Software Requirements Specification for SE 4G06, TRON 4TB6: Synesthesia Wear

Team 26, STRONE
Jordan Bierbrier
Azriel Gingoyon
Taranjit Lotey
Udeep Shah
Abraham Taha

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Contents

Revision History

Date	Version	Notes
October 2, 2022	1.0	Added Section 1 - Project Drivers
October 3, 2022	1.1	Added Section 2,3 - Functional and Non-Functional Requirements
October 4, 2022	1.2	Added Section 4,5 - Monitor and Controlled Variables, Traceability
October 5, 2022	1.3	Added Section 6 - Project Issues
October 6, 2022	1.4	Added References - Reflection Appendix
April 4, 2023	1.5	Updated Section 2 - Functional requirements

This document describes the requirements for Synthesia Wear. The template for the Software Requirements Specification (SRS) is a subset of the Volere template (Robertson and Robertson, 2012).

1 Project Drivers

1.1 The Purpose of the Project

The purpose of this project is to create an inexpensive and non-intrusive ~~hearing aid bracelet~~ wearable device that provides an alternate channel for sound recognition for our users in their surroundings. ~~First of all~~ With this in mind, Synesthesia Wear's main goal is to be able to provide an improved ~~quality of life~~ auditory awareness for our users by ~~instilling within them a sense of comfort knowing that our bracelet can help alleviate~~ alleviating their hearing difficulties in many environments. For this project, there will be 3 main aspects that must be done for its overall completion. The first one is to be able to design and create a small and lightweight bracelet that is comfortable for our users to wear while encompassing all the hardware needed for overall functionality. Simultaneously, the second aspect is one where the bracelet's sound detection is able to reliably detect as many significant sounds in our users' daily lives as possible. Lastly, an app is going to be made so that it has a user-friendly user interface (UI) that is easy to use and will allow users to easily be able to configure their sound detection settings for their bracelets.

1.2 The Stakeholders

1.2.1 The Client

N/A

1.2.2 The Customers

The customers of this project would be people in the general public who would want or need an inexpensive and non-intrusive ~~bracelet~~ wearable device that helps with their ~~hearing~~ awareness in their surroundings. Furthermore, people who are in loud environments may want to purchase Synesthesia Wear as well since hearing is likely obstructed and sound recognition through touch/vibration would be very appealing.

1.2.3 Other Stakeholders

The Developers: The developers of this project are the members of Strone. Our job is to develop a ~~bracelet~~ wearable device that is capable of assisting in the sound recognition of users within their surroundings. Throughout this project's entirety, we will test and change/improve aspects that we may deem necessary.

1.3 Constraints

1.3.1 Solution Constraints

The Synesthesia Wear application should be able to run on many computers, laptops, and phones. For phones, the application will be supported on IOS and Android OS. Furthermore, for laptops/computers, the application will be supported by macOS and Windows OS. With all this in mind, it is assumed that implementing for other mobile/laptop/computer OS's would be unprofitable and wasteful to maintain.

1.3.2 Implementation Environment of the Current System

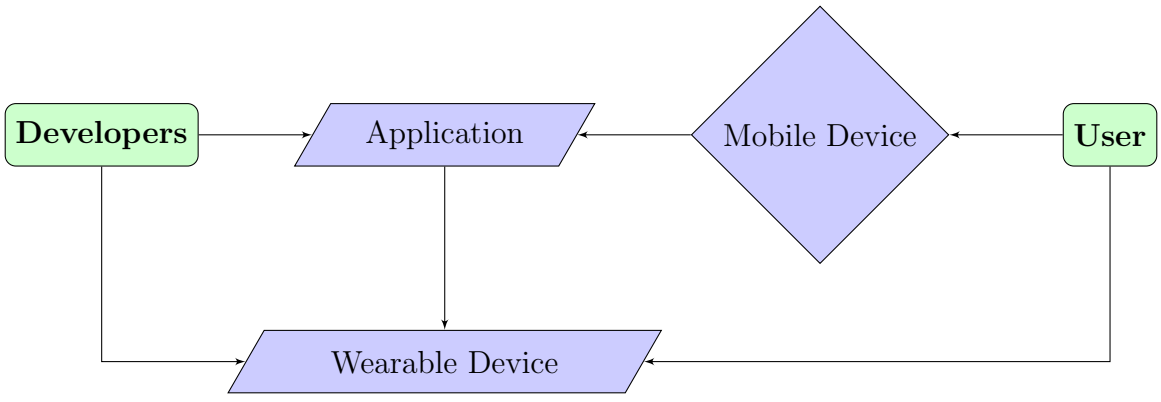

Figure 1: Implementation Environment

1.3.3 Partner or Collaborative Applications

Synesthesia Wear does not have any partner or collaborative applications. However, it does rely upon the fact that the user is using the application on a device that supports IOS, Android, macOS, or Windows OS.

