
Requirements Document

Bluetooth Low Energy Tracker (BLU)

Version 1.0

Fei Hoffman

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The BLU Team:

Raquel Hernandez

John Pauly

Samantha Preciado

Luke Trinh

Nicholas Tsimerekis

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EXECUTIVE SUMMARY

BLU is a web application that registers and tracks a receiver through Bluetooth Low-Energy signals. The idea is that the signals will use triangulation to signal to a receiver. The web application will track the receiver and display the path the receiver took as well as the time it took to complete the path.

Most tracking devices utilize GPS tracking for various reasons whether to track a package or device. However, multiple factors can hinder the accuracy and connectivity of GPS such as thick walls, satellite geometry, atmospheric conditions, and so much more. Bluetooth provides the advantage of establishing accurate and reliable connectivity within indoor environments that would otherwise be inaccurate for normal satellites. Something like Bluetooth tracking has been done before, but not to the level of accessibility as BLU.

This Document will overview the stakeholder model for BLU. The stakeholder model will involve the stakeholders and their relationships with the application. The stakeholder model will also classify the responsibilities each member will have. After is the goal model which will go through the goals the application hopes to achieve through the context of system, storage, installation, and overall ability. There will be a diagram designed and agreed upon by the team which will detail and prioritize each function for the system. The system vision will combine the goals and stakeholders and contextualize the responsibilities and interactions between stakeholders, the system, and end users. Following the system vision are the use cases for the stakeholders utilizing the application. Next are the functional and nonfunctional requirements which will be defined in the context of the stakeholders and the use cases. Lastly is the conceptual database which will go over our relational database that is going to be used for BLU's main storage.

The ultimate goal of BLU is to create an accessible, accurate, and reliable way to track objects within an indoor environment. The idea of tracking objects in an indoor environment can provide many use cases such as detecting theft in a store, tracking objects within a storage unit, as well as documenting the history of imports and exports. The goal is to also encourage the usage of Bluetooth and the advantages they provide over GPS.

STAKEHOLDER MODEL

A stakeholder is defined as any individual, group, or organization with an interest in the outcomes of the BLU project, whose involvement plays a crucial role in shaping the project's requirements. Stakeholders, as depicted below (Figure 1), may engage directly with the project, interact with other stakeholders, or be indirectly affected by the project's success or failure. The Blu Team has identified four key categories of stakeholders, each representing a critical group whose involvement and influence are essential to the project's direction and ultimate success. These categories include :

1. End Users

This category encompasses all individuals and businesses that will utilize the BLU system for real-time indoor tracking. These stakeholders will provide feedback on features, usability, and functionality and require a user-friendly interface that offers accurate, reliable tracking along with secure data management for their private information. Their input is critical for refining the system to meet practical needs and improve user experience.

2. Developers

This category includes the developer, embedded systems engineer, database administrator, UX/UI designers, and project manager that are responsible for designing, implementing, maintaining and updating the BLU system. These stakeholders will focus on technical feasibility and performance of the system.

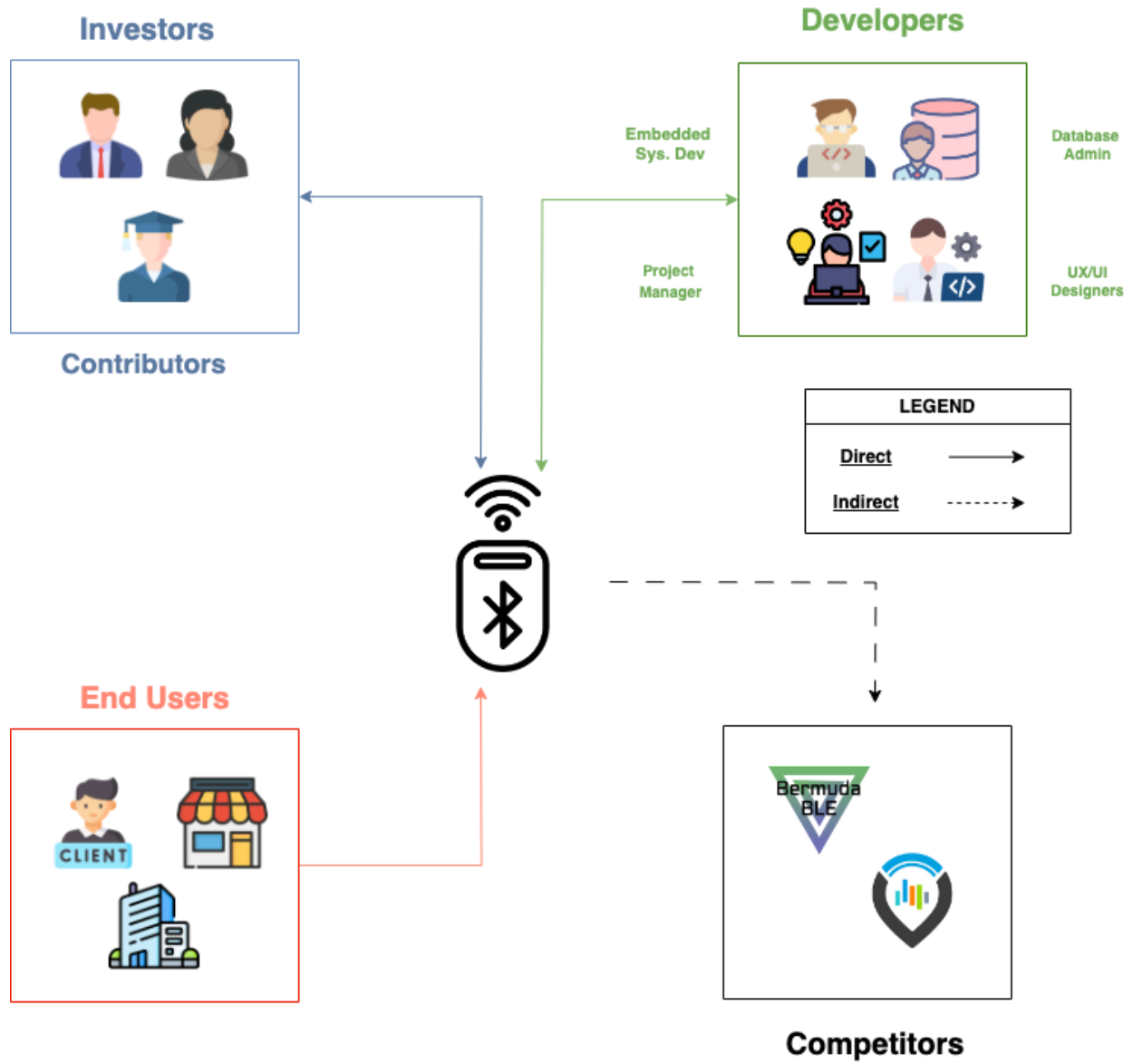
3. Investors or Contributors

This category consists of individuals or organizations that have provided funding for the project, as well as those in managerial roles responsible for key decision-making. Their primary focus is on guiding business strategies to ensure the project remains on schedule and meets its intended goals. These stakeholders assist in shaping the project's direction, offering input on budgeting, timelines, and feature prioritization. .

