

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
THE UNIVERSITY OF TEXAS AT ARLINGTON**

**SYSTEM REQUIREMENTS SPECIFICATION
CSE 4317: SENIOR DESIGN II
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**INFRARED
INFRARED ARENA**

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CONTENTS

1	Product Concept	9
1.1	Purpose and Use	9
1.2	Intended Audience	9
2	Product Description	10
2.1	Features & Functions	10
2.2	External Inputs & Outputs	10
2.3	Product Interfaces	10
3	Customer Requirements	12
3.1	Phone Used to Augment an Existing System	12
3.1.1	Description	12
3.1.2	Source	12
3.1.3	Constraints	12
3.1.4	Priority	12
3.2	Link app to hardware	12
3.2.1	Description	12
3.2.2	Source	12
3.2.3	Constraints	12
3.2.4	Priority	12
3.3	Use real maps	12
3.3.1	Description	12
3.3.2	Source	12
3.3.3	Constraints	12
3.3.4	Standards	12
3.3.5	Priority	12
3.4	User can create their own play area boundaries	13
3.4.1	Description	13
3.4.2	Source	13
3.4.3	Constraints	13
3.4.4	Standards	13
3.4.5	Priority	13
3.5	Cloud based	13
3.5.1	Description	13
3.5.2	Source	13
3.5.3	Constraints	13
3.5.4	Standards	13
3.5.5	Priority	13
3.6	App shows mini map	13
3.6.1	Description	13
3.6.2	Source	13
3.6.3	Constraints	13
3.6.4	Standards	13
3.6.5	Priority	13
3.7	Mini map shows location and direction of friendlies	14
3.7.1	Description	14

3.7.2	Source	14
3.7.3	Constraints	14
3.7.4	Standards	14
3.7.5	Priority	14
3.8	Basic communication allowed in the app	14
3.8.1	Description	14
3.8.2	Source	14
3.8.3	Constraints	14
3.8.4	Priority	14
3.9	Physical laser gun needs to have an orange tip on edge of gun	14
3.9.1	Description	14
3.9.2	Source	14
3.9.3	Constraints	14
3.9.4	Standards	14
3.9.5	Priority	14
3.10	Scoreboard	15
3.10.1	Description	15
3.10.2	Source	15
3.10.3	Constraints	15
3.10.4	Priority	15
3.11	Camera zoom feature	15
3.11.1	Description	15
3.11.2	Source	15
3.11.3	Constraints	15
3.11.4	Priority	15
3.12	Customize team sizes	15
3.12.1	Description	15
3.12.2	Source	15
3.12.3	Constraints	15
3.12.4	Priority	15
3.13	Help feature	15
3.13.1	Description	15
3.13.2	Source	15
3.13.3	Priority	16
3.14	Keep track of previous game scores	16
3.14.1	Description	16
3.14.2	Source	16
3.14.3	Constraints	16
3.14.4	Priority	16
3.15	High multiplayer usage	16
3.15.1	Description	16
3.15.2	Source	16
3.15.3	Constraints	16
3.15.4	Priority	16

4	Packaging Requirements	17
4.1	Laser Tag Equipment	17
4.1.1	Description	17
4.1.2	Source	17
4.1.3	Constraints	17
4.1.4	Standards	17
4.1.5	Priority	17
4.2	Laser Tag Application	17
4.2.1	Description	17
4.2.2	Source	17
4.2.3	Constraints	17
4.2.4	Standards	17
4.2.5	Priority	17
5	Performance Requirements	18
5.1	Cloud Server	18
5.1.1	Description	18
5.1.2	Source	18
5.1.3	Constraints	18
5.1.4	Standards	18
5.1.5	Priority	18
5.2	Sustainability	18
5.2.1	Description	18
5.2.2	Source	18
5.2.3	Constraints	18
5.2.4	Standards	18
5.2.5	Priority	18
6	Safety Requirements	19
6.1	Laboratory equipment lockout/tagout (LOTO) procedures	19
6.1.1	Description	19
6.1.2	Source	19
6.1.3	Constraints	19
6.1.4	Standards	19
6.1.5	Priority	19
6.2	Pop up warnings in dangerous areas	19
6.2.1	Description	19
6.2.2	Source	19
6.2.3	Constraints	19
6.2.4	Standards	19
6.2.5	Priority	19
6.3	Gun's tip will need to be orange	19
6.3.1	Description	19
6.3.2	Source	20
6.3.3	Constraints	20
6.3.4	Standards	20
6.3.5	Priority	20

