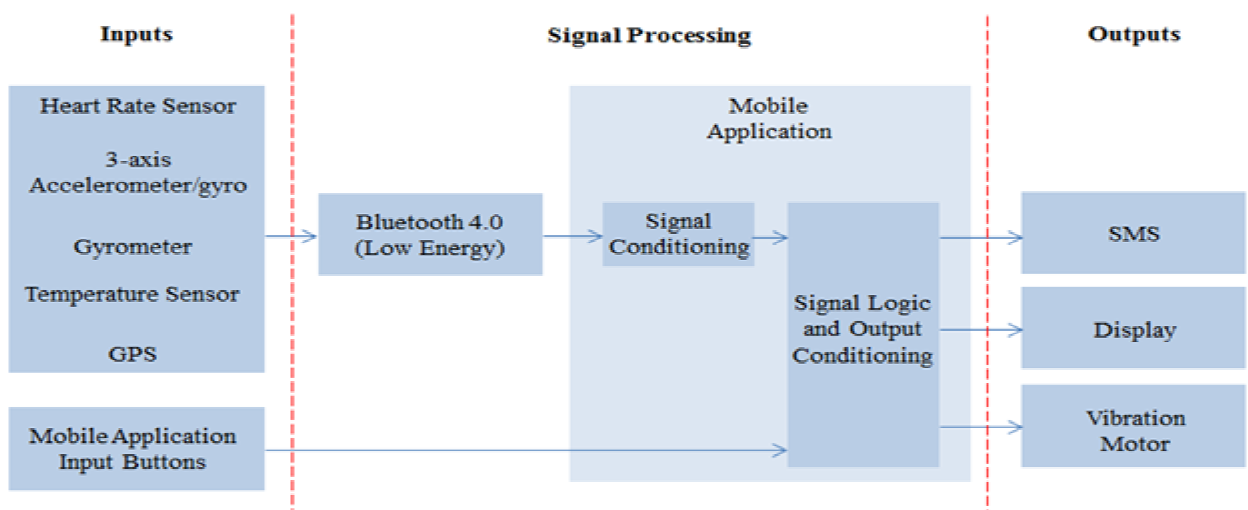

Figure 1: Block diagram of input to output flow.

Predefined constraints will be used to determine output logic based on the input sensor data. In particular, the data will be closely monitored for indications of an emergency event, in which an SMS alert will be sent to the user's designated emergency contact. During the emergency event, the vibration motor will also be activated and the user will be prompted to cancel the alert in case of a false alarm.
In order to present useful information to the user, the data will need to be sorted and displayed in a clear and concise manner for maximum clarity. Users will be able to choose which data is most relevant to them and have that data readily displayed.Figure 1 above provides a visual representation of the system flow from inputs to outputs. The inputs to the system are the five main sensors as well as user interactions through the mobile application. Raw data captured by the sensors is continuously transmitted from the Microsoft Band 2 via Bluetooth to the mobile device. As this raw data will be noisy, it will be filtered and sampled at an appropriate rate.

2.1 Hardware

Due to issues with the Angel Sensor distributors, we have since migrated our project to the Microsoft Band 2 technology, which provides similar capabilities albeit at a higher cost.

Sensors	• Optical heart rate sensor • 3-axis accelerometer/gyro • Gyrometer • GPS • Ambient light sensor • Skin temperature sensor • UV sensor • Capacitive sensor • Galvanic skin response • Microphone • Barometer
Connectivity	Bluetooth 4.0 (Low Energy)
Operating Altitude Range	-300m to 4877m
Operating Temperature Range	-10°C to 40°C
Battery	Li-Polymer
Supported Mobile Devices	• Android 4.3 or later • iOS 8.1.2 • Windows Phone 8.1 update
Environment Standards	• IP6X: No ingress of dust. Complete protection against entry of dust. • IPX7: Protection against temporary immersion in water (at depth of 1 meter for 30 minutes). • IP67: Meets both the dust- and water-resistance standards above.
Display Size	32mm x 12.8mm
Display Type	AMOLED
Band Material	Thermal plastic elastomer silicone vulcanate

Figure 2: Technical specifications for Microsoft Band 2 [1].

However, the MS Band provides some additional sensors over the Angel Sensor as well as a wider range of acceptable operating conditions and improved battery life. Figure 2 outlines technical specifications for the device. Currently, the Microsoft Band 2 is meant to serve as a prototyping platform that provides the functionality needed to develop our emergency detection algorithms with quick and effective testing while still meeting the time constraints of the project. The primary advantage to employing the Band is the quality and reliability of the sensors, which can be verified with brief sanity checks. Additionally, the sensors are comfortably wearable and durable to the specifications mentioned in Figure 2. Sizing measurements for the Band in large, medium, and small sizes are shown in Figure 3 below.

