

# Software Requirements Specification for Software Engineering: subtitle describing software

Team #2, Campus Connections

Waseef Nayeem

Zihao Du

Matthew Miller

Firas Elayan

Abhiram Neelamraju

Michael Kim

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# Contents

<b>1</b>	<b>Purpose of the Project</b>	<b>vi</b>
1.1	User Business . . . . .	vi
1.2	Goals of the Project . . . . .	vi
<b>2</b>	<b>Stakeholders</b>	<b>vii</b>
2.1	Client . . . . .	vii
2.2	Customer . . . . .	vii
2.3	Other Stakeholders . . . . .	vii
2.4	Hands-On Users of the Project . . . . .	viii
2.5	Personas . . . . .	viii
2.6	Priorities Assigned to Users . . . . .	viii
2.7	User Participation . . . . .	viii
2.8	Maintenance Users and Service Technicians . . . . .	viii
<b>3</b>	<b>Mandated Constraints</b>	<b>viii</b>
3.1	Solution Constraints . . . . .	viii
3.2	Implementation Environment of the Current System . . . . .	viii
3.3	Partner or Collaborative Applications . . . . .	ix
3.4	Off-the-Shelf Software . . . . .	ix
3.5	Anticipated Workplace Environment . . . . .	ix
3.6	Schedule Constraints . . . . .	ix
3.7	Budget Constraints . . . . .	ix
3.8	Enterprise Constraints . . . . .	ix
<b>4</b>	<b>Naming Conventions and Terminology</b>	<b>x</b>
4.1	Glossary of All Terms, Including Acronyms, Used by Stakeholders involved in the Project . . . . .	x
<b>5</b>	<b>Relevant Facts And Assumptions</b>	<b>x</b>
5.1	Relevant Facts . . . . .	x
5.2	Business Rules . . . . .	x
5.3	Assumptions . . . . .	x
<b>6</b>	<b>The Scope of the Work</b>	<b>xi</b>
6.1	The Current Situation . . . . .	xi
6.2	The Context of the Work . . . . .	xii
6.3	Work Partitioning . . . . .	xiv

6.4	Specifying a Business Use Case (BUC)	xiv
<b>7</b>	<b>Business Data Model and Data Dictionary</b>	<b>xvi</b>
7.1	Business Data Model	xvi
7.2	Data Dictionary	xvi
<b>8</b>	<b>The Scope of the Product</b>	<b>xviii</b>
8.1	Product Boundary	xviii
8.2	Product Use Case Table	xviii
8.3	Individual Product Use Cases (PUC's)	xx
<b>9</b>	<b>Functional Requirements</b>	<b>xxv</b>
9.1	Functional Requirements	xxv
<b>10</b>	<b>Look and Feel Requirements</b>	<b>xxv</b>
10.1	Appearance Requirements	xxv
10.2	Style Requirements	xxv
<b>11</b>	<b>Usability and Humanity Requirements</b>	<b>xxv</b>
11.1	Ease of Use Requirements	xxv
11.2	Personalization and Internationalization Requirements	xxv
11.3	Learning Requirements	xxv
11.4	Understandability and Politeness Requirements	xxv
11.5	Accessibility Requirements	xxv
<b>12</b>	<b>Performance Requirements</b>	<b>xxvi</b>
12.1	Speed and Latency Requirements	xxvi
12.2	Safety-Critical Requirements	xxvi
12.3	Precision or Accuracy Requirements	xxvi
12.4	Robustness or Fault-Tolerance Requirements	xxvi
12.5	Capacity Requirements	xxvi
12.6	Scalability or Extensibility Requirements	xxvi
12.7	Longevity Requirements	xxvi
<b>13</b>	<b>Operational and Environmental Requirements</b>	<b>xxvi</b>
13.1	Expected Physical Environment	xxvi
13.2	Wider Environment Requirements	xxvii
13.3	Requirements for Interfacing with Adjacent Systems	xxvii
13.4	Productization Requirements	xxvii

13.5 Release Requirements . . . . .	xxvii
<b>14 Maintainability and Support Requirements</b>	<b>xxvii</b>
14.1 Maintenance Requirements . . . . .	xxvii
14.2 Supportability Requirements . . . . .	xxvii
14.3 Adaptability Requirements . . . . .	xxviii
<b>15 Security Requirements</b>	<b>xxviii</b>
15.1 Access Requirements . . . . .	xxviii
15.2 Integrity Requirements . . . . .	xxviii
15.3 Privacy Requirements . . . . .	xxviii
15.4 Audit Requirements . . . . .	xxix
15.5 Immunity Requirements . . . . .	xxix
<b>16 Cultural Requirements</b>	<b>xxix</b>
16.1 Cultural Requirements . . . . .	xxix
<b>17 Compliance Requirements</b>	<b>xxix</b>
17.1 Legal Requirements . . . . .	xxix
17.2 Standards Compliance Requirements . . . . .	xxix
<b>18 Open Issues</b>	<b>xxx</b>
<b>19 Off-the-Shelf Solutions</b>	<b>xxx</b>
19.1 Ready-Made Products . . . . .	xxx
19.2 Reusable Components . . . . .	xxx
19.3 Products That Can Be Copied . . . . .	xxx
<b>20 New Problems</b>	<b>xxxi</b>
20.1 Effects on the Current Environment . . . . .	xxxi
20.2 Effects on the Installed Systems . . . . .	xxxi
20.3 Potential User Problems . . . . .	xxxi
20.4 Limitations in the Anticipated Implementation Environment That May Inhibit the New Product . . . . .	xxxii
20.5 Follow-Up Problems . . . . .	xxxii
<b>21 Tasks</b>	<b>xxxii</b>
21.1 Project Planning . . . . .	xxxii
21.2 Planning of the Development Phases . . . . .	xxxiii

