SUTD 2021 50.003 ESC Project Meeting 1 Report C3G7

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Project Description

Our project title is "**Mobile app for BLE and Wi-Fi mapping and testing for indoor tracking**" (Project 1) and our project name is **FindMyTag**. Our client is **UnaBiz**, a Singapore technology company specializing in the provision of cost-efficient Internet-of-Things (IoT) solutions. Indoor tracking can be achieved by using detection of BLE and Wi-Fi IDs and their respective signal strengths. The first step of deployment of this indoor tracking solution is to map the available Wi-Fi APs and Bluetooth tags IDs into a database of IDs and location. The next step would be to have a tool to test the accuracy of the mapping that has been done. For this project, functionality and performance are the two most important properties to be tested for the tools developed.

Our objectives for this project would be the following:

1. Conduct a research on popular methods for doing indoor tracking with BLE and Wi-Fi APs, as well as the different ways to interpolate the mapping data.
2. Develop a mobile app on Android which serves as the front-facing UI element for the customer to interact with.
3. Implement the various techniques on the mobile app to detect Wi-Fi APs and BLE signal strengths in an area and map the floor plan.
4. Develop a tool to test the accuracy of the mapped data.
5. Test and summarize the different methods of indoor tracking surveyed.

Our deliverables would be the following:

1. An Android mobile app that can map a floor plan with an accuracy of detection within 5 meters for a building with 2 floors and an area of at least 10000 square feet.
2. Source code of the developed tools.

Documentation of Use Cases

ID	**FindMyTag_UC_01**
Name	Area Mapping
Objectives	Accurately mapping the location on the phone and sending it to database to triangulate the location.
Pre-conditions	1. Phone must accurately map the location. 2. Phone must be able to send data to the database. 3. The various Wi-Fi APs must be up and available to connect to.
Post-conditions	Success: 1. Area mapping is successful, and the correct data is sent to the database. Failure: 1. Area mapping has failed to identify the locations. 2. Area mapping has succeeded but failed to send the data to the database.
Actors	Primary: 1. Wi-Fi APs 2. Mobile Application Secondary: 1. Database 2. User
Trigger	User presses the ‘Map’ button.
Normal Flow	1. User uploads the floor plan onto the database. 2. Once uploaded, the user may proceed to the starting location. 3. When ready, press the ‘Map’ button and move in a line through the doors. 4. The devices then sense the Wi-Fi signal strength from the different APs connected and conclude the location of the user using triangulation method. 5. The user can pause, choose to re-map or proceed to map it onto the floor plan. 6. A success message is shown to the user, prompting the user to continue. 7. The user may proceed to another area of the

	floor to continue mapping.
Alternative Flow	1. Mapping has failed and an error message is shown to the user on why it failed. a. Wi-Fi has failed to detect the location; use case concludes with error message and prompt to re-map. b. Uploading to database has failed; use case concludes with error message for user to temporarily keep data locally and fix the database.
Interacts With	Notify User, Data Collection, Wi-Fi and BLE Information Collection use cases.
Open Issues	1. How detailed should the error message be? a. Inform user ways to debug. b. Simple troubleshooting guide. 2. Will there be an admin and common user separation? a. Required if other users are expected to access the mapped data but cannot upload the data.

ID	**FindMyTag_UC_02**
Name	Data Collection for Database
Objectives	To collect and record the location data in a database.
Pre-conditions	1. Internet connection must be sufficiently strong. 2. The database must be connected to the internet and ready to receive the data. 3. Data must have been collected through the application.
Post-conditions	● Success 1. Places visited are recorded and can be checked any time. ● Failure 1. Location data collection is a failure. 2. Location data collection succeeded but information is not stored in the database.
Actors	Primary:

	1. Database 2. Mobile Application Secondary: 1. User 2. Wi-Fi APs
Trigger	User presses ‘Upload’ to send the data to the database.
Normal Flow	1. After mapping has been completed in the app, User presses the ‘Upload’ button. 2. The app does a primary check on if there is an existing local data before requesting a connection with the database. 3. The database authenticates the app before receiving the data from the app. 4. Data received is then prepared and put into the cloud function to determine the user location using the algorithm.
Alternative Flow	1. User is unable to connect to the internet; use case concludes with error notification to the user. 2. App is unable to contact the database; use case concludes with error notification to the user. 3. Database fails to authenticate the app; use case concludes with error notification to the user. 4. Database fails to receive the data from the app; use case concludes with error notification to the user.
Interacts With	Notify User, Area Mapping use cases.
Open Issues	1. How will the data be prepared for the cloud function after getting taken from the app? 2. How will we fetch the data stored locally after prior failed attempts?