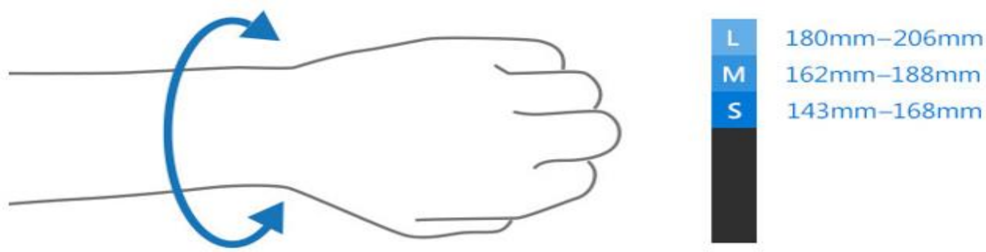

Figure 3: Size options for the Microsoft Band 2. [2]

The use of a preassembled wrist band does, however, come with disadvantages. The main drawback being the inherent lack of customization available in the hardware. It is possible that the current supported operating ranges, sensitivity levels, or precision levels of the sensors may not be able to cover certain edge cases of functionality when interacting with our algorithms. In such a situation, it would be difficult if not impossible to modify the hardware to be able to perform as necessary. However, with our current research, we do not believe the Band's technical limitations will be a hindrance to our implementation.

Another consideration is the size of the Band. Despite a healthy range of sizes available as shown in Figure 2, some users may experience difficulty properly wearing the device. Similarly, this would not be a problem with a simple remedy while utilizing a pre-assembled wrist band.

Lastly, the Band does provide some functionality that we will not be able to use in any meaningful way. The consequence of additional bloat hardware is increased power consumption, increased size, and increased weight, minimal as it may be.

For the purposes of prototyping, our research has shown the Microsoft Band 2 to be both sufficient and practical. However, we have also explored specialized hardware implementation that will be required for production models.

2.2. Software

Once environment data has been harnessed by the Band's sensors, it is reliant on the software module to process the data into meaningful information and choose appropriate outputs. For the specific case of our design, we need the software to recognize when the user is experiencing an emergency event and to send the appropriate notifications to the user's designated contacts. Other secondary outputs include displaying vital sensor information to the user as well as activating the vibration motor for haptic feedback.The main criteria for choosing a software platform includes support for Bluetooth 4.0 (Low Energy, henceforth referred to as BLE) and a mobile device with iOS 8.1.2., Windows Phone 8.1 update, Android 4.3, or any later versions of the above. For the prototype phase, we have decided on implementing our system on the Android platform, intended for use with an Android application. In the production phase, we intend to expand support to include the aforementioned Apple and Windows platforms.The key features of our design are the fall detection algorithm and the emergency notification system. The software must be able to recognize situations in which a fall has occurred while making the distinction from the normal movement involved in daily life. By utilizing the 3-axis accelerometer, we can track the acceleration values of the device as it is continuously fed to the mobile application.

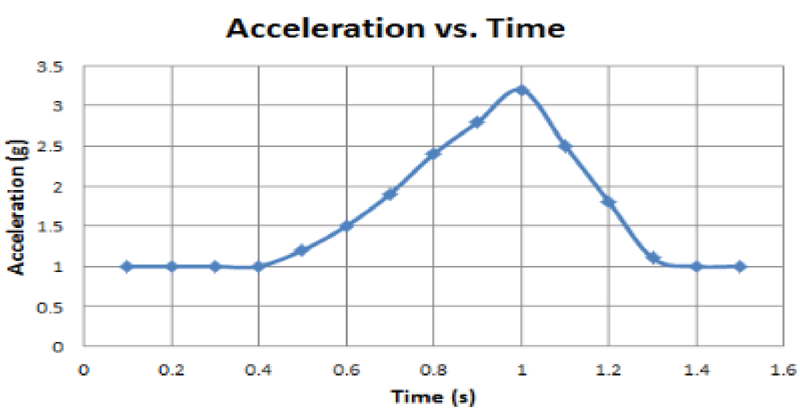

Figure 4 : Example of acceleration values that may be detected during a simple fall. Acceleration is displayed in units of acceleration due to gravity.

Figure 4 displays an example of what a simple fall may look like in terms of values detected by the accelerometer along the vertical axis (axis radial to the earth). Upon recognizing this pattern, the system would then fire an emergency event and proceed to send emergency alerts. Readings from the accelerometer are discretely sampled, so in order to determine the rate of change of acceleration, or jerk, we can employ a

rudimentary linear approximation. The maximum sample rate of the accelerometer is 62 Hz, allowing a linear approximation to be of sufficient accuracy for our use.
Not all falls are the same, or so simple as the example offered in Figure 3. For this reason not only is the maximum sample rate so pertinent, but extensive experimentation and testing will be required so as to minimize the occurrence of false alarms. In any given emergency detected, the user will be prompted to cancel the alert before emergency contacts are notified after a short period of time. Once the notifications are sent, the user will still be able to send a follow up notification should the user not require any assistance.
The emergency alert itself will contain information relevant to the type of emergency state detected. For example, an abnormally high temperature or heart rate will highlight that information in the notification, as well as containing all other vital information including time and GPS location. Should the user require assistance even when no emergency situation is detected, the user will be able to manually send a notification containing all vital information with the aid of a panic feature.
For the purposes of the prototype stage, the emergency alert will only be available as an SMS. For the future production phase, we have considered implementing other forms of messaging, including popular mobile messaging applications such as Facebook, WhatsApp, and Skype.

2.2.1 Test Cases

This section lists basic test scenarios for the software system.

