Software Requirements Specification

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Contents

1 Introduction

The software requirements specification (SRS) should aptly outline the functional requirements of the system to ensure that a third party could develop the functionality to a required degree without further input. Thus, the functional requirements should be precise and extensive to eliminate deviation from the systems goals.

1.1 Purpose

The intended audience of the application includes students of the University of Pretoria, the staff and simple visitors. NavUP can be used by new students who do not know their way around campuses yet, or simply by staff members who want to avoid clustered pathways. It is a tool that will help optimise campus navigation and reduce travel time from one destination to the other.

1.2 Scope

The NavUP system will help users to navigate campuses by allowing users to choose destinations, locate their current location, set up the appropriate path by taking into account human congestion and visually representing said path for the user to follow. NavUP will have a notifications system that will tell the user of events he/she might be interested in. An achievements system will also be in place to award users for walking certain distances or visiting certain locations. NavUP also hopes to incorporate locations with access for the disabled into its maps for those that are in need of such features. It will have a timetable feature that will allow users to create personalised timetables which the system could then use to help them get where they need to when they need to. The system will work offline but will lose some of its online features such as notifications for user interests. Users will also be able to broadcast their location so that others can see them on their maps.

1.3 Definitions, Acronyms and Abbreviations

CRUD	Create, Read, Update, Delete
GPS	Global Positioning System
NavUP	Navigation System for UP
SRS	System Requirements Specification
UP	University of Pretoria
WiFi	Technology for wireless local area networking

1.4 References

1.5 Overview

The SRS will help give a detailed representation of the functional requirements and how the elements of the system interact with eachother to achieve NavUp's purpose.

2 Overall Description

2.1 Product Perspective

The main system will be a server on campus that is connected to a database where user's details are stored such as degree, interests and timetable. The user will log into the main system by means of a user friendly GUI provided on the mobile application that sends the user's details to the server over the internet to look at the authenticity and correctness of the provided details. Thereafter the main system will load information about the user and populate the GUI with the relevant information based on the category of the current user be it a student or administrator. The application will then use wifi connections, cell phone towers and GPS to determine the user's position and then triangulate them to the destination class or activity based on these calculations. When administrators update the application or database through the server or the application itself it will notify the user and update the relevant information for the user, for example if a class is cancelled, it will update the user's timetable and notify the user of this update through the GUI as well as push notifications. The map of campus can be loaded onto the mobile application to reduce long term internet usage and only the destination and route to get there will be sent over the network.

2.2 Product Function

- Navigation from and to a location
- Store users timetable to automatically tell user where to go next
- View more information about a specific location
- See upcoming events when at a location or based on users interests
- Reward user for completing challenges
- Update user timetables if classes are cancelled or if there will be a test

2.3 User Characteristics

Four categories of users will be present:

- Guest user: Basic education level is needed as this user will just be making use of the navigation system and search system so a basic technical skill will be needed.
- Main user (student): This user has at least a high school level education and will be using more advanced parts of the system such as setting up a class timetable, looking at and competing in the reward system and managing their profile.
- Administrator / lecturer: This user has at least a high school level education and will need a more advanced technical knowledge as this user will be setting up events, cancelling classes and fixing or updating the system for other users.
- 3rd party Rewards manager: High school level education will be needed as more advanced tasks will be left up to this user such as set up challenges for the other users and include rewards if challenge is completed. An advanced technical knowledge will be needed by this user.

2.4 Constraints

This section describes restrictions on the options that are available when developing the application within feasable regions.

- Connections are limited to different types of networks at different locations. GPS cannot be used within buildings and some buildings lack a strong Wi-Fi signal. Mobile networks may also switch to EDGE in some buildings where faster connections aren't available.
- Application is initially constrained to Android and iOS only.
- Application is designed for approximately 30000 users at any given time which can be seen as a constraint on the number of active users the system can handle.
- The application can experience lengthy response times given that there is a constraint resulting from the capacity of the databases.

2.5 Assumptions and Dependencies

A major assumption of the NavUP system is related to mobile devices. The first assumption relating to this includes the idea that those who require the services rendered by the application will either have a mobile device or have access to one and have a general knowledge of how to use it. It is also assumed that every users mobile device will have enough memory and performance capabilities in order to run the application. Lastly, it is assumed that these devices will have GPS, WiFi and cellular connectivity capabilities built into the device.