7	Maintenance & Support Requirements	21
7.1	User Manual	21
7.1.1	Description	21
7.1.2	Source	21
7.1.3	Constraints	21
7.1.4	Standards	21
7.1.5	Priority	21
7.2	Bug Reports	21
7.2.1	Description	21
7.2.2	Source	21
7.2.3	Constraints	21
7.2.4	Standards	21
7.2.5	Priority	21
8	Other Requirements	22
8.1	Unity Version	22
8.1.1	Description	22
8.1.2	Source	22
8.1.3	Constraints	22
8.1.4	Standards	22
8.1.5	Priority	22
8.2	Supported OS	22
8.2.1	Description	22
8.2.2	Source	22
8.2.3	Constraints	22
8.2.4	Standards	22
8.2.5	Priority	22
8.3	C# Version	22
8.3.1	Description	22
8.3.2	Source	22
8.3.3	Constraints	22
8.3.4	Standards	23
8.3.5	Priority	23
8.4	User Interface Mode	23
8.4.1	Description	23
8.4.2	Source	23
8.4.3	Constraints	23
8.4.4	Standards	23
8.4.5	Priority	23
8.5	Low Battery Consumption	23
8.5.1	Description	23
8.5.2	Source	23
8.5.3	Constraints	23
8.5.4	Standards	23
8.5.5	Priority	23

9	Future Items	24
9.1	High multiplayer usage	24
9.1.1	Description	24
9.1.2	Source	24
9.1.3	Constraints	24
9.1.4	Priority	24
9.2	Keep track of previous game scores	24
9.2.1	Description	24
9.2.2	Source	24
9.2.3	Constraints	24
9.2.4	Priority	24
9.3	Bug Reports	24
9.3.1	Description	24
9.3.2	Source	24
9.3.3	Constraints	24
9.3.4	Standards	24
9.3.5	Priority	24

LIST OF FIGURES

1	Startup Screen	11
2	Homescreen	11
3	Create Lobby	11
4	Map and Ping	11
5	RECOIL guns we will be using	11

1 PRODUCT CONCEPT

This section describes the purpose, use, and intended audience of Infrared Arena. Infrared Arena will allow users to have their own private laser tag matches with their friends. The system will consist of a laser tag gun with an attachment for holding the user's smartphone, clip-on sensors, and an app the user will download on their smartphones. The app will allow users to create and join multiplayer matches which will be hosted on a cloud server.

1.1 PURPOSE AND USE

Infrared Arena will allow users to host custom laser tag matches with their friends. The app will allow users to choose match settings such as play area, match length, team membership and more. During matches, the app will display a map of the play area and will allow for communication between teammates. The user's smartphone will connect to a laser emitter via Bluetooth. The laser emitter will have multiple sensors in addition to the clip-on sensors, in order to register tags. During matches users will tag the sensors of other users in order to score points.

1.2 INTENDED AUDIENCE

The intended audience for this system is users 12 and up. The app and hardware will be available commercially to the public.

2 PRODUCT DESCRIPTION

This section provides an overview of Infrared Arena. The primary operational aspects of the product, from the perspective of end users, maintainers and administrators, are defined here. The key features and functions found in the product, as well as critical user interactions and user interfaces are described in detail.

2.1 FEATURES & FUNCTIONS

This section provides the reader with an overview of the primary features and functions of Infrared Arena. The primary feature of the product is to leverage cloud services to allow end-users the ability to play laser tag through a mobile device. The application will be integrated with a modified version of RECOIL's laser tag system, where we will intercept the existing Bluetooth signal to connect our user devices to the laser tag gun. By supporting our application with the laser tag gun hardware, we can better emulate traditional game play to enhance the user experience. In addition, the user-interface will feature a map that will display the user's location as well as their team's location. By pinging points on a map, a user will also have the ability to notify teammates of an target's location or need of backup.