- **Test 1**: Normal State
  - Input: All sensor values are within defined acceptable range.
  - Expected Output: No emergency alert.
- **Test 2**: Abnormal Temperature
  - Input: Skin temperature sensor value is above or below the defined acceptable range.
  - Expected Output: Emergency alert activated, highlights temperature information.
- **Test 3:** Abnormal Heart Rate
  - Input: Heart rate sensor value is above or below the defined acceptable range.
  - Expected Output: Emergency alert activated, highlights heart rate information.
- **Test 4:** Fall Detected
  - Input: Accelerometer readings indicate a fall has occurred. Equivalently, accelerometer readings match a pattern defined by the fall detection algorithm.
  - Expected Output: Emergency alert activated, highlights severity of fall and heart rate information.
  - As experimentation continues, more detailed and specific edge cases will be included.

3.0 Environmental Design Requirements

[R12-III] Battery must not contain toxic metals lead or cadmium. The requirement R12 can be fulfilled by using organic carbon batteries or Lithium Ion batteries if the former is not readily available for mass production of our product.

4.0 Band Requirements

[R45-II] The electronic parts of the wrist band should be sealed efficiently for protecting the parts from water/ liquid elements

In order to waterproof the product and meet requirement R45, the internal circuitry will be encapsulated with the transparent silicone elastomer material Polydimethylsiloxane (PDMS). PDMS is non-toxic, non-flammable and heat resistant, all properties that we require for water sealing the wristband. By using this encapsulation technique, all the connections on the printed circuit board of the wearable device will be sealed from moisture found in different environments. Below is an image that illustrates how electrical contacts on an LED can be protected with silicone elastomer and how effective it is. Both LED's were exposed to water, however, the top LED was unprotected while the bottom one was encapsulated in silicone elastomer.

Figure 5 : Unprotected LED versus encapsulated LED [1]

The straps of the wearable device are designed to be modular and thus will feature a notched securing method, as seen in figure **. Similar to the face, the straps will be available in a multitude of colours to appeal to a wide variety of consumers. In order to reduce weight and allow for recyclable parts, silicone rubber is used for the straps of the wristband. Silicone rubber is also flexible, durable and quite comfortable thus it fulfills the requirements for an ideal material for a wearable device strap. Other useful properties of silicone rubber are its ability to withstand humidity, due to the fact it doesn't corrode from water, and also withstand a large range of temperatures, from -100 to 300 °C [2].