1.3.4 Anticipated Workplace Environment

There is no specific anticipated workplace environment for this product. Ideally, this ~~bracelet~~ wearable device and corresponding app can be used anywhere so long as they have a mobile device that supports IOS, Android, macOS, or Windows OS.

1.3.5 Schedule Constraints

It has been decided that this project is to be completed by the week of April 5th, 2022. As a result, this project's scheduling will be executed over a timespan of a ~~bit more than~~ little over 7 months.

1.3.6 Budget Constraints

For this project, the budget has been dictated to be no more than $750 from the entirety of all group members. With this in mind, there is no issues with the application as all software tools and resources are expected to use open-source material found online. Thus, most/all of the budget will likely be spent towards designing and creating the lightweight, non-intrusive, and comfortable ~~bracelet~~ wearable device.

1.3.7 Enterprise Constraints

The finished application will be available for anyone to use. However, the Synesthesia Wear ~~bracelet~~ wearable device will need to be purchased as it costs money and time to buy all the components and build it.

1.4 Naming Conventions and Terminology

1.4.1 Definitions of All Terms, Including Acronyms, Used by Stakeholders Involved in the Project

ACRONYNM/ABBREVIATION	INTENDED MEANING
SYWR	Synesthesia Wear
UI	User Interface
OS	Operating System
Etc	Et Cetera
Wi-Fi	Wireless Fidelity
IDE	Integrated Development Environment
GL	Gitlab
Product	The ~~bracelet~~ wearable device and appliction being developed as a whole, in its finished state
Project	The development of the ~~bracelet~~ wearable device and application
Customer	The person(s) that will use the finished product

Table 1: Definitions

1.5 Relevant Facts and Assumptions

1.5.1 Relevant Facts

There are a few rules that the team must adhere to during the development of this project. Firstly, each developer must attend the group meeting before the submission of a deliverable to ensure that everyone has given their opinions and approval of the work, sort out any discrepancies, correct errors, and then satisfactorily submit with some time to spare. Furthermore, another rule that must be adhered is the fact that each developer has the right to question and ask for further explanations from others on their work. This is because both/all parties' work is related in some way or another and so the extra clarification and effort would be to all developers' benefit.

1.5.2 Assumptions

The developers are assuming that all software resources that will be used in the creation of the project will be open source software that is free for us to use. Furthermore, it is assumed that the majority/all of our users will have access to a device that supports macOS, Windows OS, IOS, or Android OS.