<b>22 Migration to the New Product</b>	<b>xxxiii</b>
22.1 Requirements for Migration to the New Product . . . . .	xxxiii
22.2 Data That Has to be Modified or Translated for the New System	xxxiii
<b>23 Costs</b>	<b>xxxiii</b>
<b>24 User Documentation and Training</b>	<b>xxxiv</b>
24.1 User Documentation Requirements . . . . .	xxxiv
24.2 Training Requirements . . . . .	xxxiv
<b>25 Waiting Room</b>	<b>xxxiv</b>
<b>26 Ideas for Solution</b>	<b>xxxiv</b>

## Revision History

Date	Developer(s)	Change
Oct 2	Zihao Du	Add Section 6, 7, 8 Revision 0
Oct 2	Matthew Miller	Add Section 1, 5, 13, 16 Revision 0
Oct 2	Michael Kim	Add Section 15 Revision 0
Oct 2	Waseef Nayeem	Add Section 3, 19 Revision 0

# 1 Purpose of the Project

## 1.1 User Business

The project being outlined in this document is an social media application with location-specific features for McMaster University to allow the university's students to connect with each other. The project will allow for interaction between users, in addition to allowing users to find information on different parts of the main campus of McMaster University, including on-campus events and room availability in buildings.

## 1.2 Goals of the Project

- 1.1 **Accurate Data Collection** The product must collect location and directional data to accurately ascertain the position of the user in the building and campus. This will allow the user to interact with the system and other users of the product to enhance social interactions. The error of data must be less than 5
- 1.2 **Ease of Use** The product must be user friendly and convenient to use, as many university applications are not used or underused due to the complexity and difficult operation. The end user must be able to easily download and learn the application without external guidance. At least 90
- 1.3 **Availability** The product must be able to support its users unless there is a planned maintenance or external failures. This is important as the product is using real-time data and significant delays or down-times will impact the accuracy and usability of the product.
- 1.4 **Reliable Data Communication** The product must have good and secure data communication to support the real-time nature of the product. This is important as the product is using real-time data and significant delays will impact the accuracy and usability of the product. The product must be able to provide the desired output within 5 seconds with good university WiFi connection.
- 1.5 **Protection of Personal Information** The product must keep all personal data provided by users secure in the database. Personal data

will be collected securely and only used for product functions. The application must support the removal of user data upon request. This is important because users will complete a consent form that acknowledges their privacy.

**1.6 User Communication** The product must be able to support user-to-user communication. It should provide a friend system for users to add new friends, send messages and emojis to friends and share current location and status (in lecture/event or free) with their friends. This is important because the main purpose of the project is to allow users to connect with peers effectively.

**1.7 Interactable Campus Buildings** The product must be able to provide interactions between users and campus buildings. It must show the availability of the lecture halls and information about ongoing events in a building since one of the purposes of the project is to help users utilize campus resources effectively.

**1.8 Immersive User Experience** The product should provide an immersive user experience to the users with some XR technologies. At least 90% should find the product much more attractive and immersive than other university applications when conducting the user survey. An immersive user experience is one of the unique selling points of our product.

## 2 Stakeholders

### 2.1 Client

*Insert your content here.*

### 2.2 Customer

*Insert your content here.*

### 2.3 Other Stakeholders

*Insert your content here.*



## 2.4 Hands-On Users of the Project

*Insert your content here.*

## 2.5 Personas

*Insert your content here.*

## 2.6 Priorities Assigned to Users

*Insert your content here.*

## 2.7 User Participation

*Insert your content here.*

## 2.8 Maintenance Users and Service Technicians

*Insert your content here.*

# 3 Mandated Constraints

## 3.1 Solution Constraints

- **Description:** The product shall be a mobile application.  
**Rationale:** A mobile application is the most feasible option for the anticipated user environment.  
**Fit Criterion:** The produced application can successfully be installed and run on modern mobile devices.

*Insert your content here.*

## 3.2 Implementation Environment of the Current System

- Modern mobile operating systems.
- Hardware sensors for telemetry data capture.

- Hardware device for visual data capture.
- Network/Internet interface.
- Variable external physical environment.

### **3.3 Partner or Collaborative Applications**

N/A

### **3.4 Off-the-Shelf Software**

N/A

### **3.5 Anticipated Workplace Environment**

- The product shall be used on the campus of McMaster University.
- The product shall be used under various lighting conditions.
- The product shall be used inside buildings as well as outdoors.