4. Competitors

This category includes competitors offering similar indoor tracking solutions. While they do not participate directly in the project, their presence influences development decisions related to differentiation and innovation. By analyzing competitors, the team can identify opportunities to distinguish this project in the market and create a unique value proposition.

Figure 1: Stakeholder Model



STAKEHOLDERS

Developers

Representative	Raquel Hernandez, John Pauly, Samantha Preciado, Luke Trinh, Nicholas Tsimerekis
Description	Responsible for building , maintaining and integrating the BLE Tracking system
Type(s)	Software Dev., Embedded Software Engineer, Project Manager, Database Admin, UX/UI Designers
Responsibilities	Design and develop core software and hardware components, ensure secure integration of BLE devices, test and debug systems, implement and manage database infrastructure, write and maintain technical documentation
Success Criteria	Success by developers yields a functional, stable, and secure system, delivered in a timely manner. System performance meets or exceeds benchmarks
Involvement	Handle the development and maintenance of software , database, and web application
Deliverables	A functional web application with reliable integration to the BLE system that returns all functionalities to the user

Investors

Representative	CSULB College of Engineering, Private investors
Description	Individuals or organizations with financial interest in the project
Responsibilities	Provide funding for the project, offer strategic advice and industry insights, support business growth and scaling
Success Criteria	Raise funding to support the necessary hardware for the initial BLE prototype
Involvement	Involved primarily in the planning and funding phases and provide feedback during project milestone
Deliverables	Monetary funding for the project , real time market insights

End Users

Representative	Clients: Individuals ,Organizations, Businesses
Description	Individuals or organizations who will use the BLE tracking system for real-time indoor tracking
Responsibilities	Provide feedback on usability, features, and performance. Engage with the product during beta testing and report any bugs, issues, or improvements
Success Criteria	High user satisfaction and retention. The web application is user friendly and provides seamless, accurate, real time tracking for all end users
Involvement	Involved during research, development, and post-launch by providing continuous feedback and insights for improvement.
Deliverables	Feature requests, bug reports, and ratings

Competitors

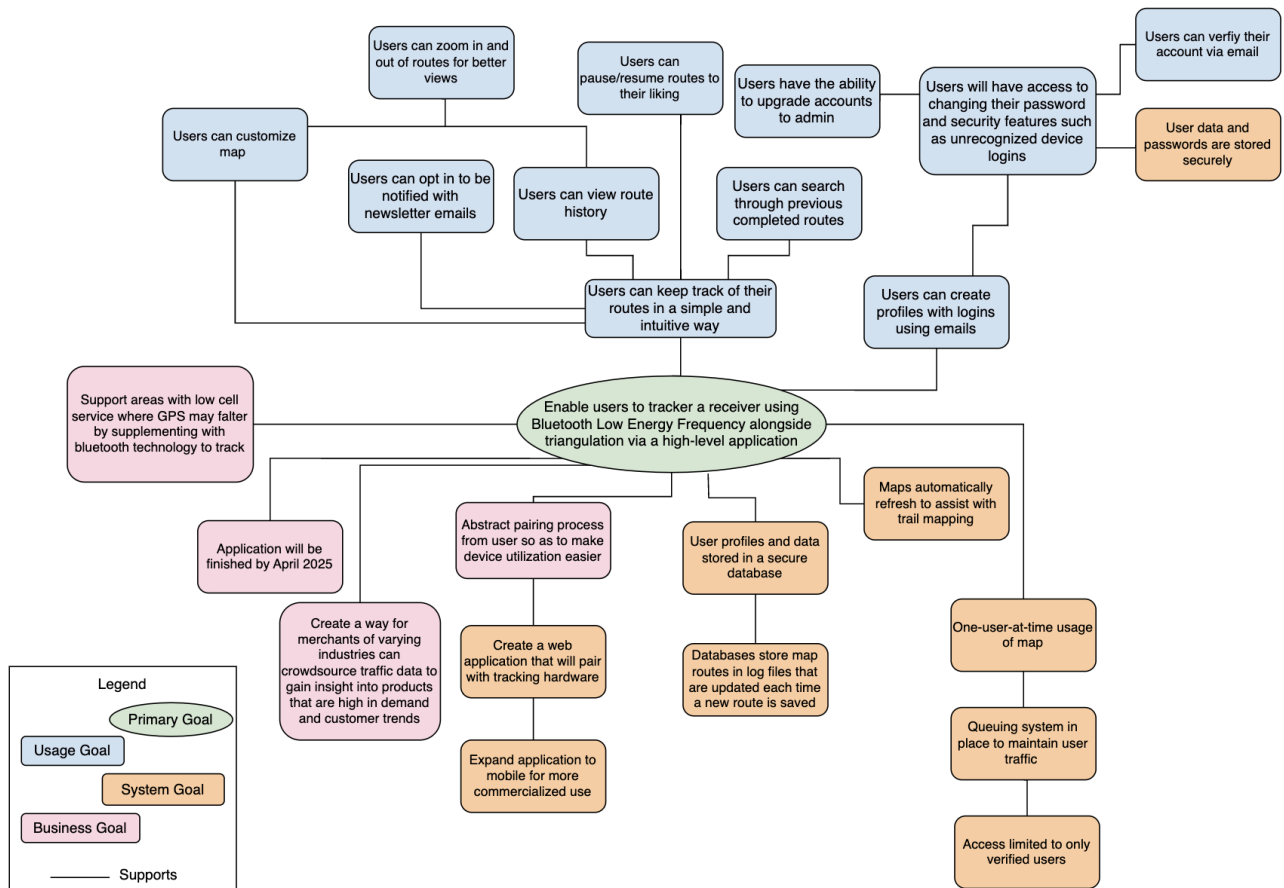
Representative	Bermuda BLE, inpixon, etc.
Description	Other companies or organizations offering similar BLE or indoor tracking solutions that indirectly impact the project by influencing innovation
Responsibilities	Provide alternate bluetooth low energy, tracking solutions
Success Criteria	The BLU system provides competitive differentiation through unique features as a part of their solution
Involvement	Monitoring during market analysis and used as a benchmark for innovation
Deliverables	A strategy for innovative solutions based off these competitors