3 Specific Requirements

This section expands on the functional requirements of the system. It gives a detailed description of the system and all of its use cases.

3.1 External Interface Requirements

This section provides a detailed description for each interface that composes the system along with other relevant information.

3.1.1 User Interface

- The user interface should initially be a login screen for first time users or logged out users. This login screen will also have the option for new users to register.
- Users should then be able to type in their preferred destination or search via an advanced search method to find a number of different places based on their search criteria.
- A results page will be in the form of a visual map which can be used interactively by the user to view his/her route clearly or to view other places of interest along the way.
- A settings page will be available for users to tweak the application to their needs as well as to update personal settings.

3.1.2 Hardware Interface

- Abstract interface via application and database infrastructure not visible to user.

3.1.3 Software Interface

- Application and GPS application communicate in order to receive geographical information.
- Application and database communicate in order to receive information about classes and desired locations.

3.1.4 Communication Interface

- No specific interface implemented. Communication is left to the underlying operating system of the application and portal/database.

3.2 Functional Requirements

This section includes all functional requirements in detail. It includes all use case diagrams, Actor-System interaction diagrams as well as a traceability matrix.

3.2.1 High Level Requirements

FR-1: The system should have basic navigation functionality

FR-2: The system should be able to provide and visualise information related to pedestrian traffic

FR-3: The system should be able to push new information to users based on their preferences and interests

FR-4: The system should integrate various activities that use location and movement

FR-5: The system should provide functionality to create, read, update and delete users

FR-6: The system should allow users to create and manage timetables

FR-7: The system should allow users to save and share locations

FR-8: The system should be able to allow users to manage events they are interested in on campus

3.2.2 Use cases

1. Navigation Subsystem

    1.1. Get current location

        i. **Description:** The NavUP system must be able to determine a users location at any point in time while the user is on the Hatfield campus. The location must be determined regardless of whether the user is indoors or outdoors.

        ii. **Precondition:** The user must have an active account and must be within range of WiFi routers.

        iii. **Postcondition:** The users location is determined and displayed.

    1.2. Search location

        i. **Description:** The NavUP system must provide functionality that enables a user to search for any location (lecture hall, dayhouse, restaurant) on the Hatfield Campus.

        ii. **Precondition:** The user must have an active account

iii. **Postcondition:** Matching locations are returned to the user. If no buildings match the search criteria, an appropriate error message is displayed.

1.3. View location details

i. **Description:** The NavUP system must allow users to view details related to specific locations. This could include restaurant menus, lecture hall timetable schedules as well as images of the buildings.

ii. **Precondition:** The user must have an active account and a valid location must be selected on the map.

iii. **Postcondition:** Relevant location details shown to user.

1.4. View places of interest

i. **Description:** The NavUP system must be able to display places of interests to a user based on their current location. This will include places like restaurants and day-houses that must be displayed in a list form.

ii. **Precondition:** The user must have an active account and their current location must be known.

iii. **Postcondition:** Relevant places of interest are listed and displayed to the user based on their location.

1.5. Navigate to location

i. **Description:** The NavUP system must be able to provide directions and navigate to a location given the users current location as well as a desired destination. The system should calculate the most optimal route by looking at the shortest path as well as pedestrian traffic.

ii. **Precondition:** The user must have an active account. The users current location must be known and the must have specified a destination through the search interface.

iii. **Postcondition:** The user is provided with directions from their current location to their desired destination.

1.6. Show pedestrian traffic

i. **Description:** The NavUP system must be able to display pedestrian traffic on campus in the form of a heatmap. When navigating to a specified location, the system must show traffic on that specific route. A user should also be able to view an overall heatmap of the campus to see traffic.

ii. **Precondition:** Users must all have the NavUP app installed and must be registered in order for them to show up on the heatmap.

iii. **Postcondition:** A heatmap of the campus is displayed.