### **3.6 Schedule Constraints**

- The proof-of-concept shall be ready to demonstrate by Nov. 13-24, 2023.
- Revision 0 shall be complete and demonstrated by Feb. 5-16, 2024.
- The final product shall be complete and demonstrated by Mar 18-29, 2024.

### **3.7 Budget Constraints**

- The project budget must not exceed \$750 CAD. The sole source of any funding shall be the team itself.

### **3.8 Enterprise Constraints**

N/A

## 4 Naming Conventions and Terminology

### 4.1 Glossary of All Terms, Including Acronyms, Used by Stakeholders involved in the Project

Term	Definition
Campus Connections	Campus Connections is the name of the company the capstone project team runs and the name of the application
Extended reality (XR)	AR technology combines the physical world with a "digital twin world" able to interact with it
OSCARplus	OSCARplus is an appointment, registration and job posting system for McMaster students and alumni
Unified Model Language (UML) diagram	UML diagram is a graphical notation used to construct and visualize object oriented system
Personal Identification Information (PII)	Personal data that could potentially identify a specific individual
Unity	Unity is a cross-platform game engine developed by Unity Technologies

Table 1: Naming Conventions and Terminology

## 5 Relevant Facts And Assumptions

### 5.1 Relevant Facts

- The two main platforms for AR are ARKit by Apple for Apple devices, and ARCore by Google for Android devices

### 5.2 Business Rules

- 

### 5.3 Assumptions

-

## **6 The Scope of the Work**

### **6.1 The Current Situation**

Currently, students do not have effective ways to connect with peers of same interest and resources available on campus. One of the most accessible tools for students to utilize campus resources is OSCARplus. However it is for McMaster students and Alumni only, and does not support interactions between users – users cannot see if their friends and classmates are joining the events nor send/read comments from others.

As for room availability information, there is no official management system for visitors and students. Students always occupy empty rooms their found to meet with friends and classmates. Due to poor management and messy process, it is usually very difficult to find an appropriate place for team discussion and club events.

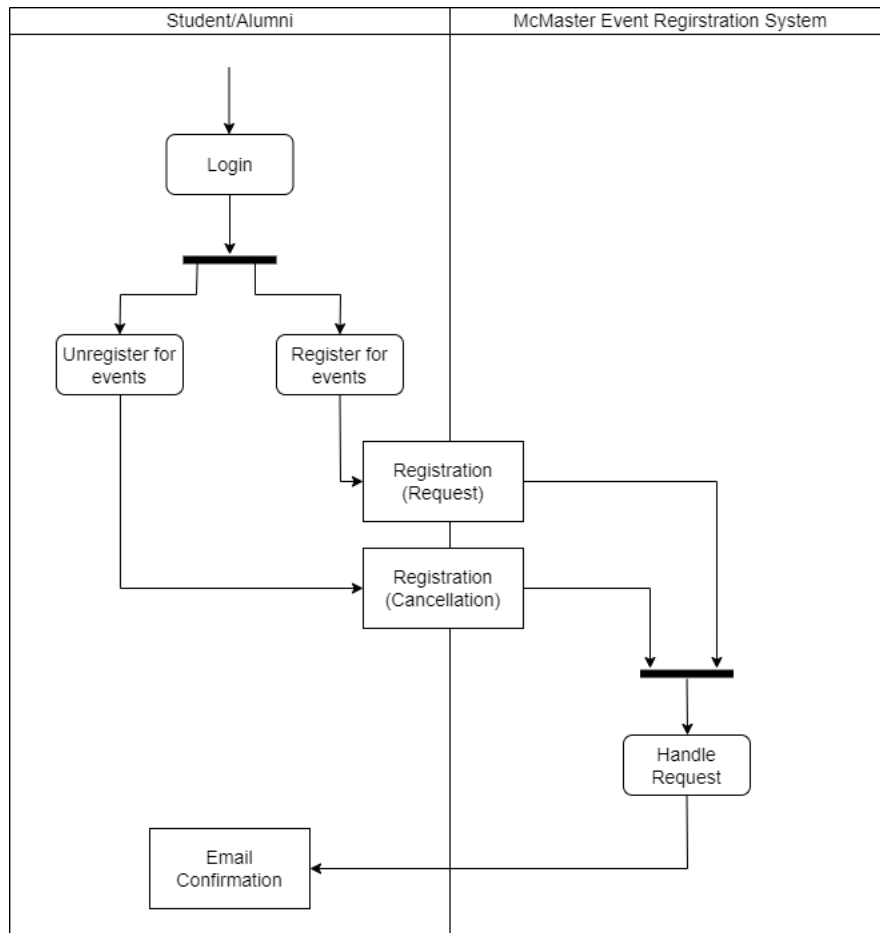


Figure 1: Context Diagram

## 6.2 The Context of the Work

The context diagram depicted below illustrates the interactions of the system with adjacent external systems and services.