ID	**FindMyTag_UC_03**
Name	Wi-Fi and BLE Information Collection
Objectives	Collecting location information using the Wi-Fi and BLE.
Pre-conditions	1. Wi-Fi and Bluetooth must be enabled. 2. Signal strength must be sufficiently strong.

Post-conditions	Wi-Fi or Bluetooth information collected upon request.
Actors	Primary: 1. Wi-Fi APs 2. BLE Beacons Secondary: 1. Mobile Application
Trigger	User presses the 'Map' function on the application.
Normal Flow	1. The Wi-Fi emitter or BLE beacon sends the signal to the device consistently. 2. The signal strength is then used by the device for mapping purposes.
Alternative Flow	1. One of the Wi-Fi or Bluetooth cannot be detected; use case concludes with slightly less accurate data collected.
Interacts With	Area Mapping use case.
Open Issues	1. (Alternative Flow 1) Might need an initial set-up to detect all possible Wi-Fi APs or beacons. 2. How will we troubleshoot the aforementioned issue?

ID	**FindMyTag_UC_04**
Name	Notify User
Objectives	From the collection of errors, pick out ones that suits the error that the user is facing.
Pre-conditions	An error has occurred in one of the use cases.
Post-conditions	Error has been rectified or the user can troubleshoot the issues.
Actors	Primary: 1. Mobile Application Secondary: 1. User 2. Database
Trigger	A connection error or data collection error in other activities has occurred.

Normal Flow	1. The activity that receives an error sends the error code to the overseer. 2. From the collection of error codes, a most suitable one is sent back to be displayed.
Alternative Flow	NIL
Interacts With	Area Mapping, Data Collection and Wi-Fi and BLE Information Collection use cases.
Open Issues	1. How will we further develop this use case?

ID	**FindMyTag_UC_05**
Name	Data Testing
Objectives	From the data collected in the prior use cases, test the accuracy of the data.
Pre-conditions	1. The collected data exists. 2. The data has been mapped.
Post-conditions	The data collected during mapping is accurate and usable.
Actors	Primary: 1. User 2. Mobile Application 3. Database Secondary: 1. Wi-Fi APs/BLE beacons
Trigger	The user presses the ‘Test’ button on the mobile application.
Normal Flow	1. The user presses the ‘Test’ button on the app. 2. Based on the Wi-Fi APs, the application fetches the floor plan from the database based on the initial estimated location. 3. The floor plan is then displayed on the mobile app, with a dot to indicate the user location. 4. The user can then choose to continue testing by pressing a ‘Next’ button to check his location at another spot. 5. The data collected is accurate and the testing concludes.

Alternative Flow	1. There is no initial data collected from Area Mapping use case; use case concludes with an error notification to the user. 2. The data collected is inaccurate; use case concludes, user can attempt to re-map the floor. 3. There is trouble fetching data from the database; use case concludes with an error notification to the user.
Interacts With	Notify User, Data Fetching, Wi-Fi and BLE Information Collection use cases.
Open Issues	1. Should we make it more user friendly by implementing extra buttons such as ‘re-map’ during the testing phase?

ID	**FindMyTag_UC_06**
Name	Data Fetching
Objectives	Fetch the data from the database and display onto the application.
Pre-conditions	1. There must be existing data in the database. 2. The application must be connected to the database.
Post-conditions	The data fetched from the database is accurately displayed on the application for the user to view.
Actors	Primary: 1. Mobile Application 2. Database Secondary: 1. User
Trigger	The user presses the ‘Test’ button on the mobile application.
Normal Flow	1. The user presses a button to try and pull the data from the database. 2. The application then collects the current location data and sends it to the database. 3. The database then proceeds to authenticate and send the data requested by the application. 4. Upon receiving the data, the application then displays the data onto the application for the

	user.
Alternative Flow	1. There is no initial data collected from Area Mapping use case; use case concludes with an error notification to the user. 2. There is trouble fetching data from the database; use case concludes with an error notification to the user.
Interacts With	Notify User, Data Testing use cases.
Open Issues	NIL

Clarification of Requirements

Our group has chosen to do project 1 and have hence managed to liaise with Mr. Calvin Foo from UnaBiz to clear our doubts with regards to the project. For the use case, we have determined that it would not be like a “safe entry checker” and that we should come up with a way to do a mapping of the chosen area while collecting the information produced when using Wi-Fi or Bluetooth Low Energy (BLE).