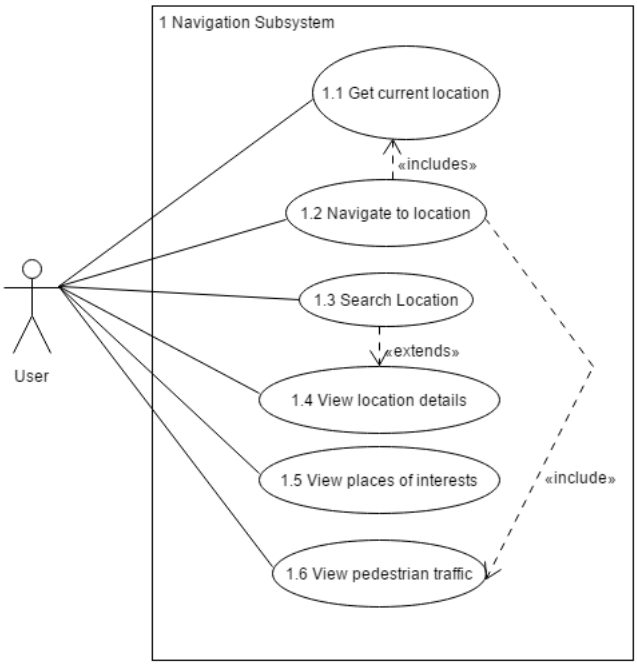

Figure 1: Navigation Subsystem

Table 1: Navigation Subsystem Traceability Matrix

		Use Cases					
Requirement	**Priority**	1.1	1.2	1.3	1.4	1.5	1.6
FR-1	1	X	X			X	X
FR-2	5						X
FR-3	7	X	X				
FR-4	8	X				X	
FR-5	2						
FR-6	4						
FR-7	3		X				
FR-8	6		X		X		
Use Case Priority		1	3	4	6	2	5

2. Location Management Subsystem

Table 2: Location Management Subsystem Traceability Matrix

		Use Cases				
Requirement	**Priority**	2.1	2.2	2.3	2.4	2.5
FR-1	1		X	X		X
FR-2	5					
FR-3	7	X				X
FR-4	8				X	
FR-5	2					
FR-6	4					
FR-7	3	X	X		X	
FR-8	6			X		
Use Case Priority		1	4	5	2	3

Table 3: User Account Management Subsystem Traceability Matrix

		Use Cases				
Requirement	**Priority**	**2.1**	**2.2**	**2.3**	**2.4**	**2.5**
FR-1	**1**					
FR-2	**5**					
FR-3	**7**					
FR-4	**8**					
FR-5	**2**	**X**	**X**	**X**		
FR-6	**4**				**X**	**X**
FR-7	**3**					
FR-8	**6**					
Use Case Priority		**1**	**2**	**3**	**4**	**5**

Table 4: Entertainment Subsystem Traceability Matrix

		Use Cases		
Requirement	**Priority**	**4.1**	**4.2**	**4.3**
FR-1	**1**	**X**		
FR-2	**5**			
FR-3	**7**			
FR-4	**8**			
FR-5	**2**			
FR-6	**4**			
FR-7	**3**		**X**	
FR-8	**6**	**X**	**X**	**X**
Use Case Priority		**1**	**2**	**3**

2.1. Save Location

i. **Description:** The NavUP system must be able to save a location that the user specifies.

ii. **Precondition:** User must be logged in if they want to save locations, and be in range of WiFi.

iii. **Postcondition:** A location will be saved to the users profile.

2.2. View Saved Location

i. **Description:** The NavUP system must allow users to view locations that the user has saved to their profile.

ii. **Precondition:** The user must be logged in and be in range of WiFi.

iii. **Postcondition:** None.

2.3. View History

i. **Description:** The NavUP system should be able to allow users to view their history of locations.

ii. **Precondition:** The user must be logged in and be in range of WiFi.

iii. **Postcondition:** None.

2.4. Share Location

i. **Description:** The NavUP system should provide the users with a means to share their current location so as to allow other users to know where they are.

ii. **Precondition:** The user must be logged in and be in range of WiFi.

iii. **Postcondition:** User location is broadcasted for other users to see.

2.5. View Most Visited Locations

i. **Description:** The NavUP system should have a favourite location section which can then be accessed by the user to view their most visited areas.

ii. **Precondition:** The user must be logged in and be in range of WiFi.

iii. **Postcondition:** None.