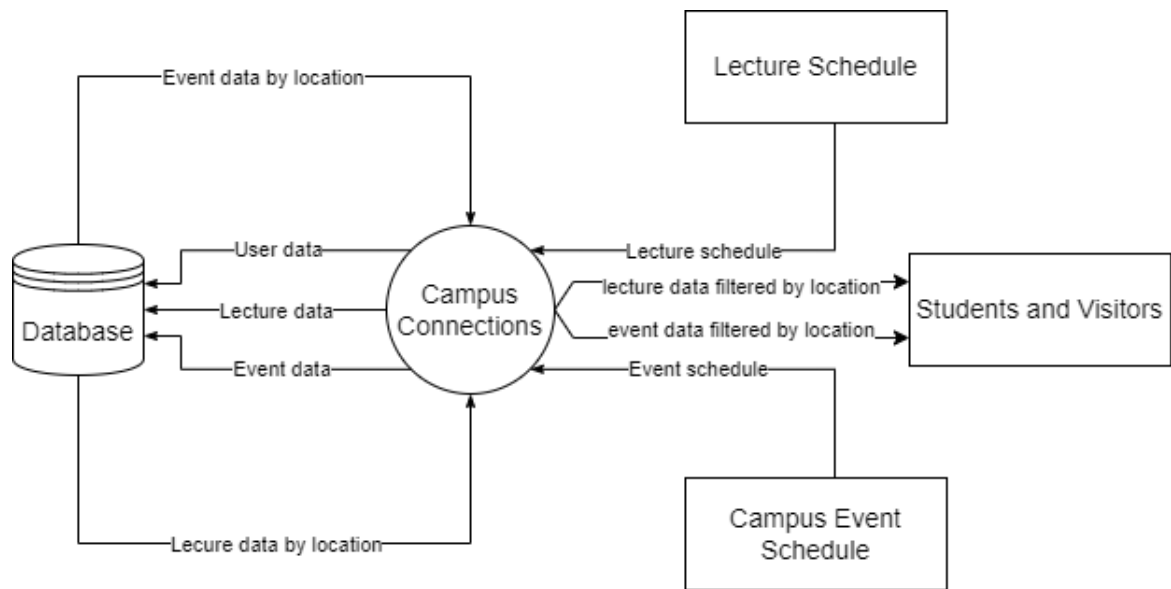


Figure 2: Current Event Registration Situation

### 6.3 Work Partitioning

Event Name	Input/Output	Summary
Provide lecture schedule	IN: Lecture schedule	Give schedule of lectures when there is an update and after every semester
Provide event schedule	IN: Event schedule	Give schedule of campus events periodically and when there is an update
Record user data	OUT: User data	Record user related data, including user settings, user friends and registered events
Record lecture data	OUT: Event data	Record lecture data, including lecture name, time, duration and location
Record event data	OUT: Event data	Record event data, including event name, time, duration and location
Display event schedule	IN: event data, OUT: event data filtered by location	Display events that are going to be held in in a given building
Display lecture schedule	IN: lecture data, OUT: lecture data filtered by location	Display lectures that are going to be held in in a given building

Table 2: Business Event List

### 6.4 Specifying a Business Use Case (BUC)

The following is an activity diagram for the Display event schedule process. The trigger of this business user case will be user interaction, and input will

be campus event data from database. What will be displayed is a schedule of events held inside a specific building with detailed event information.

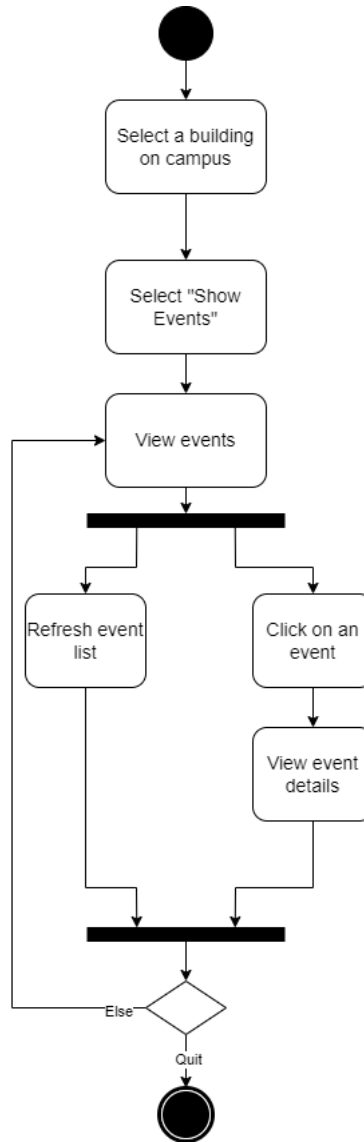


Figure 3: Activity diagram for Display Event Schedule Process



## 7 Business Data Model and Data Dictionary

### 7.1 Business Data Model

The following UML class diagram shows all types of business data that will be used in this project.

All the classes represent corresponding business data, all these entries and their attributes will be defined and explained in the data dictionary. class are defined in the data dictionary.