GOAL MODEL

Through the goal model diagram (Figure 2), we will be able to define the specific motivation behind each implementation of our overall application. The goal model will guide us and future stakeholders with varying levels of technical knowledge, creating an easy way to mutually understand BLU's purpose. Additionally, the goals specified in the model will give us a way of portraying BLU from different points of view. The primary goal set by BLU is to enable users to track a receiver using Bluetooth Low Energy Frequency alongside triangulation via a high-level application, all made possible as follows:

- Usage Goals: any goals related to how users will be interacting with the application
- Business Goals: goals pertaining to the commercial use of the application
- System Goals: goals related to the implementation and performance of the application

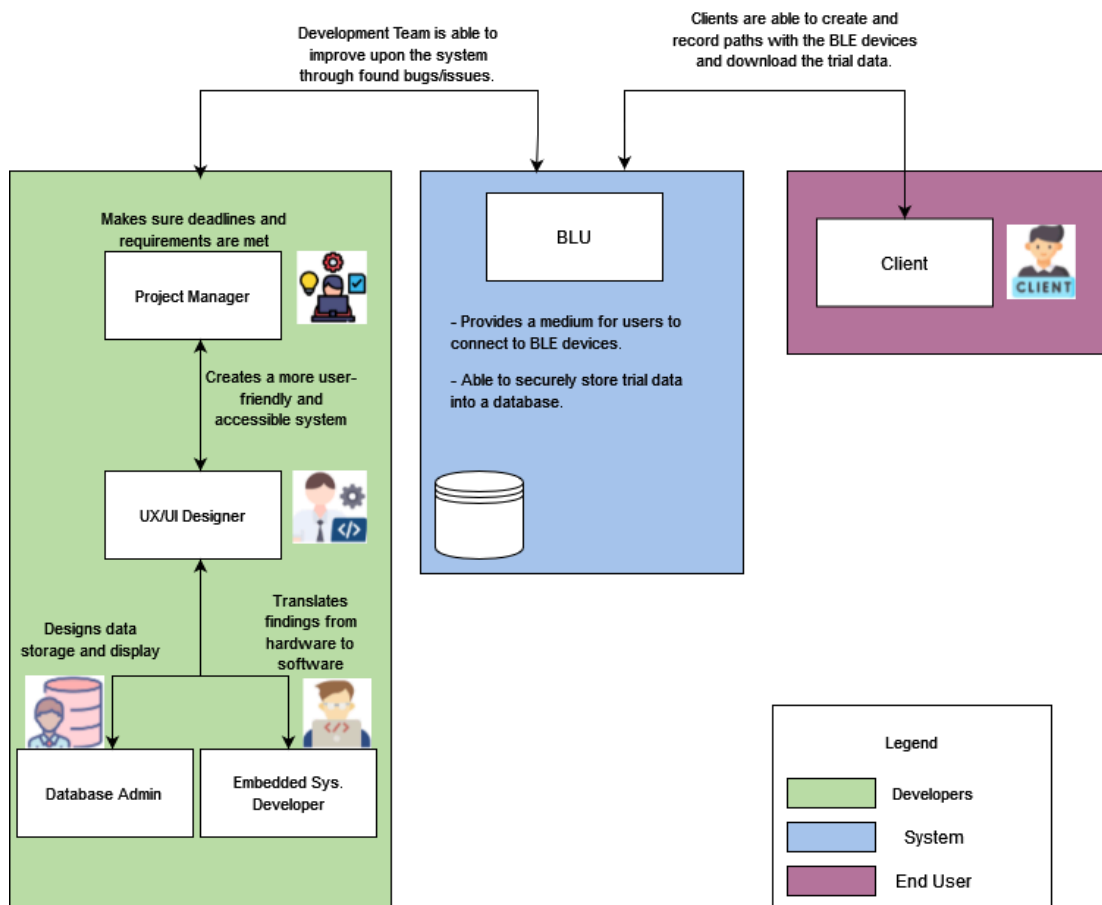
Figure 2: Goal Model



SYSTEM VISION

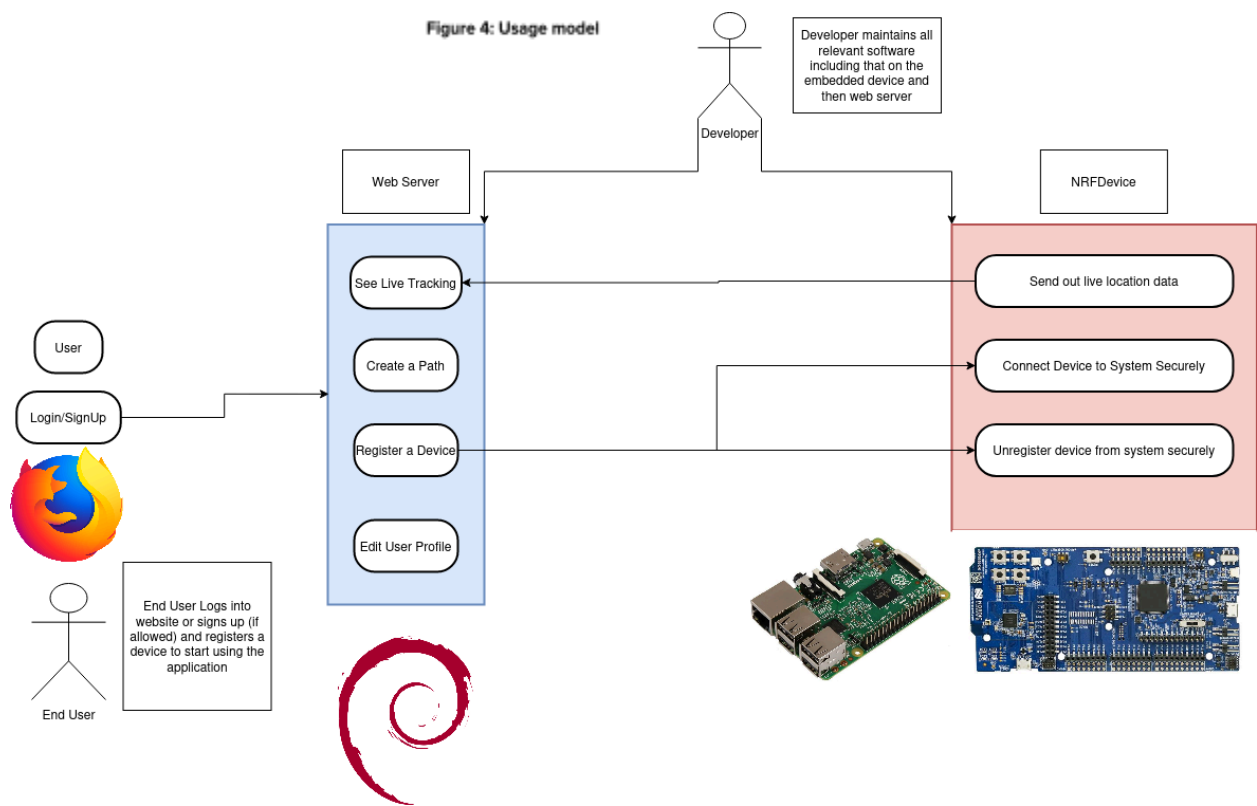
The System Vision (Figure 3) shows how the stakeholders interact with the system. The system is composed of 3 parts: The developers, the system itself, and the end user. The developers are split into multiple areas that are tasked with a specific area (deadlines, UI/UX design, database, and embedded systems). Their role is to provide updates and hotfixes to sudden issues/problems. The system provides a medium for the end users to register and track the receiver with the BLE devices. The user can also store the data in a database in the system.