3. User Account Management Subsystem

3.1. Create Profile

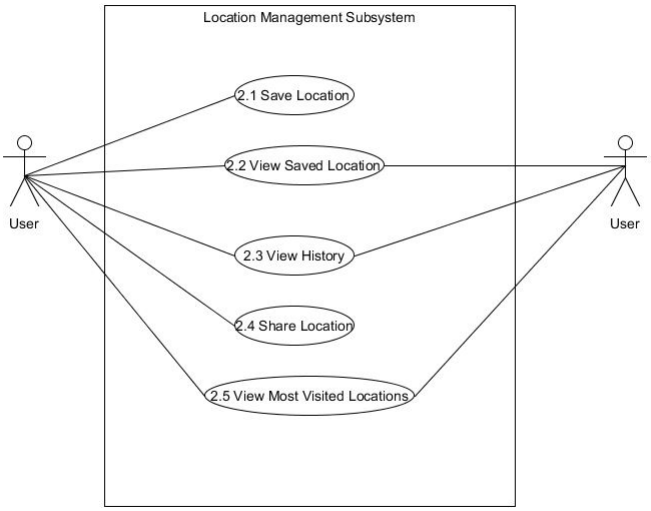

Figure 2: Location Management Subsystem

i. **Description:** The NavUP system must be able to provide the user with a means to create their profiles which will then allow them to login to the NavUP application.
ii. **Precondition:** User must be in range of WiFi.
iii. **Postcondition:** A new user account is created.

3.2. Login Function

i. **Description:** The NavUP system must allow users with a profile to be able to login to said profile and use the NavUP system to the fullest.
ii. **Precondition:** User must be in range of WiFi and have an existing NavUP account.
iii. **Postcondition:** User is logged in.

3.3. Manage Profile

i. **Description:** The NavUP system must allow users to manage their own profiles as well as allow administrators to keep track of user profiles.
ii. **Precondition:** User must be in range of WiFi and logged in. Admin has no precondition.
iii. **Postcondition:** User profile may be altererd.

3.4. Create Timetable

i. **Description:** The NavUP system should be able to allow users to create their personal timetables.

ii. **Precondition:** User must be in range of WiFi and logged in.

iii. **Postcondition:** Timetable is created on user's profile.

3.5. Manage Timetable

i. **Description:** The NavUP system must allow users to edit or manage their existing timetables so as to fit their needs. It must also allow administrators to keep track of the users timetable.

ii. **Precondition:** User must have existing timetable.

iii. **Postcondition:** Timetable is edited on the users profile.

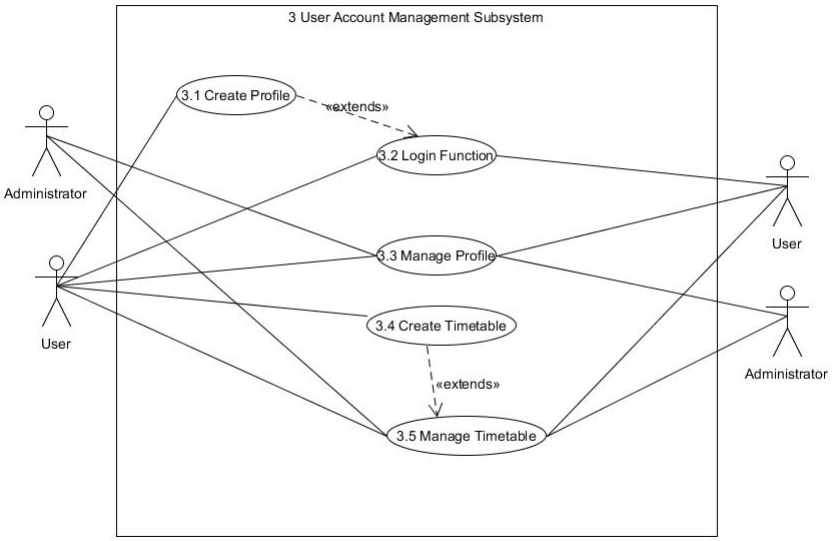

Figure 3: User Account Management Subsystem

4. Entertainment Subsystem

4.1. View events

i. **Description:** The NavUP system must enable users to view all events that are happening around campus in chronological order. The system should suggest events to a user based on their preferences and most visited locations.

ii. **Precondition:** The user must have an active account and must be logged in.

iii. **Postcondition:** Various campus-wide events are returned to the user.