Between Wi-Fi and BLE, it was recommended to use Wi-Fi as Wi-Fi access points (AP) are more readily available as compared to BLE, which would require the usage of physical devices. With regards to how Wi-Fi could be used, we found out that since our phone would be able to detect the presence of Wi-Fi in the surrounding area, we would get able to get its SSID and the unique MAC address behind it. Since the Wi-Fi access points are stationary objects, the user’s phone would encounter different access points when moving around. By constantly collecting the IDs and determining the signal strengths of each access point, we would be able to determine the relative position with respect to that access point and hence determine the user’s general position in the area.

For assets that could be provided, we found out that UnaBiz has a battery-operated device that could be put onto objects that they would want to track. The function of the object would be to scan the surrounding area and capture all the RSSIs that it could find. As the object moves around with the device, a list of RSSI and MAC addresses would be stored onto the cloud, and these could then be used to triangulate the angle of the device based on the mapping previously done. In addition to the device, we have also learnt that UnaBiz has installed BLE access points around their own car parks for the purpose of user testing, and the area could also be made available to us if required.

For the testing requirements of the project, we managed to confirm that what is required is to check that the mapping done is accurate on the phone itself. The mapping would also have to be accurate at a 5m radius as we would be able to detect the signal and get location data at around a 50m radius. We have determined that in the accuracy aspect, only the RSSI and SSID would be usable for Wi-Fi and BLE as we would not be able to have a location that could potentially bounce off data.

Additionally, we also found out that the application is to be done through an active process. By active process, it would mean that it would not be a minute-by-minute passive location tracking, but it is only when the user opens the application and starts the scanning process would the tracking process be started.

All in all, features that our application should have includes a Wi-Fi and BLE mode for mapping and accurately displaying the user's location on a floor plan through a mapping process. In addition, the main concerns that our group has currently isolated through the discussion would be in three parts, "how to take the data through the application", "how to do the triangulation of the location", and "how accurate would the triangulation be".

These are some of the questions that we asked Mr. Calvin about:

Important questions asked	Answers by client
What will the mobile app be used for? What is the direction of the project?	The app is intended to be used to track people and assets. Since it is intended to be used indoors, we need to utilize Wi-Fi and BLE signals instead of using GPS. Our focus will be on tracking people. On the other hand, asset tracking will be done using the client's proprietary devices.
Since we need to consider data sources of both Wi-Fi and BLE, how do we intend to combine the data to get the output? Do we just average them?	Client suggested to focus on Wi-Fi instead of BLE data.
Is there any specific tech stack/programming language/SDK that you would require us to use?	No, it is up to the group to decide.
Any specific database that you would like to use?	No, but a cloud-based online database is preferred since the client intended to combine with their database of Wi-Fi/BLE data obtained from their own proprietary battery-operated devices. They intend to combine both database and the triangulation results to an online dashboard website.

How should we go about in handling the rate-limiting mechanism of Wi-Fi SSID scanning in Android devices?	We can either follow the rate limits of the Android app or we can utilize a version of Android below Android 8, which is not rate-limited. As a last resort, we could utilize the client's proprietary devices to get the data used for mapping.
Where should we go to test the Android mobile app?	Try to find a location with enough Wi-Fi APs (enough density to be able to construct the mapping data accurately). Alternatively, we can do the testing at Changi Airport since the client has conducted several tests there before in the past. As a last resort, the client has offered us to come to the parking area just outside their office to conduct the testing.
What should the app do when the app is turned off/closed?	Client informed us that active mapping is done only when the app is being opened. There is no need for a passive tracking feature to be done when the app is turned off/closed.