Figure 3: System Vision



USAGE MODEL

The usage model (Figure 4) shows how users and other stakeholders will interact with our software suite. First, the implementing organization or user will have to set up the tracking apparatus infrastructure. Users can log into the system through a web portal, hosted on the main web server. Once logged in, the user can register a device to be tracked and do various tracking related things with that device. For example, the user can record a path that the device went through, or see how closely a device followed a path. These paths will be available to the user via export.



USE CASES

Use Case #1: User Logs In

Goal in Context	User accesses their personal portal to the application	
Scope & Level	Primary task	
Preconditions	User already has a registered account	
Success End Condition	User logs in and accesses their own account	
Failed End Condition	User is not able to log-in	
Primary, Secondary Actors	Primary actor: User Secondary actor: System	
Trigger	Login button is clicked	
DESCRIPTION	Step	Action
	1.	User clicks the login button upon launch
	2.	User types in their email
	3.	User types in their password
	4.	User accesses their account dashboard
EXTENSIONS	Step	Branching Action
	2a.	User types in wrong email and states email is not found, must create an account first
	3a.	User types in wrong password, must re-enter password
SUB-VARIATIONS	Step	Branching Action

	1.	User clicks login button
	2.	User clicks “forgot password”
	3.	User enters email in prompt
	4.	User is sent email to reset password with a link attached
	5.	User types in a new password
	6.	User successfully logs in to account
Related Information	Reset Password, Create Profile	
Priority:	High	
Performance	30 seconds	
Frequency	~500 times per day (depending how many users are using the application)	
Channels to actors	Database	
OPEN ISSUES	N/A	
Due Date	April 2025	
...any other management info	N/A	
Superordinates	Creating user profile	
Subordinates	Reset Password Update Profile Delete Profile	

Use Case #2: Pause Path Tracking

Goal in Context	User is able to stop tracking without completing a path	
Scope & Level	Primary task	
Preconditions	User has started a path	
Success End Condition	User's path stops and saves current position to database	
Failed End Condition	User's position is not saved or path is ended instead of paused	
Primary, Secondary Actors	Primary actor: User Secondary actor: Application	
Trigger	User clicks pause button	
DESCRIPTION	Step	Action
	1.	User clicks pause tracking button
	2.	Application displays paused message and current position
EXTENSIONS	Step	Branching Action
	2a.	Application displays "unable to pause tracking"
	2b.	Application displays that path cannot be paused because path is currently paused
SUB-VARIATIONS	N/A	
Related Information	Access map, Begin New Path , End Current Path, Set Points, Resume Path Tracking	
Priority:	Medium	
Performance	5 seconds	

Frequency	~50 times per day
Channels to actors	Database, Bluetooth Receiver
OPEN ISSUES	Will there be a limit to how many times a user can pause a path?
Due Date	April 2025
...any other management info	N/A
Superordinates	1, 4, 10
Subordinates	Resume Tracking, End Tracking

Use Case #3: Resume Path Tracking

Goal in Context	User is able to continue tracking a path after it has been paused	
Scope & Level	Primary task	
Preconditions	Path has been paused	
Success End Condition	System continues to track user's path	
Failed End Condition	System fails to track user's path and instead end's path tracking	
Primary, Secondary Actors	Primary actor: User, Secondary Actor: Application	
Trigger	User clicks resume path button	
DESCRIPTION	Step	Action
	1.	User clicks resume path button

	2.	System continues to display path tracking
EXTENSIONS	Step	Action
	2a.	System displays that path cannot continue due to connectivity issue
	2b.	System ends path
SUB-VARIATIONS	N/A	
Related Information	Pause Path, Begin New Path, End Current Path	
Priority:	Medium	
Performance	5 seconds	
Frequency	~50 times per day	
Channels to actors	Database, Bluetooth Receiver	
OPEN ISSUES	N/A	
Due Date	April 2025	
...any other management info	N/A	
Superordinates	User Login, Access Map, Begin New Path,	
Subordinates	N/A	

Use Case #4: Access Map

Goal in Context	Allow a user to access the map through the website
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Scope & Level	Primary Task	
Preconditions	Users have an account, no other user is using the map, Bluetooth device is connected	
Success End Condition	User can view the map once no other user is viewing it	
Failed End Condition	Map does not display on the website	
Primary, Secondary Actors	Primary actor: User Secondary actor: System	
Trigger	User is the first in the queue and no other user is using the map	
DESCRIPTION	Step	Action
	1.	The user enters the page via the queue
	2.	The map is displayed
	3.	The system connects to the user's data
	4.	The user interacts with the map by moving the tracker device
	5.	The system logs the movement data for the user.
EXTENSIONS	Step	Action
	4a.	The user will be returned to the home page if the website loses connection to the tracker device
SUB-VARIATIONS	Step	Branching Action
N/A		
Related	Use cases 2, 3, 10, 11, 12, 19, and 20	

Information	
Priority:	High, this is the main purpose for the application
Performance	5 seconds to load page, 1-2 seconds to update location
Frequency	One map access every 30 minutes, each access for 10 minutes
Channels to actors	Interactive
OPEN ISSUES	N/A
Due Date	May 2025
...any other management info	N/A
Superordinates	N/A
Subordinates	2, 3, 10, 11, 12, 13, 16, 17, 19, and 20

Use Case #5: Creating Profile

Goal in Context	User can create an account for the website and input necessary information
Scope & Level	Primary Function
Preconditions	User does not have an account
Success End Condition	User has a functional account, can log in, and access the map
Failed End Condition	User's information is not added to the database, user cannot log in
Primary, Secondary Actors	Primary actor: User Secondary actor: System