2 Functional Requirements

2.1 The Scope of the Work and the Product

2.1.1 Context Diagram

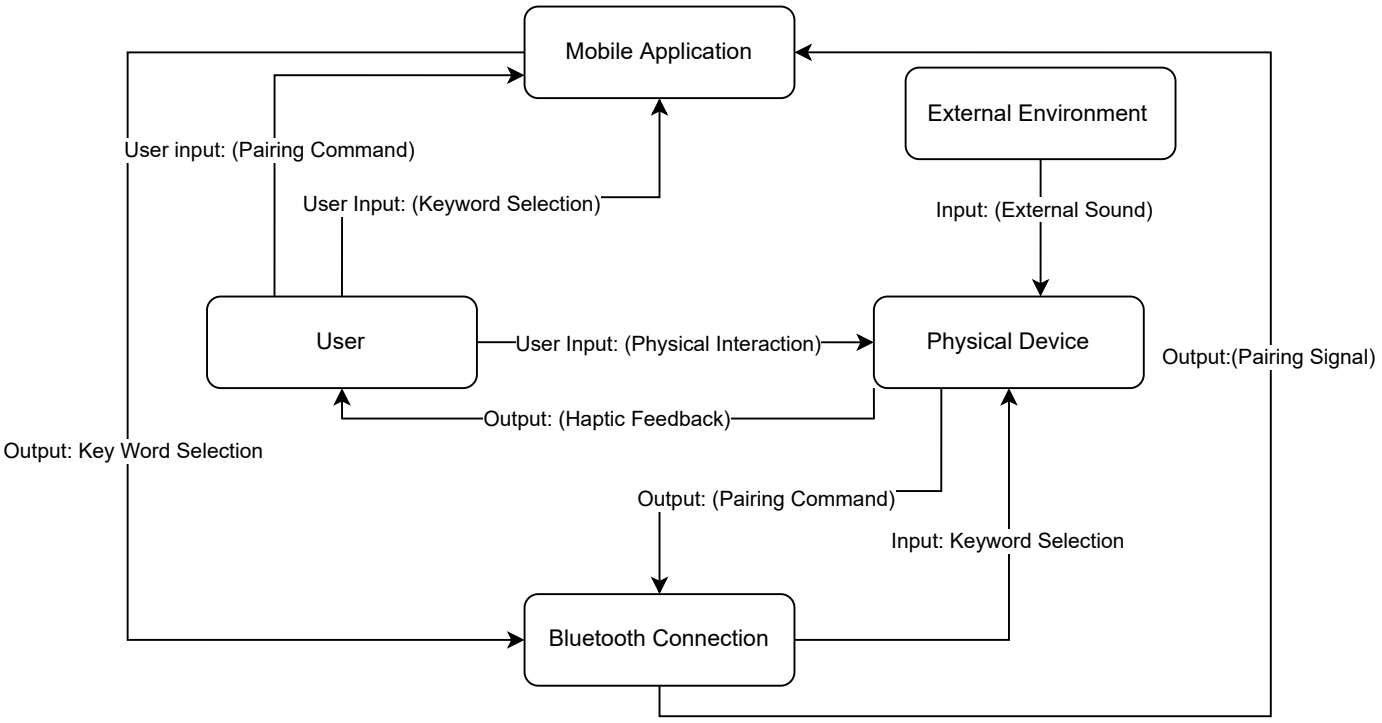

Figure 2: Context Diagram

2.1.2 Individual Product Use Cases

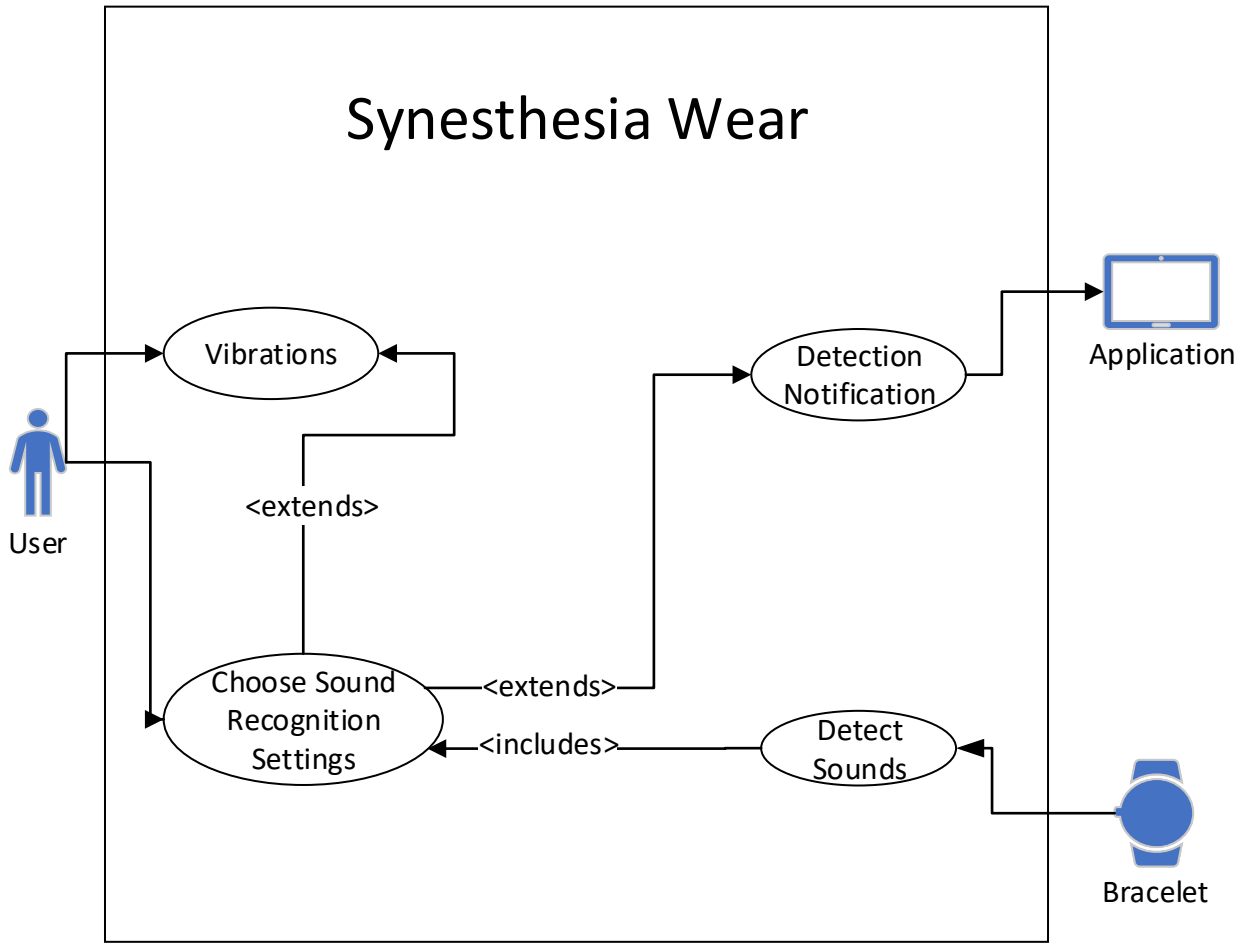

Figure 3: User Case Diagram

2.2 Functional Requirements

Requirement No	FR-1
Description	The device is able to pick up sounds in the environment of the user.
Fit Criterion	The data received by the device shall match the sounds supplied to the device's surroundings .
Dependencies	N/A