This is a summarised overview of our revised project requirements:

1. Two modes for the Android app:
    a. Mapping
    b. Testing
2. User story:
    a. User launches the app.
    b. User uploads the current floor plan to the database through the Android app.
    c. User selects the Mapping button to go to Mapping mode.
    d. User moves around the building specified by the floor plan with the Android app being actively run on the Android device to collect Wi-Fi Mapping data. Behind the scenes, the app sends the Mapping data to the cloud database and obtains the resulting triangulation output from the database. The database communicates with the cloud function, whose main job is to execute the triangulation algorithm on the input data.
    e. After the user has finished collecting the Mapping data, the user selects the Testing button to go to Testing mode.
    f. The user will be able to see and track where he/she is currently located relative to the floor plan on the Android app.

Process, Constraints and Risks

To determine the type of Software Development Process to use for our project, we need to weigh the advantages and disadvantages of using each development tool and decide accordingly to our expectation in developing this project. A few concerns to cover before heading into the selection for the software development process we will use:

- Lack of prior experiences with BLE and Wi-Fi tracking **(Constraint: Knowledge and Time)**
    - Expected to have lots of backtracking and re-planning.
    - A flexible schedule would be required to help us better adapt to the possible changes.
    - A development process that provides sufficient leeway to changes would be preferred.
- Rigorous testing of the accuracy of our algorithm and application **(Constraint: Time, Rejections and Restrictions)**
    - Expected to be the most time-consuming portion of our entire project.
    - This includes location planning that may or may not require time, depending on the suitability of each possible location.
    - In addition, a suitable location may deny us the required details to test our project due to the COVID-19 situation.
    - A development process that allows us to dedicate more time to testing would be favored.
- Fetching, sending and process data **(Constraint: Time, Knowledge, Security and Cost)**
    - One of the more tedious parts of the project.
    - Requires some flexibility that allows us to translate those data and display it in our application, and translate the data taken from our application to be stored on the database.
    - It may require more or less time than expected, hence if a less suitable development process is selected, it may result in a roadblock.

In addition, given the timeframe of about 3 months, and using the following software equation, it proves that we need a high manpower capacity as intended.

$$Effort = \left[\frac{Size}{Productivity \times Time^{4/3}}\right]^3 \times B$$

The above equation relies on the fact that size refers to the number of lines of code in the project, B refers to the scale of our project and time and effort have an inverse relationship. Given the short time span of three months, our group must pour in more effort into the project.

With our key concerns listed, we can see that there is a recurring emphasis on **time and knowledge**, which ties into the risks of the project. One of the major risks of this project comes from the unfamiliarity of working with Wi-Fi and BLE to map data. In a team of developers with no prior experience in working on a specific type of project, we can expect that there will be quite some time spent on learning, as well as a significant amount of time spent on debugging. Another big risk of this project is the selection of libraries to use. In choosing a library to work with, all team members must learn how to make efficient use of the library to help us in our software development. If an unsuitable library is chosen, the team might have to drop the current library and pick up a more suitable library, which wastes a lot of time and effort. Therefore, we need to plan our project timeline well and consistently check back to that timeline to ensure we can deliver our project on time.

Now that we have a clearer picture on the constraints and risks our project may have, we can weigh each software development methodology and decide which of the four methodologies is more suited to the needs of our project.

Software Development Life Cycle

Code-A-Bit-Test-A-Bit (CABTAB)

Advantages:

1. Allows us to focus on small pieces of features one at a time.
2. Every code functionality will be tested against its corresponding tests, thus ensuring a high guarantee that the functionalities are going to work.

Disadvantages:

1. Only feasible to be used for small-scale systems.

Conclusion: Not very suitable since our project has a moderate to large size and since we need to operate on a relatively short amount of time.

Waterfall Method

Advantages:

1. Clear picture of to-dos and the current state of our project.
2. Systematic way of planning the milestones each week.
3. Easy and quick to refer to when in any doubts or to check progress.

Disadvantages:

1. Inflexible to changes; if a change is required, the whole plan falls apart. Minor changes would lead to us restarting the whole workflow of software development stages, which is quite inefficient.
2. A project with large uncertainty at the start should avoid using this plan.

Conclusion: Not very suitable as it fails to cover all the key concerns we have regarding the project.

Rapid Prototyping

Advantages:

1. Ability to churn out the prototypes and implement changes in a short amount of time.
2. More time to test the accuracy of our algorithms and adapt to the changes in the next iteration of our application.
3. If a desirable solution is found, it will allow more time for fine tuning the application for secondary details such as UI, security, etc.
4. Constant feedback with the client allows us to understand the project better and would result in a more efficient development process.