Trigger	User clicks on the Sign up button	
DESCRIPTION	Step	Action
	1.	The user inputs email address
	2.	The user inputs username
	3.	The user inputs password
	4.	The user reenters password
	5.	System checks all items for validity
	6.	User is given option to sign up for email notifications
	7.	User clicks create account and the information is added to database
	8.	User is given prompt to verify account via email
	9.	Once verified, user can log in with account information
EXTENSIONS	Step	Action
	5a.	Refreshes page with a message requesting unique email
	5b.	Refreshes page with a message requesting unique email
	5c.	Refreshes page with a message requesting a password with 10 characters or more
SUB-VARIATIONS		Branching Action
N/A		
Related	User Log in	

Information	
Priority:	High, all map data is stored based on account
Performance	10 minutes, including time to verify email
Frequency	Once per day
Channels to actors	Database
OPEN ISSUES	How will the system verify an account via email confirmation?
Due Date	March 2025
...any other management info	N/A
Superordinates	N/A
Subordinates	N/A

Use Case #6: Update Profile

Goal in Context	Allow user to update profile features on an account page
Scope & Level	Sub function
Preconditions	The user has created an account and is logged in
Success End Condition	The user's data is updated in the database and displays the changes
Failed End Condition	The user's data is not updated correctly
Primary, Secondary Actors	Primary actor: User Secondary actor: System

Trigger	The user presses the “save changes” button on the account page	
DESCRIPTION	Step	Action
	1.	User can input new username
	2.	User can opt out of email notifications
	3.	User can view and edit map data
	3.	User can submit changes by pressing a “save changes” button
	4.	Changes are made to database
EXTENSIONS	Step	Action
	3a.	The page will refresh a message describing any invalid changes
	3b.	If an inputted username is not unique, it will cancel changes.
SUB-VARIATIONS		Branching Action
N/A		
Related Information	N/A	
Priority:	High, accounts must be able to edit account information	
Performance	1-2 minutes	
Frequency	Once per day	
Channels to actors	Database	
OPEN ISSUES	N/A	

Due Date	May 2025
...any other management info	N/A
Superordinates	N/A
Subordinates	9, 15, 18

Use Case #7: Delete Profile

Goal in Context	User can delete their profile and all data is removed
Scope & Level	Sub function
Preconditions	The user must be logged into their account, the system must be ready to permanently delete data from storage
Success End Condition	The user has successfully removed their account, all data has been erased and the user has received a confirmation of deletion
Failed End Condition	The profile is not deleted, and data remains in the system. The user receives an error message indicating the deletion failed due to system errors or existing dependencies (ongoing tracking).
Primary, Secondary Actors	Primary: User : The individual who initiates the deletion of their profile Secondary: Database: The component responsible for storing and managing user data Data Admin: May be needed for manual intervention
Trigger	The user initiates the profile deletion process by selecting the "Delete Profile" option from their

	account settings	
DESCRIPTION	Step	Action
	1.	User navigates to account settings and selects the delete profile option
	2.	The system prompts the user to confirm action, warning that the data will be deleted permanently
	3.	The user confirms profile deletion
	4.	The system removes the user's profile data, including personal information, settings, and activity logs, from the database
	5.	The system confirms deletion to the user with a confirmation message
EXTENSIONS	Step	Action
	2.	When prompted, the user decides to cancel deletion and the profile remains intact
	4.	The system is unable to delete profile while there are ongoing actions, prompts the user to complete all processes
	5.	The system encounters an error when attempting to delete, logs the error, prompts the user to try again later
SUB-VARIATIONS	Step	Action
	2a.	The user is given a 30 day window to recover their profile before permanent deletion
	4a.	The system deletes some types of data first, but requires extra steps to delete more

		important information
Related Information	Creating profile	
Priority:	High	
Performance	2-3 minutes	
Frequency	~50 times per day	
Channels to actors	Database, User Profile	
OPEN ISSUES	Not all information is deleted; ghost data	
Due Date	May 2025	
...any other management info	N/A	
Superordinates	N/A	
Subordinates	N/A	

Use Case #8: Reset Password

Goal in Context	User is able to change their password
Scope & Level	Primary task
Preconditions	User must have an existing account
Success End Condition	User is able change their password and login successfully
Failed End Condition	User is unable to change their password

Primary, Secondary Actors	Primary Actor: User Secondary Actor: Application	
Trigger	User clicks forgot password button	
DESCRIPTION	Step	Action
	1.	User clicks forgot password button
	2.	User enters their email address
	3.	An email is sent to user's inbox with link to reset password
	4.	User enters new password
	5.	User is able to login to application with new password
EXTENSIONS	Step	Branching Action
	2a.	User enters an email address that is not registered/verified; user will be prompted to re-enter
	4a.	Password entered is invalid; user will be prompted to re-enter
SUB-VARIATIONS	Step	Branching Action
N/A		
Related Information	Create Profile, User Login	
Priority:	High	
Performance	30 seconds	
Frequency	~50 times per day	
Channels to	Database	

actors	
OPEN ISSUES	How many times can a user attempt to change their password until it is considered suspicious activity?
Due Date	April 2025
...any other management info	N/A
Superordinates	Create profile
Subordinates	User login, Update Profile, Delete Profile

Use Case #9: Access Previous Paths

Goal in Context	Allows the user to access all previous paths with a table, and search for specific paths by name	
Scope & Level	Primary Feature	
Preconditions	User has saved path files stored on the website	
Success End Condition	User can view all previous paths	
Failed End Condition	User can view only some of the saved paths, or only some of the details of the paths	
Primary, Secondary Actors	Primary Actor: User Secondary Actor: System	
Trigger	Opening the Update Profile page	
DESCRIPTION	Step	Action
	1.	Update Profile page fetches path data from user's account
	2.	Path data is displayed in a dropdown table, ordered by recency

EXTENSIONS	Step	Branching Action
	1a.	The user does not have any previous paths saved
SUB-VARIATIONS	Step	Branching Action
N/A		
Related Information	Update Profile	
Priority:	High, users must be able to view previous paths	
Performance	2 seconds	
Frequency	Once per 30 minutes	
Channels to actors	Database, interactable	
OPEN ISSUES	N/A	
Due Date	April 2025	
...any other management info	N/A	
Superordinates	6	
Subordinates	14, 15, 18	

Use Case #10: Begin New Path

Goal in Context	Allows the user to begin a path on the map
Scope & Level	Sub Feature
Preconditions	The user is on the map page
Success End	The map begins tracing the path