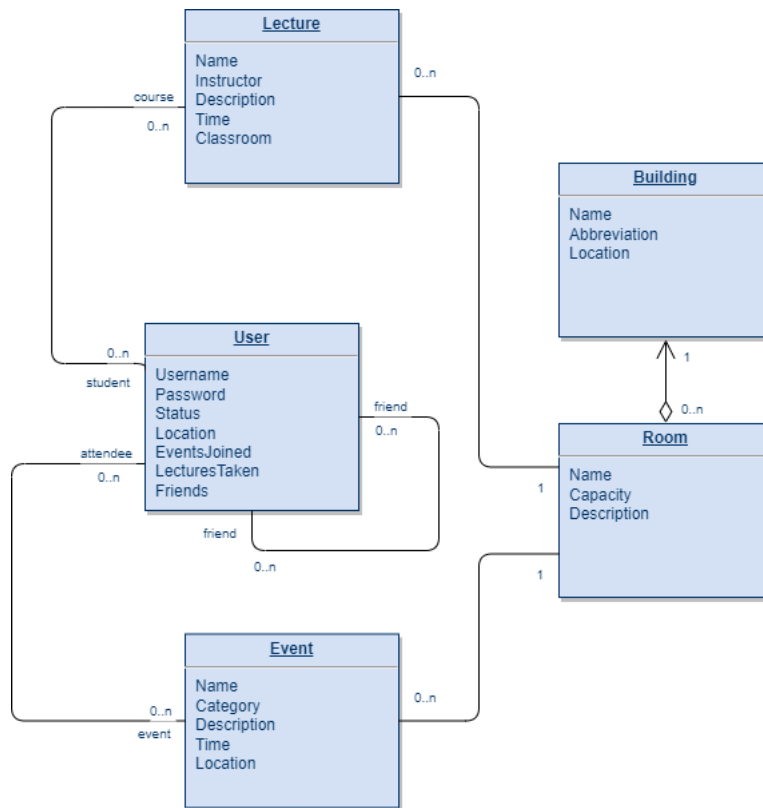


Figure 4: UML class model

### 7.2 Data Dictionary

This section will include definition of all classes in UML class model and their attributes. Some self-explanatory attributes like name will be ignored.

<b>Name</b>	<b>Content</b>	<b>Type</b>
Lecture	McMaster course data	Class
Lecture.Instructor	Course instructor	Attribute
Lecture.Time	Course schedule	*HH/MM/SS 24 hour clock*
Lecture.Classroom	Course location	Room
Event	McMaster on-campus event data	Class
Event.Category	Held by which department	Attribute
Event.Time	Event time	*HH/MM/SS 24 hour clock*
Lecture.Location	Event location	Room
User	User account data, friends data, location, event & lecture attendance	Class
User.Location	Geographic location	Attribute
User.Status	Online or not	Boolean, Attribute
User.EventsJoined	List of event	Event, Attribute
User.LecturesTaken	List of lecture	Lecture, Attribute
User.Friends	List of friends	User , Attribute
Building	McMaster main campus building	Class
Building.Abbreviation	Abbreviation of building name	Attribute
Building.Location	Geographic location	Attribute
Room	Room inside a building	Class
Room.Capacity	Room capacity	Number, Attribute

Table 3: Data Dictionary

## 8 The Scope of the Product

### 8.1 Product Boundary

The use case diagram depicted below identifies the boundaries between the users and the product.