Requirement No	FR-2
Description	The device has to be able to correctly classify different sounds that the user has specified. These sounds are limited to any distinct audible sounds whose time does not exceed 1 second.
Fit Criterion	Will compare test sounds and the device classifications shall match the true classification of the sounds.
Dependencies	FR-1, FR-4

Requirement No	FR-3
Description	The device has to be able to classify not specified sounds as random sounds.
Fit Criterion	Random sounds should have the highest confidence for the random classification which will exist as a classification even if no user specified classification exists
Dependencies	FR-2, FR-4

Requirement No	FR-4
Description	The device has to be able to store user defined classifications until any changes are made by the user.
Fit Criterion	The device should be able to retain different user specified classifications until a user change command is asserted.
Dependencies	FR-5

Requirement No	FR-5
Description	The device has to be able to communicate with Bluetooth in order to add, delete or modify its classifications and their specifications.
Fit Criterion	The commands sent through Bluetooth shall make the intended changes in classification.
Dependencies	FR-4

Requirement No	FR-6
Description	The device is able to provide feedback to the user.
Fit Criterion	The feedback should alert the user that the device is trying to communicate some information.
Dependencies	N/A

Requirement No	FR-7
Description	The feedback provided is the appropriate feedback.
Fit Criterion	The feedback shall convey what signal classification was detected.
Dependencies	FR-2, FR-4

3 Non-Functional Requirements

3.1 Look and Feel Requirements

3.1.1 Appearance Requirements

Requirement No	NFR-1
Description	• The UI of the application will contain a home page that displays the company logo and an option to pair the device. • The UI of the application will have buttons which will have different colors for different functionalities. • The UI will have a separate page for pairing the device and a page for configuring which voices you want to be alerted by. • The device will be a uniform material finish and contain an on button and Bluetooth pairing button. • The device will have a distinguished charging port built into the finished material.
Fit Criterion	Check that the UI and device satisfy mandated requirements.
Dependencies	NFR-2

3.1.2 Style Requirements

Requirement No	NFR-2
Description	• The UI will use consistent buttons, fonts, and color palette. • The device will automatically begin the pairing process when button is pressed • Buttons on the UI should be easily identified. ~~and responsive.~~
Fit Criterion	Check that all buttons of the UI and the device correctly communicate back.
Dependencies	NFR-1

3.2 Usability and Humanity Requirement

3.2.1 Ease of Use Requirements

Requirement No	NFR-3
Description	• The device shall be usable by any user with basic understanding of mobile applications and bluetooth devices. • The product should provide support that assists users in avoiding mistakes.
Fit Criterion	90% of a sample group can go through the application without a manual.
Dependencies	NFR-4, NFR-1

3.2.2 Personalization and Internationalization Requirements

Requirement No	NFR-4
Description	• Devices should allow users to pick and choose their desired sounds to be notified by. • Application of the product should allow users to choose preferred language • User Manual for the device will be written in primary language of each region device is sold
Fit Criterion	A sample group shall be able to change and manage their preferences.
Dependencies	FR-5

3.2.3 Learning Requirements

Requirement No	NFR-5
Description	This device and the corresponding application shall be able to be used by users with no prior training within 5 minutes.
Fit Criterion	A sample group shall take less than 5 minutes to start using the product.
Dependencies	NFR-3

3.2.4 Understandability and Politeness Requirements

Requirement No	NFR-6
Description	The device and the application will use icons when the icon is commonly associated with a standard action such as a bluetooth logo for pairing.
Fit Criterion	Check that the UI and device satisfy mandated requirements.
Dependencies	NFR-1, NFR-2

3.2.5 Accessibility Requirements

Requirement No	NFR-7
Description	Anybody who can operate a mobile device and is capable of wearing a ring/bracelet will be able to operate the device.
Fit Criterion	Same fit criteria as NFR-3
Dependencies	NFR-3

3.2.6 Convenience Requirements

Requirement No	NFR-8
Description	If the phone falls out of range, the device should automatically re-pair to a known device when the device is back in range.
Fit Criterion	POC testing when a phone gets disconnected it should connect back when back in range.
Dependencies	N/A

3.3 Performance Requirements

3.3.1 Speed and Latency Requirements

Requirement No	NFR-9
Description	• The device shall process sound and react, with haptic feedback, if keywords are found in 1 second of response time • Interactions between the user and UI should have a response time of 1ms • First time pairing of the device should take no longer than 1 minute • Recurring connections of the device should take no longer than 10 seconds.
Fit Criterion	Check that the device satisfies the above requirements.
Dependencies	FR-1, FR-2, FR-6, FR-7, NFR-3, NFR-8