Condition		
Failed End Condition	The path cannot be traced on the map	
Primary, Secondary Actors	Primary actor: User Secondary actor: System	
Trigger	Pressing “New Path” button	
DESCRIPTION	Step	Action
	1.	The user presses the “New Path” button
	2.	The “New Path” button is disabled, and the “End Path” button is enabled
	3.	The system begins logging path information
	4.	The connected tracker device will begin sending location data to the map
	5.	The map will display the tracker’s path
EXTENSIONS	Step	Branching Action
N/A		
SUB-VARIATIONS	Step	Branching Action
	3a.	If the user closes disconnects from the webpage, the path will immediately end and the procedures from use case 10 will begin
Related Information	End Current Path	
Priority:	High, the map cannot be used without this feature	
Performance	2-3 seconds	
Frequency	Once per 5 minutes	

Channels to actors	Caching, Interactable
OPEN ISSUES	N/A
Due Date	April 2025
...any other management info	N/A
Superordinates	4
Subordinates	N/A

Use Case #11: End Current Path

Goal in Context	Allows the user to end the current path	
Scope & Level	Sub Feature	
Preconditions	A path has been started by the user	
Success End Condition	The map has been set to default and the path is loaded into a file which is stored under the user's account	
Failed End Condition	There are still items on the map, the path is not stored into a file under the user's account	
Primary, Secondary Actors	Primary Actor: User Secondary Actor: System	
Trigger	Pressing the "End Path" button	
DESCRIPTION	Step	Action
	1.	The user presses the "End Path" button
	2.	The path data is logged in a file under the user's account and stored in the database

	3.	The “End Path” button is disabled
	4.	The “New Path” button is enabled
EXTENSIONS	Step	Branching Action
N/A		
SUB-VARIATIONS	Step	Branching Action
N/A		
Related Information	Begin New Path	
Priority:	High, this use case is necessary to store path data	
Performance	3-5 seconds	
Frequency	Once per 5 minutes	
Channels to actors	Database	
OPEN ISSUES	N/A	
Due Date	April 2025	
...any other management info	N/A	
Superordinates	4	
Subordinates	N/A	

Use Case #12: Customize Path (Color-Coding Paths)

Goal in Context	Allow the user to customize the map in several ways using a customization menu	
Scope & Level	Sub Function	
Preconditions	The user is currently on the map	
Success End Condition	The map is customized to the user's satisfaction	
Failed End Condition	The map fails to change in appearance or functionality	
Primary, Secondary Actors	Primary Actor: User Secondary Actor: System	
Trigger	Opening the customization menu on the map page	
DESCRIPTION	Step	Action
	1.	User can set points on the map (see use case 16)
	2.	User can draw a preset path (see use case 17)
	3.	User can open a color wheel to change the colors of each figure on the map, as well as the outline and background
EXTENSIONS	Step	Branching Action
N/A		
SUB-VARIATIONS	Step	Branching Action
N/A		
Related Information	Set points, Preset path	
Priority:	Low, these are additional features that are not necessary for many users	

Performance	1 second
Frequency	Once every 30 seconds
Channels to actors	Caching, interactable
OPEN ISSUES	N/A
Due Date	May 2025
...any other management info	N/A
Superordinates	4
Subordinates	16, 17

Use Case #13: Pair Device(s)

Goal in Context	Allows user to connect a compatible tracking device	
Scope & Level	Primary Function	
Preconditions	User has a compatible tracking device with connection to internet	
Success End Condition	The device connects to the web server, and can be used track position on the map	
Failed End Condition	A compatible device fails to connect to the web server	
Primary, Secondary Actors	Primary Actor: User Secondary Actor: Admin, System	
Trigger	Internet connection from device to web server	
DESCRIPTION	Step	Action
	1.	Device connects to web server

	2.	Web server confirms device's compatibility
	3.	Admin confirms its connection to the map application
	4.	Web server sets the map to receive location data from the new device
EXTENSIONS	Step	Branching Action
	2a.	If the device is not compatible, the connection will be ended.
	3a.	If the Admin denies confirmation, the connection will be ended
	4a.	If the device is shut off while sending data, the map will go offline
SUB VARIATIONS	Step	Branching Action
	4a.	If there is already a device being used by the map application, it will be replaced by this device.
Related Information	N/A	
Priority:	High, the application is nonfunctional without this feature	
Performance	30 minutes including admin confirmation	
Frequency	Once per day	
Channels to actors	Internet connection, interactable	
OPEN ISSUES	N/A	
Due Date	March 2025	

...any other management info	N/A
Superordinates	4
Subordinates	N/A

Use Case #14: Download Paths

Goal in Context	Allows user to download path files from previous uses of the map	
Scope & Level	Primary Function	
Preconditions	The user has saved path files	
Success End Condition	Path files are successfully downloaded	
Failed End Condition	Path files cannot be downloaded	
Primary, Secondary Actors	Primary Actor: User Secondary Actor: System	
Trigger	Download link is clicked	
DESCRIPTION	Step	Action
	1.	User downloads a single path file to local device
	2.	User downloads all viewable path files to local device
EXTENSIONS	Step	Branching Action
	1a.	If logged in as admin, any path file in the database can be downloaded
SUB-VARIATIONS	Step	Branching Action

	2a.	If logged in as admin, the ability to download files is restricted to only files that belong to that account.
Related Information	Searching through saved paths	
Priority:	High, users should have access to downloading account data	
Performance	2 seconds to download each file	
Frequency	Once per 20 minutes	
Channels to actors	Database, interactable	
OPEN ISSUES	N/A	
Due Date	April 2025	
...any other management info	N/A	
Superordinates	9	
Subordinates	N/A	

Use Case #15: Sort Path History

Goal in Context	Allow user to sort logged path files by several different variables
Scope & Level	Sub Function
Preconditions	User has path files saved
Success End Condition	The user can sort path data by any of the given variables
Failed End	The path data cannot be sorted by the given variables

Condition		
Primary, Secondary Actors	Primary actor: User Secondary actor: System	
Trigger	Entering into the update profile page	
DESCRIPTION	Step	Action
	1.	The user can sort by total time
	2.	The user can sort by distance
	3.	The user can sort by number of points crossed
	4.	The user can sort by accuracy to preset path
	5.	The user can sort by date created
	6.	The user can sort by name
	7.	Each category can be sorted in ascending/descending order
EXTENSIONS	Step	Branching Action
N/A		
SUB-VARIATIONS	Step	Branching Action
	3a.	If there are no paths with points, the column will not be displayed and no sorting will be possible
	4a.	If there are not paths with preset paths, the column will not be displayed
Related Information	Delete path data	
Priority:	High, it is important that the user can view account	

	data in an organized fashion
Performance	>1 second to sort
Frequency	Once every 5 seconds
Channels to actors	Caching, interactable
OPEN ISSUES	N/A
Due Date	April 2025
...any other management info	N/A
Superordinates	9
Subordinates	N/A