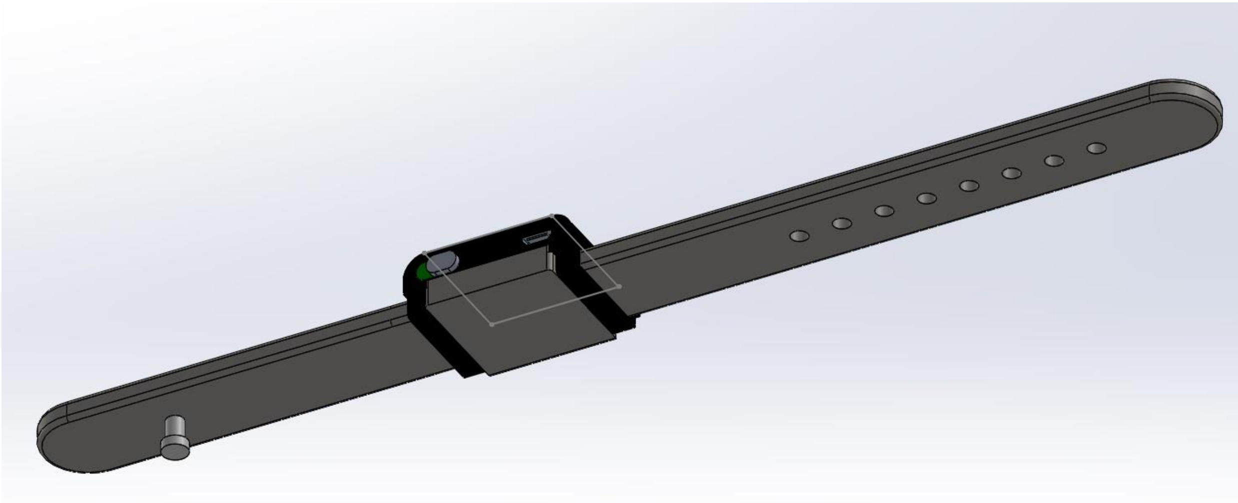

Figure 6: Underside of completed wearable

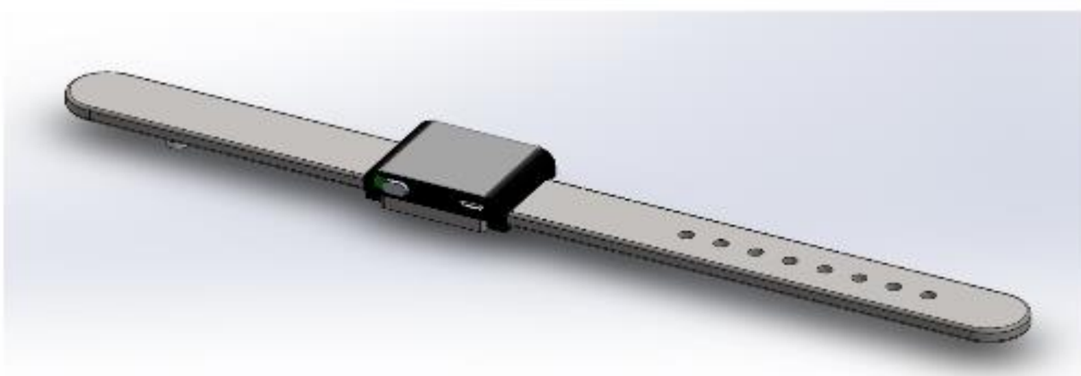

Figure 7: Assembled product with wristband

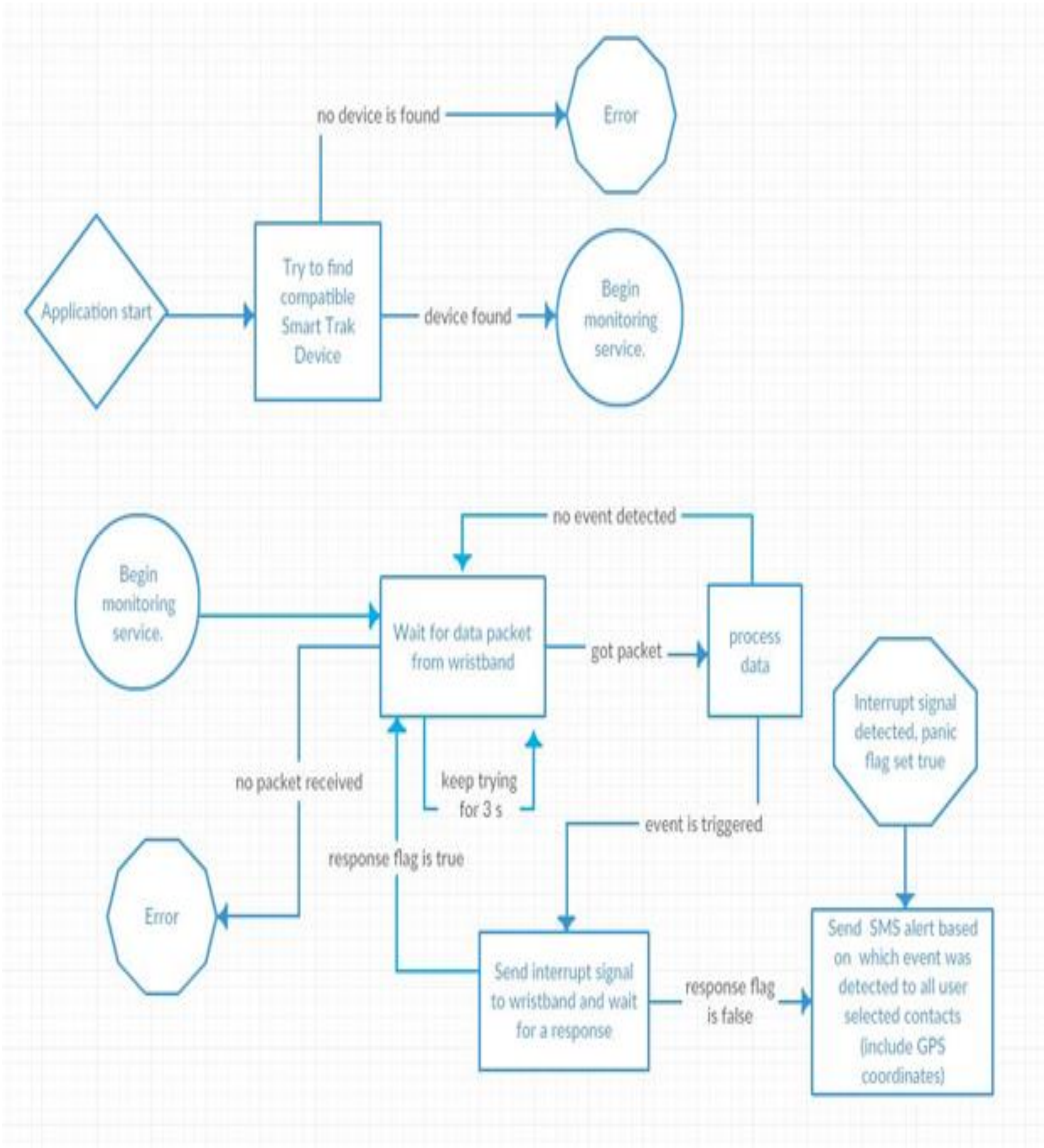

Figure 8: flow diagram of wristband

5.0 Mobile Application

This section discusses the implementation of the mobile application.

We have chosen to develop the application using Android API 17 (JELLY_BEAN_MR1), which supports Android 4.2 and higher. Although the Microsoft Band 2 has a minimum requirement of Android 4.3, we decided it would be prudent to develop on the lower API level in order to accommodate the production phase model, which will support 75.9% of currently available Android devices. The Band SDK requires a minimum API level of 17.