Disadvantages:

1. Lack of familiarity with BLE and Wi-Fi tracking means that the very first prototype will take quite some time.
2. Requires constant communications with the client, which is not very viable as our client has many groups to entertain and will not have the time to join us for every prototype testing session.
3. Since we only have a limited amount of time, discarding a potentially viable prototype due to a change in requirements or other factors would imply a time wastage.
4. Rushing to churn out prototypes might lead to overlooking some of the project requirements during development.

Conclusion: A viable methodology to follow for our project. If chosen, requires some modifications to cover the aforementioned cons.

Iterative and Incremental

Advantages:

1. Good method to follow as every iteration of the software is tested.
2. Positive snowball effect where the good is carried over to the next iteration.

3. Final form of the project is the best work possible given the timeline.

Disadvantages:
1. Strict on the time-boxed cycles.
2. A missed deadline may result in a negative snowball effect.
3. Very likely to miss deadlines given the nature of the project and the current situation; lots of testing required, working in a team, conflicting schedules, restricted testing at certain suitable locations due to COVID-19, etc.

Conclusion: Might not be too suitable for our project which requires a lot of flexibility in production that the time-boxed cycle lacks.

Agile Method

Advantages:
1. Will have many working software prototypes given the timeline of the project.
2. Ensures that everyone working on the project is always on the ball on improving the project.
3. Consistent work leads into a routine for all team members.
4. Allows for changes to be made easily even during the development cycle and thus allowing us to deliver prototypes of better quality and higher fidelity.

Disadvantages:
1. No need for rapid delivery of useful working software prototypes, just project updates.
2. Will not be able to take full advantage of the use of this method.
    a. Requirements are likely fixed and unchanging for the duration of this project.
    b. Collaboration with the business side (client) would be likely weekly or bi-weekly.

Conclusion: Possible method to follow. Can be adjusted to more clearly meet our project needs and concerns.

After weighing each of the four methodologies against our project, we can foresee ourselves using the **Agile Method** or the **Rapid Prototyping** method with possible modifications made, since they complement each other by covering the other's disadvantages and since we need to operate on a very fast timeframe.

In the context of our project, adopting the aforementioned two SDLCs can be applied to the following areas to ensure completion within 3 months:

1. Regular weekly or bi-weekly review with the client on the progress of the functionalities of our mobile Android app, cloud database and cloud function.
2. Multiple user testing at a specified location (preferably SUTD) to ensure accuracy of the algorithm.
3. Planning our project properly, such as for database design and data formatting/structure.

Project Timeline and Distribution of Workload

Project Meeting 2

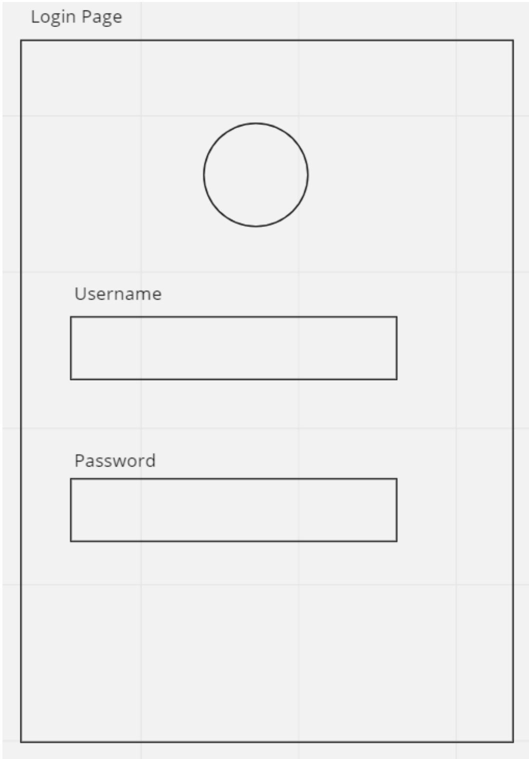
The main goal of project meeting 2 would be to come up with the foundation of the project. In the case of our project, we plan to come up with three important things, which is coming up with the initial user interface, setting up the database, and creating the basic database and application communication.

Initial User Interface

The basic layout of the user interface would be created. The application should currently contain a total of three pages which includes, the account authentication page, the mapping page, and the testing page.