2.2 EXTERNAL INPUTS & OUTPUTS

Data Name	Description	Use
Touch to Begin	Start up screen	Click to continue to lobby options
Lobby	Create or Join lobby	Used when user opens application and wishes to create or join an available game
Profile	Create profile name	Add users name to game to distribute points on scoreboard
Score	Point System	Used to indicate team loss or win
Settings Info	Specific settings input by user	Used to customize game and field settings
Player targets enemy	Laser emitter points to target	Used when game begins. User has option to use camera on mobile device to assist with accuracy
Player hits enemy	Sound emits from device when user hits an enemy player	Used to simulate battlefield environment and update of score
Networks	Verify connections	Used to verify user's device is connected to the Internet and laser tag gun

Table 2: External Inputs and Outputs

2.3 PRODUCT INTERFACES

- After the user touches the home screen (Figure 1) to begin, another similar screen (Figure 2) will appear where the user will have the options to create a lobby or join an existing lobby or adjust the game settings (Figure 3). By creating or entering a lobby, the user will be able to join fellow players in starting a new game.
- As depicted in Figures 4, the user's location is shown on a map which reflects real-world terrain and utilizes a pinging system for team communication.
- Figure 5 shows the RECOIL guns that we obtained from the existing RECOIL Kit Laser Tag system and are modifying for our app.



Figure 1: Startup Screen

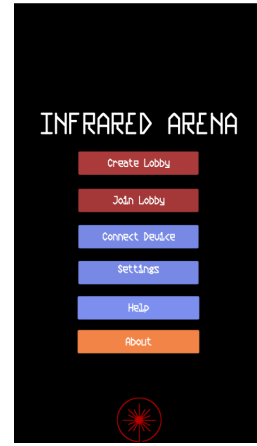


Figure 2: Homescreen

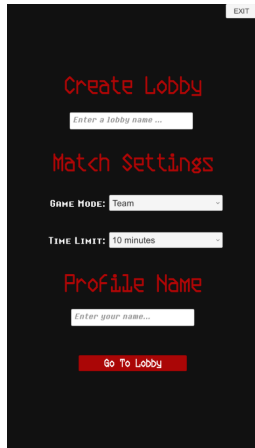


Figure 3: Create Lobby

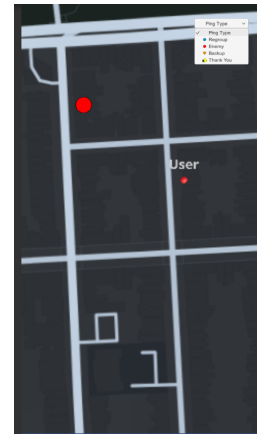


Figure 4: Map and Ping



Figure 5: RECOIL guns we will be using

3 CUSTOMER REQUIREMENTS

The requirements listed in this section will address the primary functionality and features that will be present in the game application.

3.1 PHONE USED TO AUGMENT AN EXISTING SYSTEM

3.1.1 DESCRIPTION

Team will take an existing system and alter it to their needs to create a better gaming experience. System will consist of phone (mobile application) and hardware (physical laser gun).

3.1.2 SOURCE

Sponsor

3.1.3 CONSTRAINTS

Existing system must allow alteration of their product.

3.1.4 PRIORITY

Critical

3.2 LINK APP TO HARDWARE

3.2.1 DESCRIPTION

Mobile application will be able to sense changes in hardware and update real time, such as ammo and health of player

3.2.2 SOURCE

Sponsor

3.2.3 CONSTRAINTS

Phone must fit into the holder on the physical gun. User has downloaded app to their device. Correct wire connection will be available between hardware and device that has the app.

3.2.4 PRIORITY

Critical

3.3 USE REAL MAPS

3.3.1 DESCRIPTION

App will be connected to a map API in order to create a reflect the real world terrain onto the mini map in the game.

3.3.2 SOURCE

Sponsor

3.3.3 CONSTRAINTS

Follow Google Maps Terms of Service

3.3.4 STANDARDS

Google Maps Platform Terms of Service

3.3.5 PRIORITY

Critical

3.4 USER CAN CREATE THEIR OWN PLAY AREA BOUNDARIES

3.4.1 DESCRIPTION

User's will be able to draw a game boundary through the mobile application.

3.4.2 SOURCE

Sponsor

3.4.3 CONSTRAINTS

User must allow app access to location. User will not trespass into private areas.

3.4.4 STANDARDS

List of applicable standards

3.4.5 PRIORITY

Critical

3.5 CLOUD BASED

3.5.1 DESCRIPTION

App will be cloud based to allow multiple users to access the game servers to play.