Use Case #16: Set Points on Path

Goal in Context	Allow the user to place points on the map that change colors when crossed over on the tracker	
Scope & Level	Sub Function	
Preconditions	User is on the map	
Success End Condition	The points change color when crossed over	
Failed End Condition	The points do not change color or do not stay on the map	
Primary, Secondary Actors	Primary actor: User Secondary actor: System	
Trigger	Pressing “add points” button on map page	
DESCRIPTION	Step	Action

	1.	User is prompted to add points on the map
	2.	A point is drawn anywhere the user clicks on the map
	3.	The user finishes adding points by pressing a “confirm points” button
	4.	Whenever the tracker goes over a point, it changes color.
	5.	The user can remove all points by pressing a “remove points” button
EXTENSIONS	Step	Branching Action
	3a.	The points will be added to the path file once confirmed with a timestamp
	4a.	Crossed points will be logged in the path file
	5a.	The removal of the points will be logged to the path file with a timestamp
SUB-VARIATIONS	Step	Branching Action
N/A		
Related Information	Preset Path for User to Follow	
Priority:	Low, only some users will find this feature important	
Performance	30 seconds to place points, 1-2 seconds to update color when crossed	
Frequency	Once per 5 minutes	
Channels to actors	Web application, interactable	
OPEN ISSUES	Should there be a limit to the number of points a user	

	can draw?
Due Date	May 2025
...any other management info	N/A
Superordinates	4, 9
Subordinates	N/A

Use Case #17: Preset Path for User to Follow

Goal in Context	Allows user to draw a path for the tracker, calculates accuracy that the user followed the preset path	
Scope & Level	Sub function	
Preconditions	User is on map page	
Success End Condition	The webpage displays the correct accuracy to the preset path	
Failed End Condition	The webpage does not display the correct accuracy to the preset path	
Primary, Secondary Actors	Primary actor: User Secondary actor: System	
Trigger	Clicking “add preset path” button on map page	
DESCRIPTION	Step	Action
	1.	The user is prompted to draw a path on the map display
	2.	The user draws a single continuous line starting from the current position of the tracker using their mouse
	3.	a prompt appears asking for confirmation

		on the submitted path
	4.	Once confirmed, the path is displayed on the map
	5.	Accuracy score is displayed next to the map, and updates automatically
EXTENSIONS	Step	Branching Action
	4a.	The path can be removed at any time by pressing a “remove preset path” button
	5a.	Accuracy score will be saved in the path file
SUB-VARIATIONS	Step	Branching Action
Related Information	Set points	
Priority:	Low, this is additional function that will not be necessary for other features to work properly	
Performance	5 seconds to upload preset path, 1 second to update accuracy	
Frequency	Once per 30 minutes	
Channels to actors	Web application, interactive	
OPEN ISSUES	How will we measure accuracy to the path?	
Due Date	May 2025	
...any other management info	N/A	
Superordinates	4	
Subordinates	N/A	

Use Case #18: Delete Path Data

Goal in Context	Allows a user to view path data and delete any given path	
Scope & Level	Sub function	
Preconditions	User has saved path data	
Success End Condition	Path data is removed from database	
Failed End Condition	Path data is not removed from database	
Primary, Secondary Actors	Primary Actor: User Secondary Actor: System	
Trigger	User presses “save changes” button	
DESCRIPTION	Step	Action
	1.	User views path data in a table
	2.	User checks checkboxes next to any desired path files for deletion
	3.	User presses “save changes” button
	4.	System removes selected files from database
EXTENSIONS	Step	Branching Action
	4a.	Data was manually deleted between opening page and pressing save changes; no deletions will be made
SUB-VARIATIONS	Step	Branching Action
	1.	User submits other profile changes that are invalid, files are still deleted

Related Information	Delete profile, Update profile
Priority:	High, users should have control over their data.
Performance	5 seconds
Frequency	Once every week
Channels to actors	Database, interactable
OPEN ISSUES	N/A
Due Date	May 2025
...any other management info	N/A
Superordinates	6
Subordinates	15, 9

Use Case #19: Join Queue for Bluetooth Receiver

Goal in Context	User enters a queue to use the map feature
Scope & Level	Primary Task
Preconditions	A user is currently using the map
Success End Condition	The queued user enters the map once first in the queue and no user is using the map
Failed End Condition	The queue does not automatically enter into the map once it is available
Primary, Secondary Actors	Primary actor: User Secondary actor: System
Trigger	Attempting to access the map

DESCRIPTION	Step	Action
	1.	User enters queue page which displays position in queue
	2.	Queue position decrements live as other users leave queue
	3.	Once first in the queue, and the map is not being used, the user is sent to the map page.
EXTENSIONS	Step	Branching Action
N/A		
SUB-VARIATIONS	Step	Branching Action
	1.	User exits site page while queued
	2.	Other users behind in queue will have their positions updated
Related Information	N/A	
Priority:	High, multiple users cannot access the map at the same time	
Performance	Updates queue every in 5 seconds	
Frequency	Once per 5 minutes	
Channels to actors	Caching	
OPEN ISSUES	How will the queue be updated when as queued user leaves the page?	
Due Date	April 2025	
...any other	N/A	

management info	
Superordinates	N/A
Subordinates	N/A

Use Case #20: Alert User When Crossing Boundary

Goal in Context	Display a warning message if the tracker is leaving the map boundary	
Scope & Level	Sub function	
Preconditions	User is currently using the map	
Success End Condition	A message is displayed when the tracker crosses the boundary	
Failed End Condition	A message is displayed any time other than when crossing the boundary, or is not displayed when crossing	
Primary, Secondary Actors	Primary actor: User Secondary actor: System	
Trigger	Tracker crosses the boundary on the map	
DESCRIPTION	Step	Action
	1.	The website receives data that the tracker is located on or outside the boundary
	2.	A warning message is sent to the user on the web page
EXTENSIONS	Step	Branching Action
N/A		
SUB-VARIATIONS	Step	Branching Action

N/A		
Related Information	Connecting to Bluetooth device	
Priority:	High, the map will not work properly when the tracker is out of the boundary	
Performance	1-2 seconds	
Frequency	Once per 10 minutes	
Channels to actors		
OPEN ISSUES	How will the server log the position of the tracker while it is outside the boundary?	
Due Date	May 2025	
...any other management info	N/A	
Superordinates	4	
Subordinates	13	

FUNCTIONAL & NON-FUNCTIONAL REQUIREMENTS

Functional (Features)

- **Sign in/Sign up**
 - Users will be split up between clients and admins.
 - Admins are assigned and distributed on the backend. All admin accesses are restricted from normal users
- **Profiles**
 - Users can create their profile which will be part of their account creation.
 - Profiles will include basic information such as email, user name, linked devices, and trial history.
- **Device registration**
 - Users can register their Bluetooth devices and receivers through Bluetooth connection.
 - Device information will be stored in the profile and will be identified through the MAC address.
- **Path creation**
 - After setting up the devices, users will be able to set up trial runs where they record paths.
 - Users will be able to play, pause/resume, and stop recording the trial.
 - Play feature
 - Users will start their trial and a line will follow the Bluetooth receiver in real time.
 - Users will also be timed and see the timer until they choose to stop the trial.
 - Pause/Resume feature
 - Users will be able to pause the trial after they activate the play feature.
 - The pause will stop drawing and recording the path created by the receiver. It will also pause the timer.
 - After activating the resume feature, the path will resume to where the feature is currently and the timer will resume as well.
 - Stop feature
 - Users will be able to stop at any time after they activate the play feature.