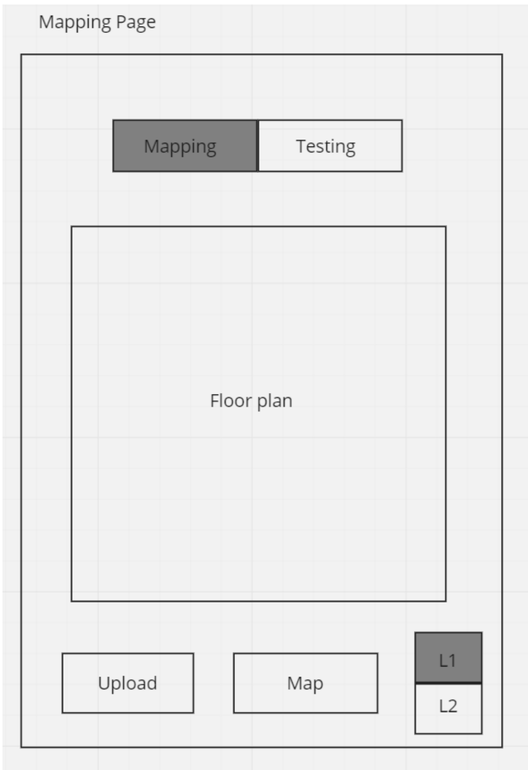
Account Authentication Page

This page would be used for users to log into their account so that all data collected would be collected under their account information.



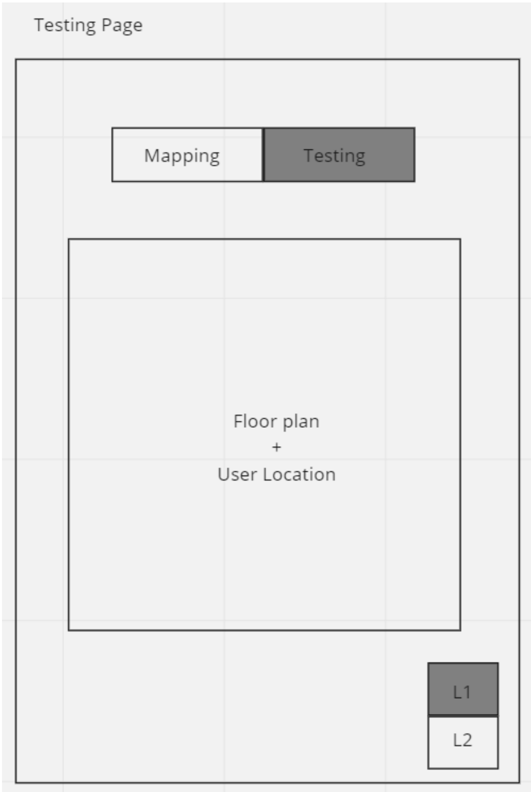
Mapping Page

This is the page where users would use to initially map their surroundings. There would be a button for users to upload the floor plan and a button for users to start the mapping process.



Testing Page

The testing page would be a simple layout that shows the floor plan and the user's location relative to the floor plan.



Basic Database

The database would first be created to hold the basic information that our application needs. We will be using Firebase, and thus our data will have a JSON-like structure. The structure of the database would look something like this:

```
{
  "user_id": "uuid",
  "username": "name",
  "floor_plan": "url_to_the_firebase_storage_image",
  "current_predicted_location": "some_data_here",
  "wifi_list": [
    {
      "ssid": "some_ssid",
      "signal_strength": 0,
      "location": "coordinate_against_floor_plan"
    },
    {
      "ssid": "another_ssid",
      "signal_strength": 1,
      "location": "some_other_coordinate_against_floor_plan"
    },
    ...
  ]
}
```

Project Meeting 3

The main goal of project meeting 3 would be to start adding and testing the functionality of the project. This would be done by creating the initial algorithm and the cloud function that holds the algorithm.

We plan to use a cloud function as we believe that the mobile application could potentially be swapped with tracking devices which would also have the same functionality, which would be detecting all the surrounding Wi-Fi SSID and RSSI and sending it to a central database. Therefore, by putting the calculation on the server side, we could potentially work with more applications of our project in the future.

The algorithm would be done in two parts, the first part would be to formulate an algorithm that maps the various access points on the floor plan. This would be done through the collection of Wi-Fi RSSI and creating a heatmap like structure to determine the signal strength at different distances.