3.5.2 SOURCE

Sponsor

3.5.3 CONSTRAINTS

Budget will limit the size and type of cloud service that will be used. Users must be connected to the internet.

3.5.4 STANDARDS

NIST Cloud Computing Standards

3.5.5 PRIORITY

Critical

3.6 APP SHOWS MINI MAP

3.6.1 DESCRIPTION

App will display a smaller version of the map of the arena drawn by players.

3.6.2 SOURCE

Sponsor

3.6.3 CONSTRAINTS

User must allow app access to location.

3.6.4 STANDARDS

Google Map Platform Terms of Service

3.6.5 PRIORITY

Critical

3.7 MINI MAP SHOWS LOCATION AND DIRECTION OF FRIENDLIES

3.7.1 DESCRIPTION

Mini map will display the location and direction of friendlies using GPS of user

3.7.2 SOURCE

Sponsor

3.7.3 CONSTRAINTS

User must allow app access to location.

3.7.4 STANDARDS

Google Map Platform Terms of Service

3.7.5 PRIORITY

Critical

3.8 BASIC COMMUNICATION ALLOWED IN THE APP

3.8.1 DESCRIPTION

Teammates will be able to communicate using pings such as an enemy being spotted, missing, rendezvous, and back up. Teammate will be notified by display on their mini map, by sound, or by text on screen.

3.8.2 SOURCE

Sponsor

3.8.3 CONSTRAINTS

Players will accurately use the communication system to help their team's overall game play.

3.8.4 PRIORITY

Critical

3.9 PHYSICAL LASER GUN NEEDS TO HAVE AN ORANGE TIP ON EDGE OF GUN

3.9.1 DESCRIPTION

Physical laser gun requires an orange tip on the outer rim of the gun

3.9.2 SOURCE

Federal Regulation

3.9.3 CONSTRAINTS

Every physical laser gun MUST comply to this.

3.9.4 STANDARDS

Part 272 of Title 15 of the Code of Federal Regulations

3.9.5 PRIORITY

Critical

3.10 SCOREBOARD

3.10.1 DESCRIPTION

Data for current game will be stored to display at the end of match to see who the winner is.

3.10.2 SOURCE

Team member Linda Phanvilay

3.10.3 CONSTRAINTS

App must be able to store the data throughout the game, at the minimum, locally on their device to reference for end score.

3.10.4 PRIORITY

High

3.11 CAMERA ZOOM FEATURE

3.11.1 DESCRIPTION

User will be able to use their device's physical camera to zoom in on targets to and "arena" to confirm what is seen.

3.11.2 SOURCE

Team member Justine Batongmalaki

3.11.3 CONSTRAINTS

User must allow app access to camera

3.11.4 PRIORITY

Medium

3.12 CUSTOMIZE TEAM SIZES

3.12.1 DESCRIPTION

Users will be able to customize team sizes such as individual or team-based.

3.12.2 SOURCE

Team member Edgar Acevedo

3.12.3 CONSTRAINTS

Users will be connected to the same server.

3.12.4 PRIORITY

Medium

3.13 HELP FEATURE

3.13.1 DESCRIPTION

The game will be intuitive that instructions should not be required, however if time permits, a help feature will be added to give clear instructions on how the game is to be played.

3.13.2 SOURCE

Team agreement

3.13.3 PRIORITY

Low

3.14 KEEP TRACK OF PREVIOUS GAME SCORES

3.14.1 DESCRIPTION

Game will store the information of previous game data to display statistics of the user.

3.14.2 SOURCE

Team member Linda Phanvilay

3.14.3 CONSTRAINTS

User must create an account and login. Database needs to be available to store data from games.

3.14.4 PRIORITY

Future

3.15 HIGH MULTIPLAYER USAGE

3.15.1 DESCRIPTION

Game will allow multiple users (10 or more) to participate in the game.

3.15.2 SOURCE

Team member Linda Phanvilay

3.15.3 CONSTRAINTS

Lack of time due to coronavirus has reduced the time on implementing a high level of multiplayer usage along with switching the server from DigitalOcean to Firebase.

3.15.4 PRIORITY

Future

4 PACKAGING REQUIREMENTS

The Infrared application will come as a downloaded software from the app store that can be played on a mobile phone and the required laser tag hardware will be delivered upon purchase.