3.3.2 Safety-Critical Requirements

Requirement No	NFR-10
Description	Battery of the device should be shielded to prevent any direct contact with the user.
Fit Criterion	When the device is worn there is no way to directly touch the hardware components other than the buttons and ports.
Dependencies	N/A

3.3.3 Precision or Accuracy Requirements

Requirement No	NFR-11
Description	Devices shall only miss-process noise or give a false haptic feedback once in every x amount of processes (Where x is determined by the team).
Fit Criterion	Check that the device satisfies the above requirements.
Dependencies	FR-2, FR-7, NFR-9

3.3.4 Reliability and Availability Requirements

Requirement No	NFR-12
Description	• Battery life of the device should last for 12 hours of use. • Sound sensor should be listening for keywords at all times while the device is powered on. • ~~Application should have an uptime of 24 hours a day, 365 days a year.~~
Fit Criterion	Check that the device satisfies the above requirements.
Dependencies	FR-1, NFR-9

3.3.5 Robustness or Fault-Tolerance Requirements

Requirement No	NFR-13
Description	• Device should be able to filter out noise in loud environments while still picking up on keywords. • Device should still function even if the bluetooth gets disconnected from the user's mobile device.
Fit Criterion	Testing of accuracy in different environments
Dependencies	FR-1, NFR-11

3.3.6 Capacity Requirements

Requirement No	NFR-14
Description	• System should only record the 5 keywords as chosen by the user of the device. • Application should record the inputted keywords by the user even if the application is closed.
Fit Criterion	Check that the device satisfies the above requirement.
Dependencies	NFR-9

3.3.7 Scalability or Extensibility Requirements

Requirement No	NFR-15
Description	The device should be capable of processing the current 5 keywords and upwards of 5 additional keywords two years after launch.
Fit Criterion	NFR-14 shall be achieved along with scope that more words can be added.
Dependencies	NFR-14

3.3.8 Longevity Requirements

Requirement No	NFR-16
Description	The device should have an expected lifetime of 5 years considering regular maintenance and use cases.
Fit Criterion	The estimated battery lifecycle shall be above 5 years.
Dependencies	NFR-12

3.4 Operational and Environmental Requirements

3.4.1 Expected Physical Environment

Requirement No	NFR-17
Description	• The device will be used by individuals in normal day to day activities. • The product dimensions should allow fitment on either wrist or finger of the user. • The application shall run on any mobile device that is using an IOS or Android operating system.
Fit Criterion	Using a study group check that the device operates during normal day activities, fits on all users, and runs on their desired phones.
Dependencies	NFR-12, NFR-13, NFR-1, NFR-2

3.4.2 Requirements for Interfacing with Adjacent Systems

Requirement No	NFR-18
Description	The device will be able to interface with an application running on the user's mobile device.
Fit Criterion	Check that the device correctly pairs and reacts with updates from the application.
Dependencies	NFR-8, NFR-14, NFR-15

3.4.3 Productization Requirements

N/A

3.4.4 Release Requirements

Requirement No	NFR-19
Description	Yearly software releases will be deployed to improve the signal processing of the device as well as to maintain the corresponding application of the device.
Fit Criterion	Ensure software updates have been deployed on a year to year basis.
Dependencies	N/A

3.5 Maintainability and Support Requirements

3.5.1 Maintenance Requirements

Requirement No	NFR-20
Description	Updates to the software of the device should only require the application to be down for one day at a time.
Fit Criterion	If an update is pushed, check to ensure application down time does not exceed 24 hours.
Dependencies	N/A

3.5.2 Supportability Requirements

N/A

3.5.3 Adaptability Requirements

Requirement No	NFR-21
Description	Product is expected to interface with Android and IOS mobile devices.
Fit Criterion	Using mobile devices running Android and IOS attempt to pair the device.
Dependencies	NFR-18

3.6 Security Requirements

3.6.1 Access Requirements

Requirement No	NFR-22
Description	• Nobody will have access to the signals being processed. Sounds should be processed and deleted in real time. • Any user will have access to the UI of the application but only developers will have access to the backend of the code.
Fit Criterion	Check that nobody has access to signals after processing is complete and ensure anybody has access to the UI.
Dependencies	N/A

3.6.2 Integrity Requirements

Requirement No	NFR-23
Description	The device will filter out redundant high frequency external noise in order to improve the integrity of our signal processing.
Fit Criterion	Reduce amplitude by 90% for all frequencies higher than 1/4 of sampling frequency (16kHz).
Dependencies	FR-1, FR-2, NFR-13, NFR-15

3.6.3 Privacy Requirements

Requirement No	NFR-24
Description	The product will protect the users right to privacy by not keeping a record of the data it takes in for the signal processing.
Fit Criterion	N/A
Dependencies	NFR-22