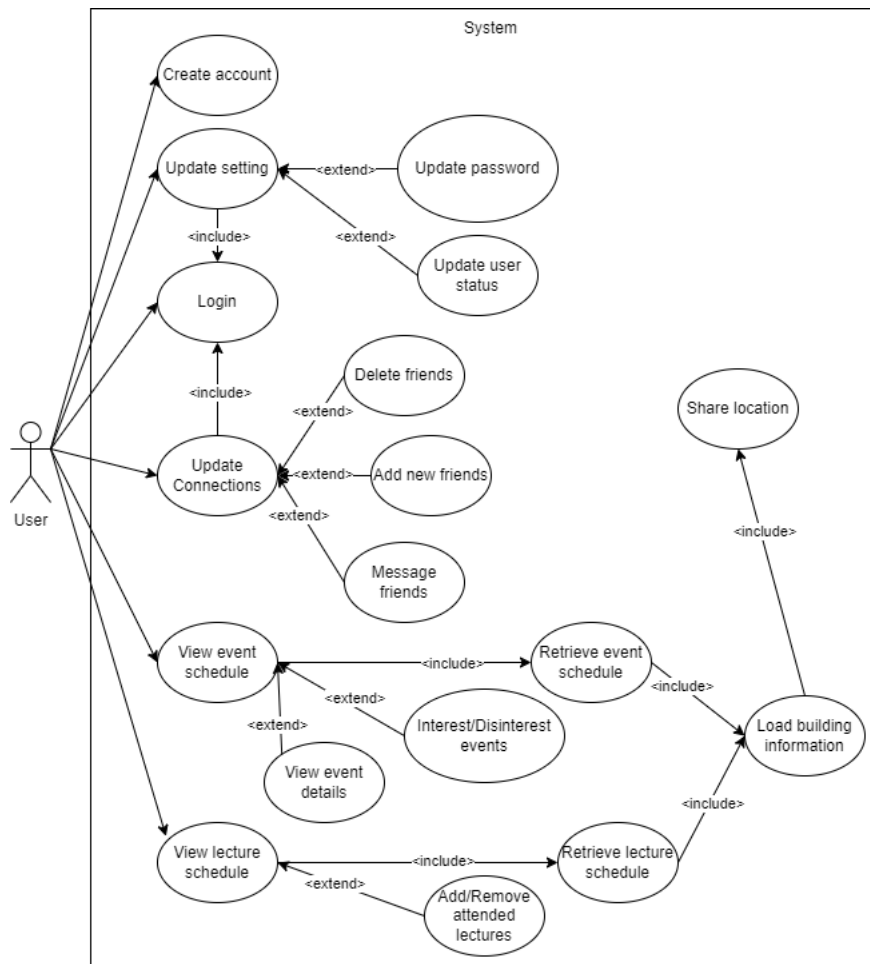


Figure 5: Use Case Diagram

### 8.2 Product Use Case Table

<b>PUC No</b>	<b>PUC Name</b>	<b>Actor/s</b>	<b>Input &amp; Output</b>
1	Create Account	User	Username & Password (in)
2	Update Password	User	Username & New Password (in)
3	Update User Status	User	New Status (in)
4	Login	User	Username & Password (in), Response message (out)
5	Add New Friend	User	Friend Username (in), Friend Request (out)
6	Delete Friend	User	Friend Username (in), Confirmation Message (out)
7	Message Friend	User	Message Content (in), Message Sent Notification (out)
8	View Event Details	User	User Interaction (in), Event details (out)
9	Interest/Disinterest Event	User	User Interaction & Event Name (in)
10	Add/Remove attended lecture	User	User Interaction & Lecture Name (in)
11	Retrieve Event Schedule	System	New Schedule (out)
12	Retrieve Lecture Schedule	System	New Schedule (out)
13	Load Building Information	System	Location & Sensor data (in), Building Name (out)

Table 4: Product Use Case

## 8.3 Individual Product Use Cases (PUC's)

**Use case #1:** Create Account

**Precondition:** None

**Trigger:** The user clicks on create account button

**Outcome**

1. User provides the required information
2. System verifies all required information has been provided
3. System securely registers user information
4. User is redirected back to the Home page

**Postcondition:** The user has successfully created an account and account information is stored and secured in a database.

**Use case #2:** Update Password

**Precondition:** The user has already created an account

**Trigger:** The user clicks on change password button

**Outcome**

1. User navigates to change password page
2. User provides old password
3. User provides new password
4. System verifies old password is correct and new password is valid
5. System updates password of current user in the database
6. User is redirected back to the Home page

**Postcondition:** The user has successfully changed the password.

**Use case #3:** Update User Status

**Precondition:** The user has already created an account

**Trigger:** The user clicks on change status button

**Outcome**

1. User navigates to change status page

2. User updates status to a new status
3. System updates user status and redirects back to the Home page

**Postcondition:** The user status has been changed successfully.

**Use case #4:** Login

**Precondition:** The user has already created an account

**Trigger:** The user clicks on login button on the home page

**Outcome**

1. User navigates to login page
2. System verifies all required information has been provided and matches the database record
3. User is redirected to the home page as a logged-in user

**Postcondition:** The user has successfully logged in to the created account with all settings and connections loaded from the database.

**Use case #5:** Add New Friend

**Precondition:** The user has already logged in

**Trigger:** The user searches for another user and sends a friend request

**Outcome**

1. User searches for another user
2. User sends a friend request
3. System sends the request and user information to the destined user
4. Destined user accepts/rejects the request
5. User receives a notification

**Postcondition:** The user gets a new connection in their friends list.

**Postcondition 2:** The user is rejected and gets a notification about that.

**Use case #6:** Delete Friend

**Precondition:** The user has already logged in and has at least one friend

**Trigger:** The user clicks delete button on friend page

**Outcome**

1. User searches for a friend
2. User deletes the friend
3. System sends a confirmation prompt
4. User continues to delete
5. User receives a notification

**Postcondition:** The friend is deleted from user's friends list.

**Use case #7:** Message Friend

**Precondition:** The user has already logged in and has at least one friend

**Trigger:** The user texts a friend on friend page

**Outcome**

1. User searches for a friend
2. User start to text the friend
3. System sends message to the destined friend

**Postcondition:** The friend receives a message from the user.

**Use case #8:** View Event Details

**Precondition:** The user has already logged in and necessary sensors are working properly

**Trigger:** The user clicks on an event

**Outcome**

1. User moves the device to target a building on campus
2. User finds a list of events
3. User clicks on one of the event
4. System displays more information about the event

**Postcondition:** The content, time and location of the event are displayed.

**Use case #9:** Interest/Disinterest Event

**Precondition:** The user has already logged in and had a target building

**Trigger:** The user clicks on interest/disinterest button

**Outcome**

1. User browses the event list of the target
2. User navigates to an event detail page with a specific name
3. User clicks on the corresponding button
4. System sends the request to the database
5. System displays the new state of the event

**Postcondition:** The user event list in the database is updated and the UI changes correspondingly.

**Use case #10:** Add/Remove Attended lecture

**Precondition:** The user has already logged in and had a target building

**Trigger:** The user clicks on add/remove button

**Outcome**

1. User browses the lecture list of the target
2. User navigates to a lecture detail page with a specific course code
3. User clicks on the corresponding button
4. System sends the request to the database
5. System displays the new state of the lecture