The application is designed to be as lightweight and unobtrusive as possible. To achieve this goal, we minimize the amount of storage the application consumes and the number of processes while running, reducing memory usage. This will also keep battery usage at a minimum. Additionally, the application will only require permissions concerning Bluetooth, SMS, and location services.

We utilize Microsoft's Band SDK to interface with the Band via its BLE connection. The SDK allows the application to access the information streams generated by each sensor in the Band in an act referred to as subscribing. When subscribing to a stream, the sampling frequency is selected (where options are available) and will continue until the subscription is ended. As data is collected, the application will monitor the streams for abnormalities, while simultaneously creating a log that can be viewed by the user. The user will be able to choose specific streams to view either live or over a desired time frame.

The user will be able to create a profile in order to customize settings and view past data logs. Settings will include selecting which data the user finds most important, selecting an emergency contact list, and clearing all data. Figure 4 displays a sample of the application home page.

The user will be able to quickly access basic vital information by simply tapping its respective tab. The user will also be able to choose which data appears on the home page and the order of its appearance. The panic button will always be available in case of emergency.

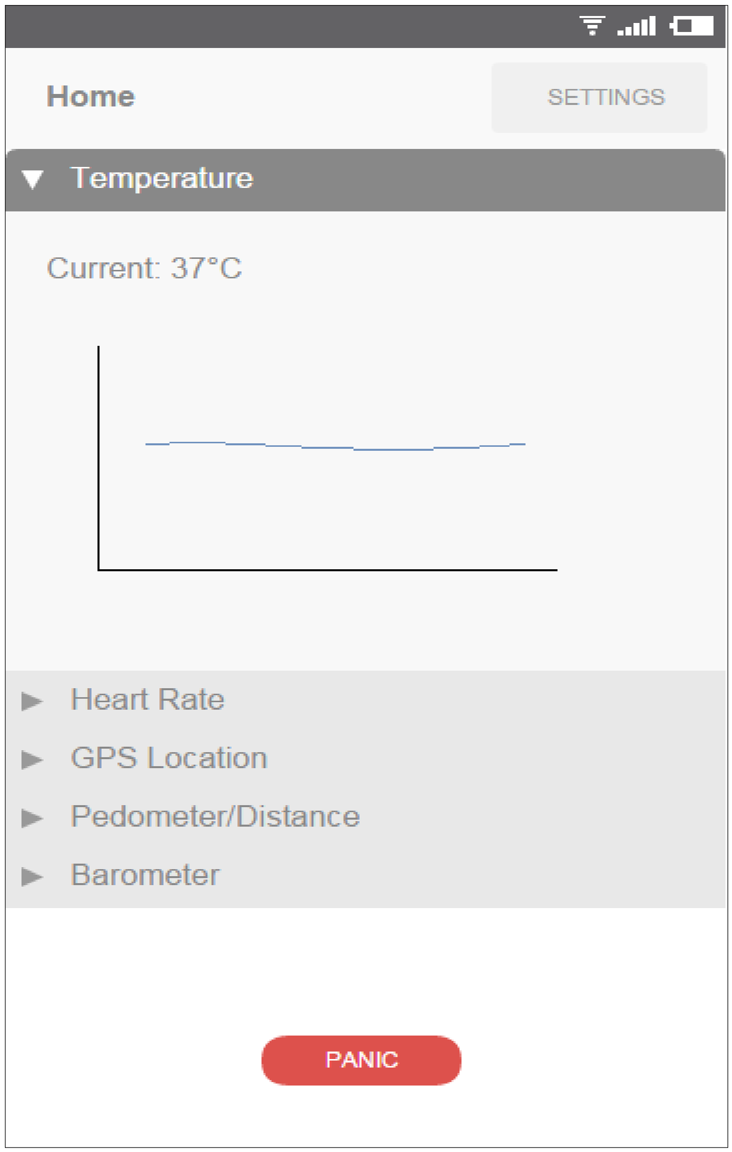

Figure 9: Android application home page sample.

Should the button be accidentally pressed, an option to cancel the alert will be immediately available before the notification is sent after a short period of time.