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- The stop will prevent any further path creation as well as stop the timer.
 - The stop feature will also happen automatically if the receiver goes outside the boundaries of the Bluetooth receivers
 - The website will give the user the option of whether or not they want to save the trial data to the database. Yes will save the data to their profile and no will delete the path in its' entirety.
- **Customization**
 - Users will be able to set preferences and customizations to their path before they record their path.
 - Customizations include different path colors, highlighting, and setting checkpoints.
 - When setting checkpoints, the checkpoints will change colors when the receiver path crosses them.
 - **Search Previous paths**
 - Users will be able to view their previous trials through their profiles.
 - Users can filter and search for specific trials.
 - Trials will initially be organized by the time & date the user recorded the trial.
 - Users can filter and organize the paths based on the date and the amount of time the trial took.
 - **Downloadable data**
 - Users will have the option to download path data through their profile.
 - Users will receive data in the form of a CSV or JSON file.

Quality Requirements

- The website should be accessible and easy to follow by users
 - Sign-up should be simple for users to create a profile as well as being able to log in.
 - Overall website should be simple for users to be able to navigate from page to page.
 - Registering a device should be clear as to what the website needs to run trials.
 - Organizing, viewing, and downloading trial data should be straightforward and communicated to the client.
- The trial data should be accurate to what the user did.

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- The paths created by the receiver should stay accurate to how the receiver moved.
 - The path information should be able to be updated in real-time with no delays.
 - The website must be secure.
 - Sensitive information such as login information and trial data should only be accessible by the respective client or admin.
 - Access to the devices should only be by the user who registered them.

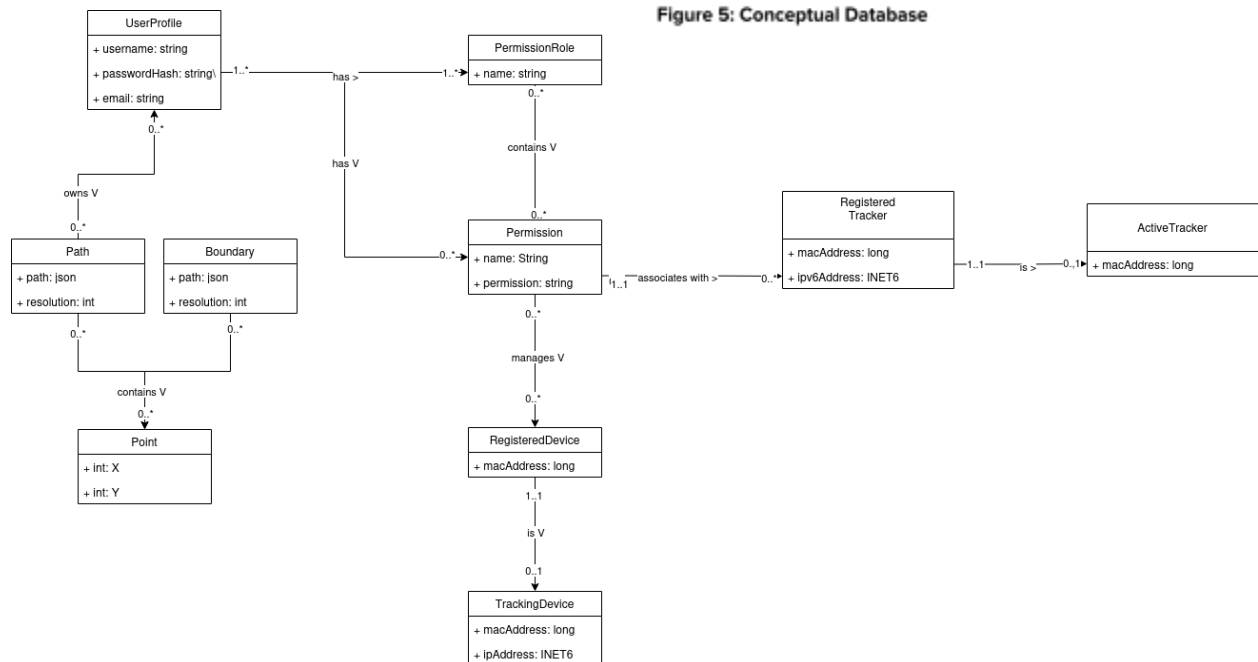
Constraints

- Financial needs
 - Initial financial investments in Bluetooth hardware such as the NRF boards, Raspberry Pis, etc.
 - Some services cost money to maintain such as databases (MariaDB) and an AWS server for emails (Terraform).
- Hardware constraints
 - Bluetooth connections will only stay accurate and consistent within a certain distance.

Development Process (Deadlines, deliverables)

- Complete all necessary documentation to note all resources needed.
- Purchase and set up all necessary hardware for the tracker
- Test and develop hardware to be able to track the receiver
- Develop a database to be able to store path data.
- Be able to communicate information to the web server
- Have the backend receive and process relevant data(location, time, etc.)
- Have the front end communicate with the back end to properly display information.
- Publish web applications and maintain web software.
- Release updates and hotfixes for further improvements.

CONCEPTUAL DATABASE



Entity	Relationship	Related Entities
UserProfile	Owns paths and has attached PermissionRoles and Permissions	Paths,PermissionRoles,Permissions
Path	Contains many points	User,Point
Boundary	Contains many points	Point
PermissionRoles	Associated with many permissions	User, Permission
Permission	Associated with many users and registered devices	User, Registered Device
RegisteredDevice	Is one active TrackingDevice	Permission, TrackingDevice
TrackingDevice	An active RegisteredDevice	RegisteredDevice
RegisteredTracker	A registered tracker for the backend	Permission, TrackingDevice
ActiveTracker	Is a single RegisteredTracker	RegisteredTracker