**Postcondition:** The user lecture list in the database is updated and the UI changes correspondingly.

**Use case #11:** Retrieve Event Schedule



**Precondition:** None

**Trigger:** A request to update schedule is sent or trigger by the system timer

**Outcome**

1. System sends a request to the on-campus schedule interface
2. System gets the up-to-date schedule
3. System stores the new schedule to the database

**Postcondition:** The new schedule is stored in the database and will be utilized later.

**Use case #12:** Retrieve Lecture Schedule

**Precondition:** None

**Trigger:** A request to update schedule is sent or trigger by the system timer

**Outcome**

1. System sends a request to lecture schedule interface
2. System gets the up-to-date schedule
3. System stores the new schedule to the database

**Postcondition:** The new schedule is stored in the database and will be utilized later.

**Use case #13:** Load Building Information

**Precondition:** Location share is allowed and sensors are set properly

**Trigger:** A request for event/lecture schedule is sent by the user

**Outcome**

1. System gets geographic location and sensor data from the device
2. System finds the most likely building on campus
3. System displays building information

**Postcondition:** The system provides information of the building the user locates now.

## **9 Functional Requirements**

### **9.1 Functional Requirements**

*Insert your content here.*

## **10 Look and Feel Requirements**

### **10.1 Appearance Requirements**

*Insert your content here.*

### **10.2 Style Requirements**

*Insert your content here.*

## **11 Usability and Humanity Requirements**

### **11.1 Ease of Use Requirements**

*Insert your content here.*

### **11.2 Personalization and Internationalization Requirements**

*Insert your content here.*

### **11.3 Learning Requirements**

*Insert your content here.*

### **11.4 Understandability and Politeness Requirements**

*Insert your content here.*

### **11.5 Accessibility Requirements**

*Insert your content here.*

## **12 Performance Requirements**

### **12.1 Speed and Latency Requirements**

*Insert your content here.*

### **12.2 Safety-Critical Requirements**

*Insert your content here.*

### **12.3 Precision or Accuracy Requirements**

*Insert your content here.*

### **12.4 Robustness or Fault-Tolerance Requirements**

*Insert your content here.*

### **12.5 Capacity Requirements**

*Insert your content here.*

### **12.6 Scalability or Extensibility Requirements**

*Insert your content here.*

### **12.7 Longevity Requirements**

*Insert your content here.*

## **13 Operational and Environmental Requirements**

### **13.1 Expected Physical Environment**

- The product will be installed on the user's smartphone (iPhone or Android) and be used around the main campus of McMaster University

## **13.2 Wider Environment Requirements**

- The product must interface with the latest three major releases of iOS and Android OS (as of October 2023)

## **13.3 Requirements for Interfacing with Adjacent Systems**

- 

## **13.4 Productization Requirements**

- 

## **13.5 Release Requirements**

- The product must be downloadable through the App Store and Google Play Store

# **14 Maintainability and Support Requirements**

## **14.1 Maintenance Requirements**

Major updates could be rolled out during periods of reduced usage such as Reading Week, after exams, or Spring semester. This will allow significant time to stabilize the update and test them before the updates are applied to the users.

Additionally, the administrator can perform maintenance on the database and server to check the correct operation of the product. This will maximize the availability of the product.

## **14.2 Supportability Requirements**

Feature requests or issues can be sent to the product GitHub. These opened issues will be discussed by the maintainers and communicated through the issue on how they will be dealt with.

A user manual will be compiled and stored in the GitHub, this manual will be updated with Frequently Asked Questions and other entries as additional

features are introduced. The application will direct users to this manual in the menu.

### **14.3 Adaptability Requirements**

This product will be accessible in Android 13 and above. (???) This product will be accessible in Windows 10 and above.

This product may be ported to other universities in Ontario, Canada, or other countries. Although the product is designed to work for university, this can be ported to other large events and buildings to help users navigate and coordinate better.

## **15 Security Requirements**

### **15.1 Access Requirements**

There will be three levels of access.

The first will be before login and account creation, where anyone can access. They must not have access to anything beyond the login, account creation, and account recovery pages.

The second will be after login that verifies their identity, where the user has provided information matching the McMaster student or faculty member with McMaster email account. Only the user can access this page.

The third level will be the administrator account, used for adding, deleting, or editing official events. This account can be accessed by login that verifies that they are the maintainer, this will be used by the maintainers to check the functionality of the product and pull logs that are not accessible to users.

### **15.2 Integrity Requirements**

*Insert your content here.*

### **15.3 Privacy Requirements**

All data collected must be encrypted on disk in the server by standard encryption algorithm. All data collected must be encrypted on transit by industry standard encryption algorithm.

The product will require users to agree on the terms prior to account creation and additional data submission. The product must erase all data if the user requests, or when account is deleted. Additionally, accounts that are inactive for a certain period of time will have their account deleted after notice to prevent unnecessary data being held.

## **15.4 Audit Requirements**

N/A (This currently does not apply)

## **15.5 Immunity Requirements**

The product must only use open source libraries with many users and continuous security updates. The product must undergo

# **16 Cultural Requirements**

## **16.1 Cultural Requirements**

- 

# **17 Compliance Requirements**

## **17.1 Legal Requirements**

The data collected from users will be handled as per the same legal requirements for the university. As this application will be used in university, it is subject to the same regulations that the university is beholden to. In the future, different functions can be developed to match specific university or state/country requirements, but this is currently not in scope.