3.6.4 Audit Requirements

N/A

3.6.5 Immunity Requirements

N/A

3.7 Cultural Requirements

3.7.1 Cultural Requirements

Requirement No	NFR-25
Description	• ~~The product will only support English at launch but will strive to include more languages based on regions of purchase.~~ • The application and the device will both have zero references pertaining to religions, ethinic groups or any cultures.
Fit Criterion	Check that all buttons of the UI and the device correctly communicate back.
Dependencies	FR-2, FR-4

3.8 Legal Requirements

3.8.1 Legal Compliance Requirements

Requirement No	NFR-26
Description	The product will comply with all laws and regulations pertaining to regions where it is sold and distributed.
Fit Criterion	Take a law professional's opinion that the product follows all laws and regulations.
Dependencies	N/A

3.8.2 Standards Compliance Requirements

Requirement No	NFR-27
Description	Product will adhere to any Open License agreements.
Fit Criterion	Consult the license agreement to ensure no breach of license.
Dependencies	N/A

3.9 Health and Safety Requirements

Requirement No	NFR-28
Description	• Product will use certified batteries. • Product will use haptic feedback that is not intrusive to the user.
Fit Criterion	Check haptic feedback on a group study of people and ensure all batteries have been certified.
Dependencies	NFR-26

4 Monitor and Control Variables

Variables			
Monitored	Description	Controlled	Description
Pairing Command	Start the pairing process	Key Word Selection	Sound selection
External Sound	Monitor the incoming sounds	Haptic Feedback	Motor signals
User Selection	If device is active	Mode Selection	What mode is required

Table 2: Monitor and Control Variables

5 Traceability

5.1 Traceability Diagram

Requirement	Dependent Requirements	Requirements This Depends On
FR-1	FR-2, NFR-9, NFR-12, NFR-13, NFR-23	
FR-2	FR-5, NFR-9, NFR-11, NFR-23, NFR-25	FR-1, FR-3
FR-3	FR-2, NFR-4, NFR-25	
FR-4	FR-5, NFR-9	
FR-5	NFR-9, NFR-11	FR-2, FR-4
NFR-1	NFR-2, NFR-3, NFR-6	NFR-2
NFR-2	NFR-1, NFR-6, NFR-17	NFR-1
NFR-3	NFR-5, NFR-7, NFR-9	NFR-1, NFR-4
NFR-4	NFR-3	FR-3
NFR-5		NFR-3
NFR-6		NFR-1, NFR-2
NFR-7		NFR-3
NFR-8	NFR-9, NFR-18	
NFR-9	NFR-11, NFR-12, NFR-14	FR-1, FR-2, FR-4, FR-5, NFR-3, NFR-8
NFR-10		
NFR-11	NFR-13	FR-2, FR-5, NFR-9
NFR-12	NFR-16, NFR-17	FR-1, NFR-9
NFR-13	NFR-17, NFR-23	FR-1, NFR-11
NFR-14	NFR-15, NFR-18	NFR-9
NFR-15	NFR-18, NFR-23	NFR-14
NFR-16		NFR-12
NFR-17		NFR-12, NFR-13, NFR-1, NFR-2
NFR-18	NFR-21	NFR-8, NFR-14, NFR-15
NFR-19		
NFR-20		
NFR-21		NFR-18
NFR-22	NFR-24	
NFR-23		FR-1, FR-2, NFR-13, NFR-15
NFR-24		NFR-22
NFR-25		FR-2, FR-3
NFR-26	NFR-28	
NFR-27		
NFR-28		NFR-26

Figure 4: Traceability Diagram

5.2 Phase in Diagram

Requirement	Phase In Date	Priority ✓✓✓ | ✓✓ | ✓
FR-1	October 31st 2022	✓✓✓
FR-2	November 3rd 2022	✓✓✓
FR-3	December 2nd 2022	✓✓
FR-4	November 5th 2022	✓✓✓
FR-5	November 9th 2022	✓✓✓
NFR-1	January 24th 2022	✓✓
NFR-2	January 26th 2022	✓✓
NFR-3	February 10th 2022	✓✓
NFR-4	February 10th 2022	✓✓
NFR-5	March 1st 2022	✓
NFR-6	January 26th 2022	✓✓
NFR-7	March 1st 2022	✓✓
NFR-8	January 31st	✓✓✓
NFR-9	February 21st 2022	✓✓✓
NFR-10	March 1st 2022	✓
NFR-11	February 28th	✓✓✓
NFR-12	March 1st 2022	✓
NFR-13	February 17th 2022	✓✓
NFR-14	February 17th 2022	✓✓
NFR-15	March 10th	✓
NFR-16	N/A	✓
NFR-17	March 1st 2022	✓✓✓
NFR-18	March 1st 2022	✓✓✓
NFR-19	N/A	✓
NFR-20	N/A	✓
NFR-21	March 10th 2022	✓✓
NFR-22	March 1st 2022	✓✓✓
NFR-23	December 10th 2022	✓✓✓
NFR-24	March 1st 2022	✓
NFR-25	March 5th 2022	✓✓
NFR-26	October 31st 2022	✓✓✓
NFR-27	October 31st 2022	✓✓✓
NFR-28	November 11th 2022	✓✓

Figure 5: Phase in Diagram

The number of check marks within the Priority column in Figure 5 corresponds to the level

of priority. Three check marks has a higher priority than two, and two check marks has a higher priority than one check mark.