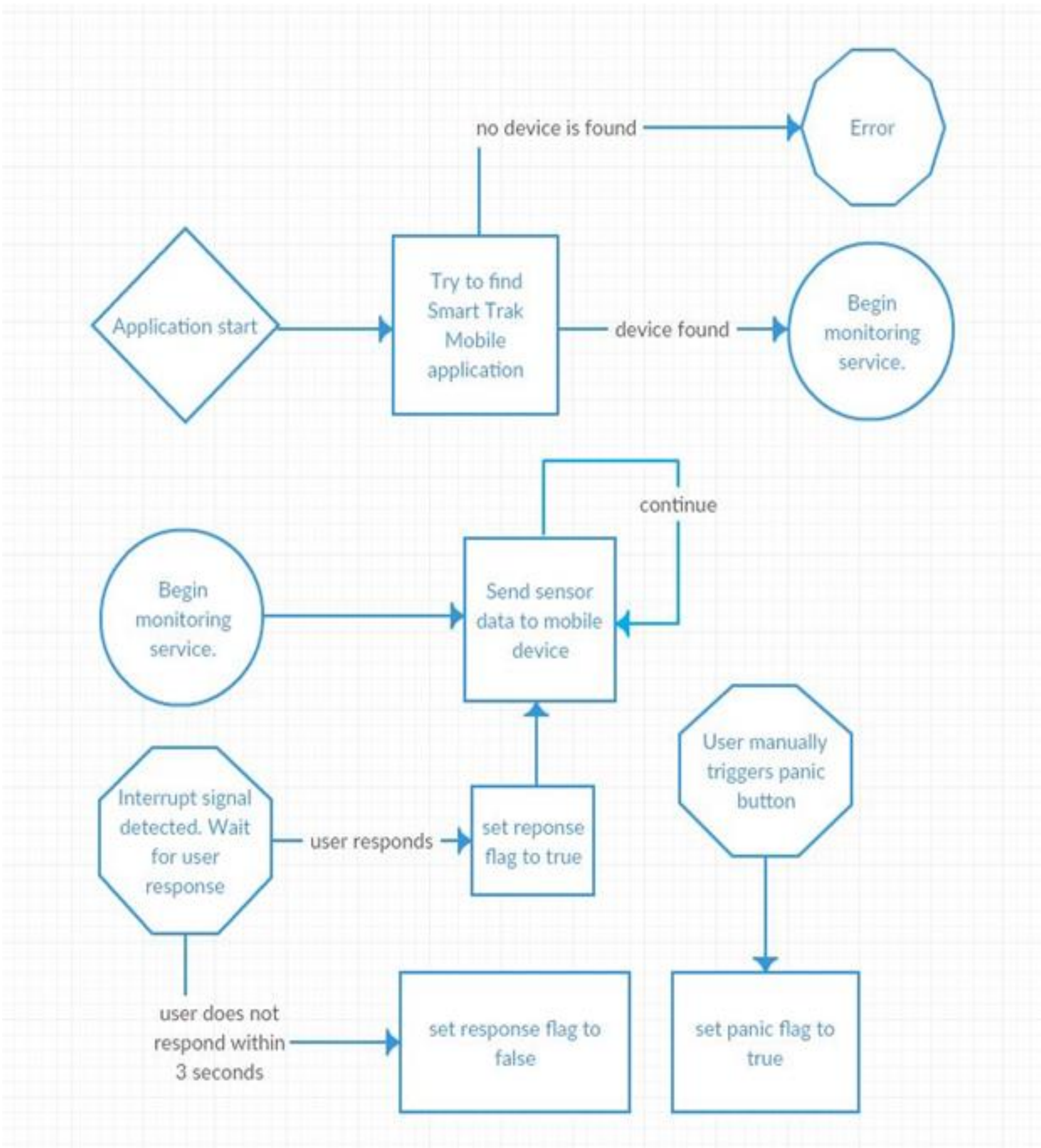

Figure 10: Flow diagram of mobile application

6.0 Fall detection

Fall detection will be a difficult feature to implement due to data being collected on the wrist. The primary focus of Smart Band is not used for minor falling, but rather sever falls where the user is unable to recover from the ground. Thus we can reduce the frequency of false positives by reducing the sensitivity and adjust the detection algorithm such that a fall event is triggered only when the system has detected a severe fall.The principle of detection we will use employs a 3axis accelerometer and gyroscope. By analyzing the data present in a typical fall and understanding previous research done by “SPEEDY: A Fall Detector in a Wrist Watch”(Degen and Jacckel, 2003) and “Optimization of an Accelerometer and Gyroscope-Based Fall Detection Algorithm”(Huynh et, 2015)[??][??] we can develop a modified algorithm which will be robust enough to detect falling in various orientations. A typical falling event will be triggered, when the following conditions are satisfied.

> [A] A fall starts with a brief period of free fall, which will cause the acceleration to fall below 1G
>
> [B] An impact must be detected within a 3 second window, which will cause a large spike in amplitude followed by a brief settling period
>
> [C] The user is stationary (constant 1G) and has not disabled the false alarm notification

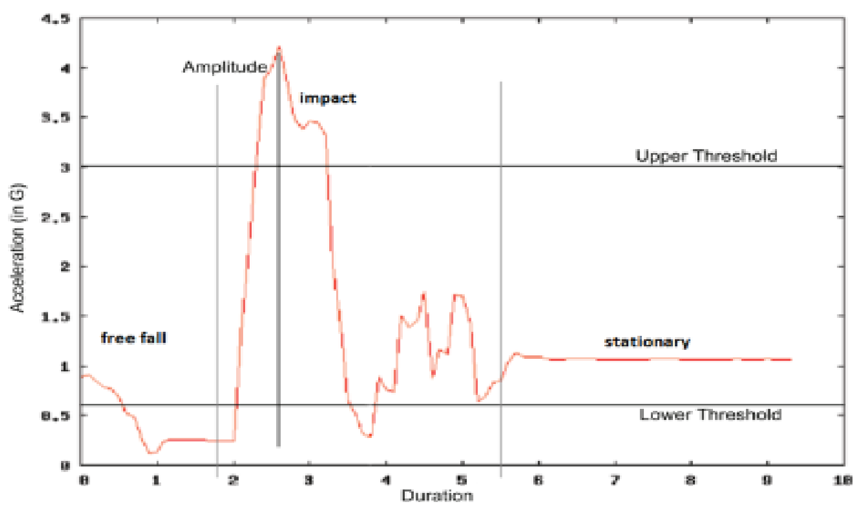

Figure 11: Illustrates a typical fall forwards.