4.1 LASER TAG EQUIPMENT

4.1.1 DESCRIPTION

A box will be delivered and contains all the necessary equipment to play the game.

4.1.2 SOURCE

Infrared Team

4.1.3 CONSTRAINTS

The equipment will need to be able to connect to the phone application and mounted alongside with it.

4.1.4 STANDARDS

ISO

4.1.5 PRIORITY

Critical

4.2 LASER TAG APPLICATION

4.2.1 DESCRIPTION

The laser tag game will be available to download and purchase on the google play store as an application within a mobile phone.

4.2.2 SOURCE

Infrared Team

4.2.3 CONSTRAINTS

The mobile device needs to support the application version.

4.2.4 STANDARDS

The application will abide by the app store policies and guidelines.

4.2.5 PRIORITY

Critical

5 PERFORMANCE REQUIREMENTS

The application must be able to connect to a cloud based server and access usage of communications/maps. The average battery life needs to maintain 3 hours or greater.

5.1 CLOUD SERVER

5.1.1 DESCRIPTION

The laser tag game must be able to connect through a cloud server to access maps, communications and teams.

5.1.2 SOURCE

Sponsor

5.1.3 CONSTRAINTS

The cloud server may be down due to performance issues or maintenance.

5.1.4 STANDARDS

ISO/IEC 17788

5.1.5 PRIORITY

Critical

5.2 SUSTAINABILITY

5.2.1 DESCRIPTION

The usage of maps and communication will need to be on par with the system resources. The application will maintain its resources to optimize and reduce power consumption to improve the longevity of battery life.

5.2.2 SOURCE

Danny Vu

5.2.3 CONSTRAINTS

This will depend on the mobile phone and usage.

5.2.4 STANDARDS

N/A

5.2.5 PRIORITY

Medium

6 SAFETY REQUIREMENTS

Safety of our users will have to be a priority since players will be less aware of their surroundings when immersed in the game.

6.1 LABORATORY EQUIPMENT LOCKOUT/TAGOUT (LOTO) PROCEDURES

6.1.1 DESCRIPTION

Any fabrication equipment provided used in the development of the project shall be used in accordance with OSHA standard LOTO procedures. Locks and tags are installed on all equipment items that present use hazards, and ONLY the course instructor or designated teaching assistants may remove a lock. All locks will be immediately replaced once the equipment is no longer in use.

6.1.2 SOURCE

CSE Senior Design laboratory policy

6.1.3 CONSTRAINTS

Equipment usage, due to lock removal policies, will be limited to availability of the course instructor and designed teaching assistants.

6.1.4 STANDARDS

Occupational Safety and Health Standards 1910.147 - The control of hazardous energy (lockout/tagout).

6.1.5 PRIORITY

Critical

6.2 POP UP WARNINGS IN DANGEROUS AREAS

6.2.1 DESCRIPTION

Users will be running wild when immersed in our game so it is our responsibility to alert the user when they are in an area that they should not be in. Pop up messages will be displayed notifying the user of situations such as "Remember not to play in the streets" or "Be cautious of areas that are off limits". We will be using a mapping API so we will be able to identify buildings and streets.

6.2.2 SOURCE

Jean-Marcel

6.2.3 CONSTRAINTS

Cannot interfere with the player while in game. Notification must be visible but not obstruct the player.

6.2.4 STANDARDS

N/A

6.2.5 PRIORITY

Moderate

6.3 GUN'S TIP WILL NEED TO BE ORANGE

6.3.1 DESCRIPTION

In order for our players to not get in trouble with the authorities, our "gun" will need to have an orange tip indicating that it is not a real gun.

6.3.2 SOURCE

Shawn Gieser

6.3.3 CONSTRAINTS

None

6.3.4 STANDARDS

Part 272 of Title 15 of the Code of Federal Regulations on foreign commerce and trade (15 CFR 272).

6.3.5 PRIORITY

Critical

7 MAINTENANCE & SUPPORT REQUIREMENTS

7.1 USER MANUAL

7.1.1 DESCRIPTION

A detailed user manual will be provided along with the hardware to show the user how to interact with the app and it will also provide setup instructions for the hardware to get started.