6 Project Issues

6.1 Requirements Likely/Unlikely to Change

- **FR** The functional requirements that were stated above are likely to remain the same as they are fundamental to the creation of the product. If any functional requirement happens to change, it would only be a slight deviation from the current requirements.
- **NFR-9** This non-functional requirement is likely to change as the processing time depends on the microcontroller we use. Ideally, we would use a high-speed microcontroller, however, cost and size are trade offs here. As a result, the processing times may change.
- **NFR-12** The battery life may vary according to the size and cost of the battery. Additionally, power consumption from the microcontroller will have to be considered when calculating the battery life. After further research into batteries and power consumption, will we be able to adjust this non-functional requirement to see if 12 hours of use is feasible.
- **NFR-14** this non-functional requirement may need to be adjusted to more or less keywords being ~~able to detect~~ detected. This is dependent on the size of memory the microcontroller has.
- **NFR-21** this non-functional requirement may be changed to only interface with ~~IOS~~ Android mobile devices as we have limited development time.

6.2 Off-the-Shelf Solutions

6.2.1 Ready-Made Products

- The Apple Watch contains a noise detection and alert function. The user can input specific sounds and the watch will notify the user if the noise is detected.
- The SoundWatch is another product which can detect sounds and notify the user when they are heard. The notifications come up on the watch to update users of heard sound.
- The Clarify wearable wristband, created by Neosensory, uses vibrations to notify users when a sound is detected.

6.2.2 Reusable Components

- Small scale motors
- Speech recognition library, for example Google's Speech application programming interface
- CNN model trained on speech recognition (pretrained weights included)
- Small scale microcontroller
- Small scale microphone
- Tutorial videos about how Java works, and how to improve user interface for application
- Gitlab, Github, Visual Studio Code are softwares that will help with creation and maintenance of code

6.2.3 Products That Can Be Copied

- Certain aspects and features of ready-made products within section Ready-Made Products will be considered as a guide to follow when developing the product.

6.3 Tasks

6.3.1 Project Planning

- The Life Cycle will take on the V-Model
- Development approach will utilize CI/CD Pipeline

6.3.2 Planning of the Development Phases

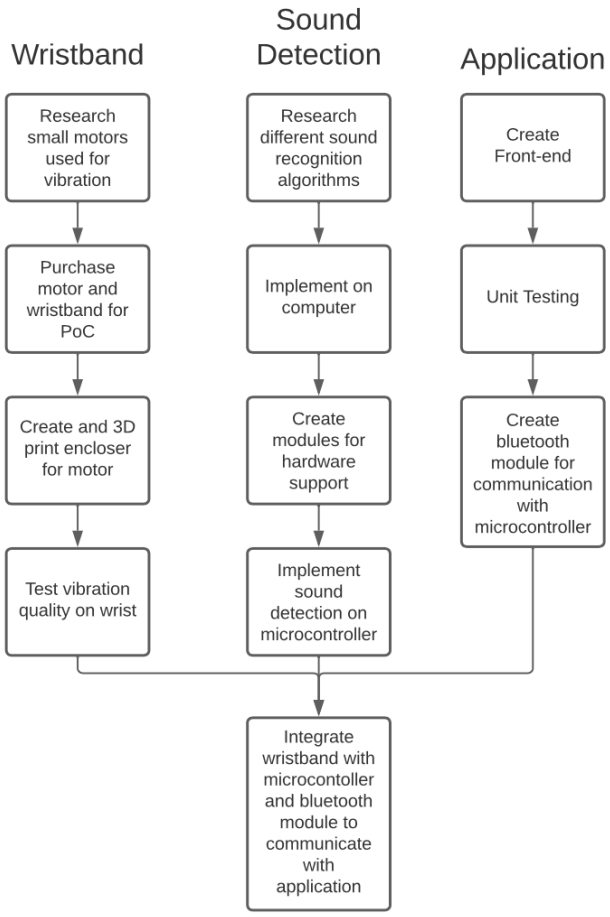

Figure 6: Tasks Diagram

6.4 Costs

Highlighted below are the cost estimates for the project's physical system. Avoidable costs are the environmental set up and software, this is due to universal resource availability.