If all these conditions are met, it is sufficient to believe that the user has experienced a severe fall and is in need of assistance. Of course not all falls are so straightforward, thus extensive data collection will be required to refine to detect other edge cases such as falling down sideways or backwards.

The following requirements can be met with our design of the wearable band:

[R29-II]	The device firmware should upgradeable via USB or Bluetooth connection
[R37-II]	All electronic components shall be enclosed to prevent direct contact with user
[R42-II]	There should be a reset and on/off switch placed on the band
[R22-II]	All collected information will be cleanly presented to the user
[R24-II]	The user will be notified when an emergency alert has been activated
[R5-III]	Device must be aesthetically pleasing to eliminate stigma
[R10-III]	Final product must be made of reusable or easily recyclable materials

Below are coloured and uncoloured CAD diagrams of the wearable device without straps attached. The switch on the left of the device is used for power, as required by R42, and is in the 'ON' position when the green portion can be seen. The right side of the device houses the widely used Micro USB charging and syncing port commonly found in many currently available
Smart phones and digital cameras and also fulfills requirement R29. The off-white top face of the wearable device represents an E-ink screen, which realizes requirements R22 and R24 and serves as a display for notifications and collected information. A panic button is also implemented underneath the E-ink screen so that pressing down on the display would activate an emergency response.

The housing of the wearable band's case will be made of aluminum, which easily recyclable and salvaged thus fulfilling R10 [1]. The aluminum housing will also enclose the circuitry and thus fulfilling requirement R37. As seen above in the CAD diagrams, requirement R5 has been meet with a modern and minimalist design.

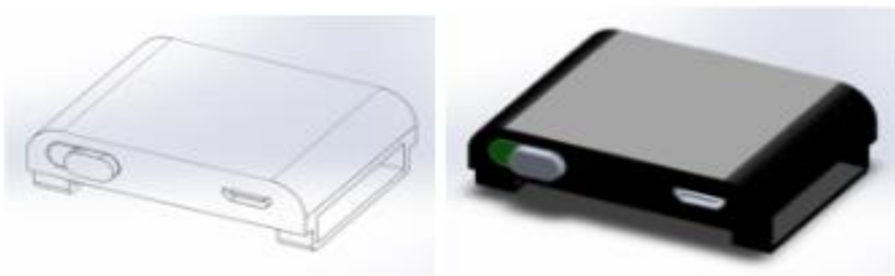

Figure 12 : Coloured and Uncoloured CAD renders of the wearable production model

7.0 Communication

In order to communicate with the user, the product would use haptic feedback and an E-ink display. Haptic feedback would be provided in the form of short vibrations from an internal motor and would be activated to alert the user when the wristband detects a possible health or safety issue. E-ink screens are ideal displays for production models of product due to its low power consumption, ability to display crisp text and readability in direct sunlight. The E-ink screen would also be used to alert the user and show more detailed information of the current status of the device as well as allow for a graphical user interface. The following images illustrate what the screen might display depending on what state it is in.

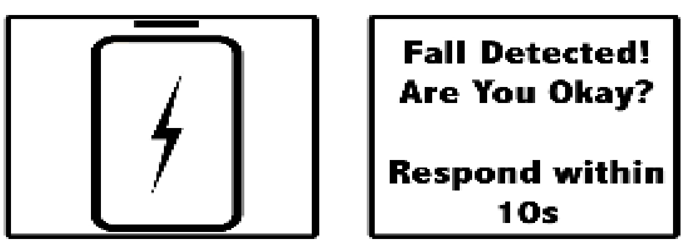

Figure 13 Charging screen (left) and alert screen (right)

How well the product can communicate with the user's smartphone is also an important aspect. By using a BLE module that is qualified to Bluetooth 4.0 standards, requirements R88 to R90 and R93 to R94 from our functional specifications can be met, since the requirements were envisioned to match Bluetooth Smart Technology found in 4.0 standards.

[R88–II] Bluetooth wireless data transfer rate must be approximately 1 Mbit/s
[R89-II] Bluetooth communication range must be over 100 m
[R90-II] Bluetooth Latency must be approximately 6ms or lower when not connected
[R92–III] Bluetooth module must be no larger in area than 15mm x 15mm as to keep electronics section small
[R93-III] Power consumption must be approximately within 0.01 to 0.5W
[R94–III] Peak current consumption must be lower than 15mA

Many BLE modules exist that meet the aforementioned requirements and we have selected the Panasonic PAN1740 as the module we would use for production models of our product. The PAN1740 is an exceptional module and fulfills all the Bluetooth requirements including R92 as it is only 9 x 9.5 mm in area [3].

8.0 Test Plan

In order to properly test the smart watch, testing will be done during the development, integration and Testing phases. This is to ensure that there is positive feedback after putting the smart watch in production.

During the integration phase testing will focus on the communication of data between hardware and software. Initial testing will ensure that the signal is been via BLE to the software. The main focus of our testing will be to differentiate between falls and normal hand gesture. Since software is huge component of our project we will also do extensive software testing, to ensure communication between hardware and software.