## **17.2 Standards Compliance Requirements**

The encryption on data in storage and in transit must be industry standard. This ensures that the application is safe and can be scaled and expanded to other universities or interested parties when needed.

## 18 Open Issues

- To target iOS devices, a device capable of building iOS apps is required.

## 19 Off-the-Shelf Solutions

### 19.1 Ready-Made Products

- **Snapchat:** Snapchat is an existing social media platform that makes use of AR technology through its Lenses feature which provides various filters and effects that users can apply to their content.
- **Instagram:** Instagram is another platform that incorporates AR in the form of filters and effects.
- **TikTok:** TikTok similarly uses AR for visual effects and filters.
- **Facebook:** Many clubs at McMaster use Facebook Groups to coordinate events.
- **Meetup:** Meetup is another platform designed for organizing and finding events and other social gatherings.
- **CampusGroups:** CampusGroups is a platform that focuses specifically on university student groups. It allows universities to create private communities for various events and other student engagement activities.

### 19.2 Reusable Components

- Event planning, scheduling and searching
- Friends and Groups system
- AR-integrated content (virtual billboards, avatars, ...)
- Asynchronous communication (text messages, voice messages)

### 19.3 Products That Can Be Copied

N/A

## **20 New Problems**

### **20.1 Effects on the Current Environment**

This application will not take place of any existing official tools. It intends to improve certain social networking processes students are following and provide a platform for users to connect with each other better. The following are some changes that will impact users.

#### **Expand Networking**

Students will be able to expand networking when attending events lectures on this social media platform. Users may lose connection with peers when there is a failure in the system.

#### **Event Registration**

Students and alumni will be able to login with their McMaster email and write comments about on campus events, which means there will be a risk of personal identification information (PII) leakage if the data is not stored securely.

#### **Available Room Management**

This application can be utilized to get information about lecture time and location which should not be displayed publicly. Therefore insecure data storage may lead to data breaches.

### **20.2 Effects on the Installed Systems**

The application will be completely stand alone and will not be interfacing with any existing systems. As described in the previous section, this application should not affect or replace any existing systems.

### **20.3 Potential User Problems**

Any potential adverse reactions related to using the device in which application is being launched on (mobile device or tablet) would extend to the use of this application. Any adverse reactions of Virtual Reality and Augment Reality, like nausea, dizziness and disorientation would be introduced to the use of the application as well.



## **20.4 Limitations in the Anticipated Implementation Environment That May Inhibit the New Product**

- The database free plan is not able to cope with our projected user growth pattern.
- Low quality internet connection will lead to latency between user inputs and in-game reactions or even failures of loading in-game assets.
- The accuracy of input data totally depends on device sensor. Low accuracy data may cause bad user experience.

## **20.5 Follow-Up Problems**

Any failures or downtime on Unity game engine and its third-party libraries may affect the availability of this application. In-game schedules may fail to load when the event and lecture schedule interfaces are down or the two external systems are under maintenance. There will also be a risk of violating privacy laws in the future since the application is collection personal information and there may be new laws prohibit this kind of information collection.

# **21 Tasks**

## **21.1 Project Planning**

The project schedule will follow the deadline for the deliverables outlined in the SFWRENG 4G06 course outline.

Phase	Task	Deadline
Revision 0	Hazard Analysis	Oct 20, 2023
	Verification and Validation Plan	Nov 3, 2023
	Proof of Concept Demo	Nov 13-24, 2023
	Design Document	Jan 17, 2024
	Demonstration	Feb 5-16, 2024
	Verification and Validation Report	Mar 6, 2024
Revision 1	Final Demonstration	Mar 18-29, 2024
	EXPO Demonstration	April 2024
	Final Documentation	Apr 4, 2024

Table 5: Project Plan

## 21.2 Planning of the Development Phases

*Insert your content here.*

## 22 Migration to the New Product

### 22.1 Requirements for Migration to the New Product

*Insert your content here.*

### 22.2 Data That Has to be Modified or Translated for the New System

*Insert your content here.*

## 23 Costs

*Insert your content here.*

## **24 User Documentation and Training**

### **24.1 User Documentation Requirements**

*Insert your content here.*

### **24.2 Training Requirements**

*Insert your content here.*

## **25 Waiting Room**

N/A

## **26 Ideas for Solution**

*Insert your content here.*

## Appendix — Reflection

The information in this section will be used to evaluate the team members on the graduate attribute of Lifelong Learning. Please answer the following questions:

1. What knowledge and skills will the team collectively need to acquire to successfully complete this capstone project? Examples of possible knowledge to acquire include domain specific knowledge from the domain of your application, or software engineering knowledge, mechatronics knowledge or computer science knowledge. Skills may be related to technology, or writing, or presentation, or team management, etc. You should look to identify at least one item for each team member.
2. For each of the knowledge areas and skills identified in the previous question, what are at least two approaches to acquiring the knowledge or mastering the skill? Of the identified approaches, which will each team member pursue, and why did they make this choice?