Project Cost	
Description	Cost (in Canadian Dollars)
FLORA Arduino Microcontroller	14.95
SparkFun Analog MEMS Microphone	6.95
Tatoko DC Motor	25.04
Silicone Watch Strap	15.50
5V Battery	20.20
Memory Card Reader	6.94

Table 3: Project Cost

6.5 User Documentation and Training

Documentation of the features and user application of the product will be provided in written and video format enabled with a unique QR code, which will be provided in packaging of the product. Required training of the product will be needed to record initial sound detection. This is provided in the same user documentation used in the set-up stages.

6.6 Risks

- Inaccurate sound detection - retrain that particular sound with more training samples to increase accuracy of product
- Wrong vibration pulse - reselect how many pulses required for particular sound
- Incorrect application signals - reboot device and user application to re sync user settings

6.7 Future Developments

Future developments will be conducted in different versions, listed below are the corresponding order from version 1.0 - version 4.0.

- Double the microphones for improved sound detection
- Controlled vibration sensitivity through user application
- User LED display
- Compact design to fit in a wearable ring or necklace

References

- https://www11.informatik.uni-erlangen.de/Lehre/WS1718/SW-SYS3/SWE-in-der-Praxis-WINF/volere-template.pdf

Reflection Appendix

This section deals with what knowledge and experiences each team member will need to acquire so that the capstone project can be completed successfully. With that in mind, before identifying what each member is going to learn/master, some approaches of learning need to be established. Firstly, we believe that one of our main approaches to learning/mastering new skills is by scouring the internet for resources, videos, websites, blogs, or any other notable sources for relevant information. Another approach would be to look through books at McMaster's library to see if there is any applicable details that could be used for this project. Furthermore, one could also master their new skills via practice and trial-and-error by following tutorials and then trying to do them in real-time. Lastly, a final approach could be to find someone with relevant expertise and ask them for advice or some lessons on relevant skills/knowledge that would be beneficial for the project as a whole.

Jordan Bierbrier

The knowledge that Jordan needs to acquire during this project is signal processing within a microcontroller. This is a crucial step for the project because we need to filter the incoming noise and extract meaningful information from the sound. This knowledge is important for the future as many products and technologies include signal processing. In order to learn more about signal processing, Jordan will talk to experts within the field to learn more about the techniques that are implemented. For example, past professors have a wealth of knowledge and there is a lot they can teach. Meetings will have to be scheduled with professors to learn more about the topics. Additionally, reviewing their course content would also help enrich Jordan's knowledge of signal processing.

Azriel Gingoyon

The knowledge that Azriel needs to acquire for this project will be that of electrical circuitry and mechanical design. This is because he needs to be able to understand and learn of feasible, efficient, and effective ways to design the bracelet so that it can incorporate all of the necessary hardware for overall functionality while being non-intrusive for the user's comfortability. In terms of skills, it is most likely that he will need to become more proficient in CAD design, PCB design, circuit diagrams, and component research for cost-effective hardware to be used in the project.

In regards to approaches to acquiring said knowledge or mastering these skills, Azriel believes that the approach he should use is to scour the internet to learn more relevant information as well as do tutorials to improve applicable skills. This is because it is very effective to learn about new things from the web and its large databases of information. Furthermore, mastering skills can only be done through repetition and practice while continuously trying to learn new tricks/skills along the way.

Taranjit Lotey

Knowledge of object-orientated programming for application development
Will be utilizing the web to master skills needed to have a deployable application. Main focus will be on retaining information on certain functions and header files needed to create a user interface. Proxy communication will be required to communicate between the backend embedded system and frontend application.

Udeep Shah

One of my approaches would be to learn from the web through articles and research documents. The other is to learn from my teammates. For signal processing and filtering I would learn from research documents and web articles as these are more comprehensive and have a lot of detail for easy understanding of topics. For the writing aspect I would learn from my teammates as many of them have had to write requirements and technical documentation (software) that I have not done before. I select this approach as simply looking up on the web makes it a little too complicated in this case.

Abraham Taha

The knowledge that Abraham needs to acquire for this project will include signal processing, mobile application development and speech recognition algorithms. Being the only software engineering student on the team these skills will be essential to creating the Front-end software portion of the project. Furthermore, improving knowledge in speech recognition will be essential for the core requirement of capturing keywords out of a data stream of sounds. More specifically, working with the programming languages of Swift and Java as they pertain to developing mobile applications will also be a key part of creating the final product.

These skills will be acquired through numerous avenues. First off, Youtube tutorials will be the main method. Youtube has a vast amount of resources for differing knowledge levels. Other avenues will include forum sites such as StackOverflow, these types of websites are useful for debugging programs through community help. Finally, another methodology for learning these skills will come from taking advantage of the opportunities at McMaster. Speaking with different professors who have experience in these issues will be great resources as we complete this project.