8.1 Hardware Testing

The testing of the hardware component of the smart watch will mainly focus on durability, comfort and integration with the Electronics. Testing will ensure that the straps meet size requirements, and that the straps will survive regular use and cleaning. Also we will be making sure that the smart watch isn't too bulky.

8.2 Software Testing

Software testing will first ensure the UI is very easy and user friendly. Secondly the software testing will ensure that the input data are processed in real time to produce the desired output values. It will ensure that input data are processed to differentiate between emergency and false alarms. Software testing will ensure that emergency SMS is sent to a user's contact in case of emergency.

8.3 System Testing

At the end of the Integration phase, it is expected that the Electronics, Kit and Software are all functional and that there is basic marriage between them. Entering the Alpha Testing phase, the focus will be on tuning the data stream so that the outputs align with expectations. The following use cases will be tested. It I important that differentiate test cases will be added as the project evolves.

The following functional modes will be tested:

- Fall detected emergency alert triggered
- Hardware is able to communicate with software via BLE
- Sensors are recording correct data
- Data is being processed by software application
- Emergency alert is being able to be turned off by user
- Emergency sms is being sent to contact
- All four limbs perform synchronous motion to ensure complete system functionality.

The following failure modes will be tested:

- Fall detected, emergency alert not triggered.
- -Fall detected emergency alert turned off, but sms still sent
- -Differentiation between fall and normal hand and limb movement
- Emergency SMS is not sent when during false alarm

Below are example of two normal use cases that will be tested

- **Normal Case 1:**

All sensors are attached to user's body correctly

User Input: Patient boots up the smart band

Condition : User needs to be fit to wear sensors. All sensors should be attached to the user's body correctly. User will be required to open mobile application.

Expected Result : There are data and analyzed results that are expected to show on mobile application.

Normal Case 2:

Smart watch detects a Fall

User input: User falls

Condition: Fall motion and elevated heart rates are detected.

Expected Result: The emergency alert is expected to be triggered. User gets 30 seconds to respond. An SMS alert is expected to be sent to the emergency contacts.

9.0 Sustainability & Safety

The current prototype for the Smart Trak Solutions Smart Band utilizes the Microsoft band ,which is a prebuilt smart wearable device with support for open source development. Since our hardware is already assembled, we have no control over what materials were used. The Cradle to Cradle cycle can still be considered with our chosen hardware, since C2C is a very important aspect of an engineering design.

All components of the Microsoft band wearable could be recycled or repurposed to follow the Cradle to Cradle design philosophy. The housing for the device uses plastic and silicone both of which could be sent to a recycling facility for processing into reusable raw materials.The nonconductive substrate of the printed circuit board could be reused as glass fibre after the flame retardant coating has been chemically separated into valuable elements. Microelectronic chips, switches, motors and LED's could be unsoldered and reused by us for the next iteration of our Smart Band or could be sent to a recycling facility.

The hard plastic could be melted down and extruded into reusable pellets while silicone could be pulverized and merged with a binding agent for remolding. As for the internals of the device, the printed circuit board as well as the wiring and connections could all be recycled as well. Copper was used for wiring as well as the printed circuit board and lead was used for solder, both metals could be removed and melted for reuse.

The nonconductive substrate of the printed circuit board could be reused as glass fibre after the flame retardant coating has been chemically separated into valuable elements. Lastly, since the Microsoft band, is a fully functioning hardware device, it could be repurposed by installing software by other developers and using it for ourselves after our project has been concluded.

Sustainable and nonhazardous materials used for internal circuitry as well as the outer casing for the device need to be used. A suitable material for housing our device needs to be carefully studied in order to be lightweight, strong and easily recyclable. Materials easily recycled and widely available in recycled forms such as hard plastic, silicone and aluminum are ideal for the implementation of the Smart Band. Non hazardous materials are also a priority, by using them, need for consumers to be around dangerous materials as well as the harm they cause to the environment can be eliminated. Much more sustainable materials such as lead, freesolder alloys, organic carbon batteries and recycled materials would be used.

The production model of our device will have to be designed with several safety and sustainability factors in mind. The first obstacle to overcome would be how the internal circuitry can be configured as to minimize the likelihood of spontaneous combustion, electrocution or explosion of components such as the battery. New, safer and more environmentally friendly batteries such as the organic carbon battery fulfill our requirements quite well. No rare metals, heavy metals or unstable active materials are used in organic carbon batteries which makes them completely recyclable as well as significantly less likely to cause fires or explosions[2].

The device would also be sustainable in the sense that as little electricity as possible will be consumed throughout the product's lifespan through using the more efficient and reliable battery as well as BLE for wireless communication. Waterproofing of the final production device is needed so that it can be worn at all times without short circuiting and or electrocuting the user[1].

10.0 Conclusion

The report reflects possible solutions that have been chosen to meet the functional specifications of SmartTrak's smart wrist band design. The main core of the system consists of sensors for user interactions through the user's mobile application. Sensors are used for capturing raw data from the Microsoft Band 2 via Bluetooth to the mobile device. We will be heavily referring to this design specification report while implementation, in order to fulfil all the functional and design specifications.

SMARTTRAK SOLUTIONS

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