The second part of the algorithm would be used to triangulate the user’s position relative to the provided floor plan. This would be done by getting the RSSI from the various Wi-Fi access points in our chosen location and use the signal strength from all surrounding access points to estimate where the user currently is.

Project Meeting 4

The main goal of project meeting 4 would be to finish up what was introduced in project meeting 3. This would be to complete the algorithm and cloud functionalities before linking everything up with the created user interface to come up with a full working prototype. At this stage, various testing of the algorithm and user interface should be done to ensure that everything is working as intended and if not, understand the underlying bugs that might be hindering our project.

Project Final Presentation

For the final project presentation, the project should be finished with all the underlying bugs eliminated. The user interface should also be polished and ready for use by users. In addition, the algorithm and cloud functionalities created should all be working in order. The application in general should also be properly linked up to ensure that all intended functionalities are working properly.

General Timeline & Distribution of Technical Workload

This is a summary of the features of our project ("**A**" indicates Android app-related features and "**C**" stands for cloud-related features):

No.	Project Features
A1	Upload floor plan file
A2	Switching between Mapping and Testing mode
A3	Send Mapping data to cloud database
A4	Receive output of triangulation algorithm from cloud
A5	Display heat map of the Mapping data or/and current location of the user relative to the floor plan
C1	Store floor plan, Mapping data and triangulation output data
C2	Communicate with the Cloud Function to send/receive data
C3	Actual algorithmic calculation from the input data

This is a summary of the timeline and distribution of technical workload for our project:

Tasks	PIC	Deadline	Comments
Read up on research papers about Wi-Fi mapping techniques	Everyone	W3, Thursday	
Learn about Cloud Functions	James, Harshit, Zen	W4, Monday	We will use Google Cloud Functions to deploy the algorithm.
Develop initial UI prototype for Android app's login page	Darren, Zen	W4, Friday	
Create the authentication feature for the login page	Harshit	W4, Friday	Use Firebase Authentication.
Create the functionality of receiving the list of Wi-Fi SSIDs from the Android device, along with their signal strengths	James	W4, Friday	
Choose a triangulation algorithm and start to work on its implementation	Harshit, Jiajie	W4, Friday	More algorithms could be considered in the future for comparison purposes if we have enough time.
Come up with plans for robustness testing, system testing and unit testing	Everyone	W5, Monday	
Set up and refine the Firebase database structure and design	James, Zen	W5, Sunday	Need to decide on the most efficient way to store and arrange the data.
Continue work on the main algorithm	Harshit, Jiajie	W6, Monday	
Develop initial UI prototype for the mapping and testing Activities for the Android app	Darren, James, Zen	W6, Monday	
Develop unit tests for the Android app	Darren, James	W6, Tuesday	
Discussion with client	Everyone	W6, Tuesday	Review with the client for necessary feedback and testing.
Project Meeting 2 Review	Everyone	W6,	

		Wednesday	
Continue work on the triangulation algorithm	Harshit, Jiajie	W8, Monday	
Finish developing the UI elements for the Android app	Darren, Zen	W8, Monday	
Discussion with client	Everyone	W8, Wednesday	
Start implementing and porting the algorithm onto the cloud function platform	Harshit, Jiajie	W8, Friday	
Develop unit tests for the database	James, Zen	W9, Monday	
Develop unit tests for the algorithm	Harshit, Jiajie	W9, Tuesday	
Project Meeting 3 Review	Everyone	W9, Wednesday	
Finish implementing and porting over the algorithm on the cloud function	Harshit, Jiajie	W9, Friday	With appropriate unit tests to verify that connection is working properly.
Discussion with client	Everyone	W10, Monday	
Develop integration tests between database and algorithm	James, Harshit, Garg	W10, Friday	
Develop integration tests between database and Android app	James, Darren, Zen	W11, Wednesday	
Conduct on-site physical testing to test for accuracy	Everyone	W11, Wednesday	Check against the 5-meters threshold and 2-storey building requirement.
Discussion with client	Everyone	W11, Thursday	
Project Meeting 4 Review	Everyone	W11, Friday	
Finish implementing integration tests	Everyone	W11, Friday	

Write up documentation	Everyone	W12, Wednesday	
Final debugging, testing and cleanup	Everyone	W12, Friday	
Final wrap-up with client	Everyone	W13, Monday	Tie up the last few loose ends, if any.
Final Project Presentation	Everyone	W13, Tuesday	