4.2. Save event

i. **Description:** The NavUP system must enable users to save events that they are interested so that they can be viewed later.

ii. **Precondition:** The user must have an active account, must be logged in and there must be events available to save.

iii. **Postcondition:** An event is saved.

4.3. Delete event

i. **Description:** The NavUP system must enable a user to delete any saved events

ii. **Precondition:** The user must have an active account, must be logged in and must have saved events

iii. **Postcondition:** A saved event is deleted .

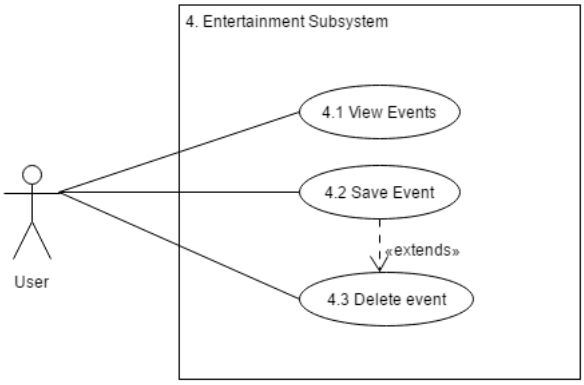

Figure 4: Navigation Subsystem

5. Achievements Subsystem

6. Administration Subsystem

3.3 Performance Requirements

Not relevant

Table 5: Achievements Subsystem Traceability Matrix

		Use Cases			
Requirement	Priority	5.1	5.2	5.3	5.4
FR-1	1				
FR-2	5				
FR-3	7	X	X		X
FR-4	8	X	X	X	X
FR-5	2				
FR-6	4				
FR-7	3			X	
FR-8	6				
Use Case Priority		2	3	1	3

Table 6: Administration Subsystem Traceability Matrix

		Use Cases			
Requirement	Priority	6.1	6.2	6.3	6.4
FR-1	1				
FR-2	5				
FR-3	7				X
FR-4	8		X		
FR-5	2	X			
FR-6	4			X	
FR-7	3		X		
FR-8	6			X	
Use Case Priority		2	1	3	1

3.4 Design Constraints

This section describes restrictions on design alternatives regarding standards and limitations of hardware capabilities

1. **Storage space**

    - **Description:** The amount of storage space required by the application must be within the maximum storage limits of a budget phone to accomodate a range of phones typically used by students.
    - **Maximum:** 90MB
    - **Reasonable:** 40MB
    - **Optimal:** 10MB.

2. **Memory usage**

    - **Description:** The amount of RAM used by the application should be a reasonable amount considering that some smartphones only have a capacity of 1GB RAM
    - **Maximum:** 150MB
    - **Reasonable:** 90MB
    - **Optimal:** 40MB.

3.5 Software System Attributes

This section describes all quality related requirements of the software system.

1. **Reliability**
   Description: The system should return results that are trustable and accurate

    - **Minimum:** 98% response and accuracy rate
    - **Reasonable:** 99% response and accuracy rate
    - **Optimal:** 100% response and accuracy rate

2. **Security**
   Description: The system must maintain encryption between system and server so that usernames and passwords remain confidential and database security is not compromised.

    - **Minimum:** 100% encryption and security rate
    - **Reasonable:** 100% encryption and security rate

- **Optimal:** 100% encryption and security rate

3. **Availability**
   Description: The system must be usable at any given time since it will be used by students during the day and possibly visitors for events during the night.
   - **Minimum:** 98% availability rate
   - **Reasonable:** 99% availability rate
   - **Optimal:** 100% availability rate

4. **Interoperability**
   Description: The system must have the ability to exchange and use data between the application and database effectively.
   - **Minimum:** 98% Interoperability rate
   - **Reasonable:** 99% Interoperability rate
   - **Optimal:** 100% Interoperability rate

3.6 Other Requirements

Not relevant