7.1.2 SOURCE

Edgar Acevedo

7.1.3 CONSTRAINTS

None

7.1.4 STANDARDS

IEC: 82079-1 Preparation of instructions for use (international standard). ISO/ IEC Guide 37:2012 Instructions for use of products by consumers (international standard). ANSI Z535.6 Product Safety Information in Product Manuals, Instructions, and Other Collateral Materials (American national standard)

7.1.5 PRIORITY

Low

7.2 BUG REPORTS

7.2.1 DESCRIPTION

If a user is experiencing issues with the app itself, there will be an option to send bug reports to the development team to further improve the app. This feature will be a future update.

7.2.2 SOURCE

Linda Phanvilay

7.2.3 CONSTRAINTS

Team will no longer support application after project completion.

7.2.4 STANDARDS

N/A

7.2.5 PRIORITY

Future

8 OTHER REQUIREMENTS

8.1 UNITY VERSION

8.1.1 DESCRIPTION

The version of Unity used in developing this application and system will be Unity 2019.2.8.

8.1.2 SOURCE

Agreement among team.

8.1.3 CONSTRAINTS

Due to the choice of developing in Unity, the team will only be able to use assets available with this version of Unity.

8.1.4 STANDARDS

Unity Manual

8.1.5 PRIORITY

Medium

8.2 SUPPORTED OS

8.2.1 DESCRIPTION

The application will be developed for primarily Android devices. If time permits, the application will also be available for iOS devices.

8.2.2 SOURCE

Agreement among team.

8.2.3 CONSTRAINTS

A majority of team members use iOS devices, so field testing will be limited unless we port the application to both Android and iOS devices or borrow strictly Android devices to use. We will need to borrow Android tablets.

8.2.4 STANDARDS

Android Design and Quality Guidelines

8.2.5 PRIORITY

High

8.3 C# VERSION

8.3.1 DESCRIPTION

Unity 2019.2 supports up to C# 7.3, so this is the version of C# that will be explicitly supported.

8.3.2 SOURCE

Agreement among team.

8.3.3 CONSTRAINTS

There may be desire to use features in later version of C# such as C# 8. In order to use those features, the code must be compiled outside of Unity and then dropped into the project.

8.3.4 STANDARDS

8.3.5 PRIORITY

Medium

8.4 USER INTERFACE MODE

8.4.1 DESCRIPTION

The application will support dark mode and light mode features and can be adjusted according to the user's current environment.

8.4.2 SOURCE

Team member Justine Batongmalaki

8.4.3 CONSTRAINTS

There may be insufficient time.

8.4.4 STANDARDS

Android Design & Quality Guidelines

8.4.5 PRIORITY

Future

8.5 LOW BATTERY CONSUMPTION

8.5.1 DESCRIPTION

The application will not consume too much battery life of user's mobile devices during game play.

8.5.2 SOURCE

Peer Review Presentation Questions & Concerns

8.5.3 CONSTRAINTS

As mentioned previously, a majority of team members use iOS devices, so testing the app's battery consumption will be limited and time consuming if only done by one user.

8.5.4 STANDARDS

8.5.5 PRIORITY

Low

9 FUTURE ITEMS

This section lists features/functions that were discussed but are not feasible for the prototype version of this project due to constraints on budget, time, skills and technology.

9.1 HIGH MULTIPLAYER USAGE

9.1.1 DESCRIPTION

Game will allow multiple users (10 or more) to participate in the game.

9.1.2 SOURCE

Team member Linda Phanvilay

9.1.3 CONSTRAINTS

Lack of time due to coronavirus has reduced the time on implementing a high level of multiplayer usage along with switching the server from DigitalOcean to Firebase.

9.1.4 PRIORITY

Future

9.2 KEEP TRACK OF PREVIOUS GAME SCORES

9.2.1 DESCRIPTION

Game will store the information of previous game data to display statistics of the user.

9.2.2 SOURCE

Team member Linda Phanvilay

9.2.3 CONSTRAINTS

User must create an account and login. Database needs to be available to store data from games.

9.2.4 PRIORITY

Future

9.3 BUG REPORTS

9.3.1 DESCRIPTION

If a user is experiencing issues with the app itself, there will be an option to send bug reports to the development team to further improve the app. This feature will be a future update.

9.3.2 SOURCE

Linda Phanvilay

9.3.3 CONSTRAINTS

Team will no longer support application after project completion.

9.3.4 STANDARDS

List of applicable standards

9.3.5 PRIORITY

Future