

SE 3XA3: Software Requirements Specification TankWar

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This document describes the requirements for TankWar. The template for the Software Requirements Specification (SRS) is a subset of the Volere template (Robertson and Robertson, 2012).

Table 1: **Revision History**

Date	Version	Notes
Feb. 2, 2020	1.0	Creates the first version of SRS
Feb. 26, 2020	2.0	Follows all the comments from TA to improve the SRS. Fixed some of the minor issues. Improve the functional and non-functional requirements. Makes the document consistent.
April. 2, 2020	2.1	The rationales behind the functional requirements are added into the SRS. Fixed some minor issues.

1 Project Drivers

1.1 The Purpose of the Project

The purpose of this project is to recreate and upgrade the game BattleCity. BattleCity was one of the most popular games decades ago, and it was usually on family computers. However, a family computer is hard to find today, and the game BattleCity is also somehow too simple for today's person, so we are going to upgrade it to a new game called TankWar, which will be compatible with modern computers. Also more modes will be added in the upgraded version. The first one is the player versus player mode, which can increase the competitiveness of the game. The other new mode is the map editor, which allows the players to create a new map on their own to increase their interest.

1.2 The Stakeholders

1.2.1 The Client

The clients for this project are Dr.Asghar A Bokhari, and the TAs, Andrew Lucentini and Maryam Hosseinkord. They will be the final reviewer of our project.

1.2.2 The Users

The users for this project are all the people who want to play this new game. Therefore, the potential users can be anyone above 12 years old with simple compute operation knowledge and the ability to operate a keyboard. ~~Our game is developed for all ages. Therefore the potential costumers can be anyone at any age.~~

Comments: This was "The Customers" in the original template, but I think the word users are more appropriate since our product is totally free and accessible for anyone.

1.2.3 Other Stakeholders

The other stakeholders are the developers, who are the three team members in our group. Redeveloping the whole program and implementing new functions

will be developers' responsibilities.

1.3 Mandated Constraints

1. The project must be finished in one term, by April 6, 2020.
2. The new game should be able to run under Windows system **that later than Windows 7**, Mac OS X **10.0** system, and Linux **Ubuntu 18.0** system with python and pygame.
3. The new game will be free and accessible for all the players.

1.4 Naming Conventions and Terminology

1. **Developers:** The team members.
2. **Project:** TankWar project. Recreate and upgrade the original game BattleCity.
3. **User** : ~~The players of the TankWar game.~~
4. **PVE:** Player1 and Player2 Versus Environment.
5. **PVP:** Player1 Versus Player2.

1.5 Relevant Facts and Assumptions

1.5.1 Relevant Facts

- In the original TankWar game(BattleCity), there are 1012 lines of code.
- The original game is written in python.

1.5.2 Assumptions

- Python and pygame are assumed already being installed on the users' computer.
- The game is assumed to be played by two players.
- **A US standard keyboard is assumed to be available for the players.**

- The players are assumed to be able to operate a keyboard.
- The players are assumed to have simple computer operation knowledge.
- The users' computer are assumed to meet the minimum requirements for 2-cores processor and 1GB RAM.

2 Functional Requirements

2.1 The Scope of the Work and the Product

2.1.1 The Context of the Work

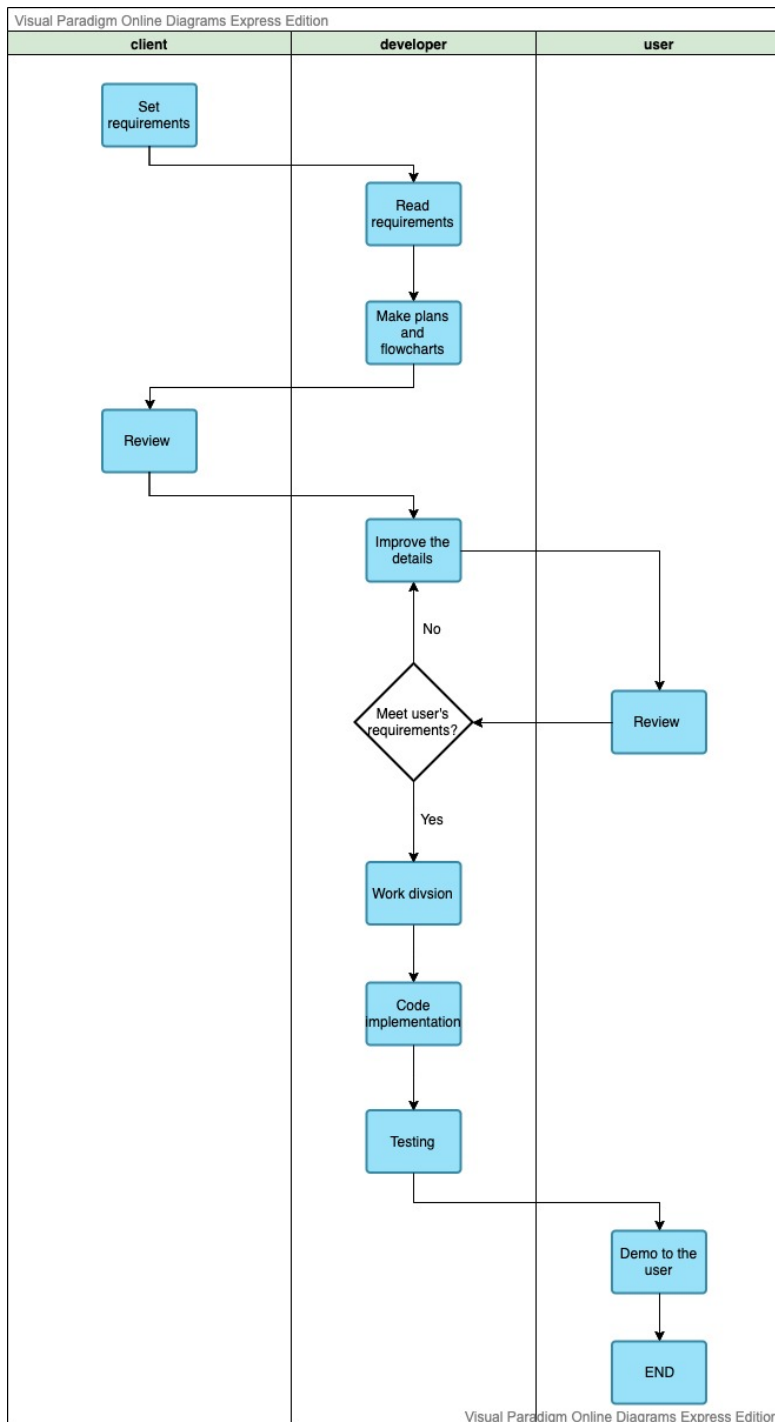


Figure 1: Swimlane Diagram.

2.1.2 Work Partitioning

Event Number	Event Name	Input	Output
1	TankWar Game Interface Creation	Python Code	User Interface
2	Map Editor	Python Codes, graphics, and user's operations	A created map file
3	Tank Control	Python Codes and user's operation	Movements and attack of the tank.
4	Tank Object	Python Code	Characteristics and the corresponding ultimate skill will be determined.
5	<u>PVP</u> and <u>PVE</u> mode	Python Code	Rules of <u>PVP</u> and <u>PVE</u> mode will be implemented.
6	Game result determination	Python Code	Game status will be able to detected and a end screen will be shown.

Table 2: Work Partitioning Table

2.1.3 Individual Product Use Cases

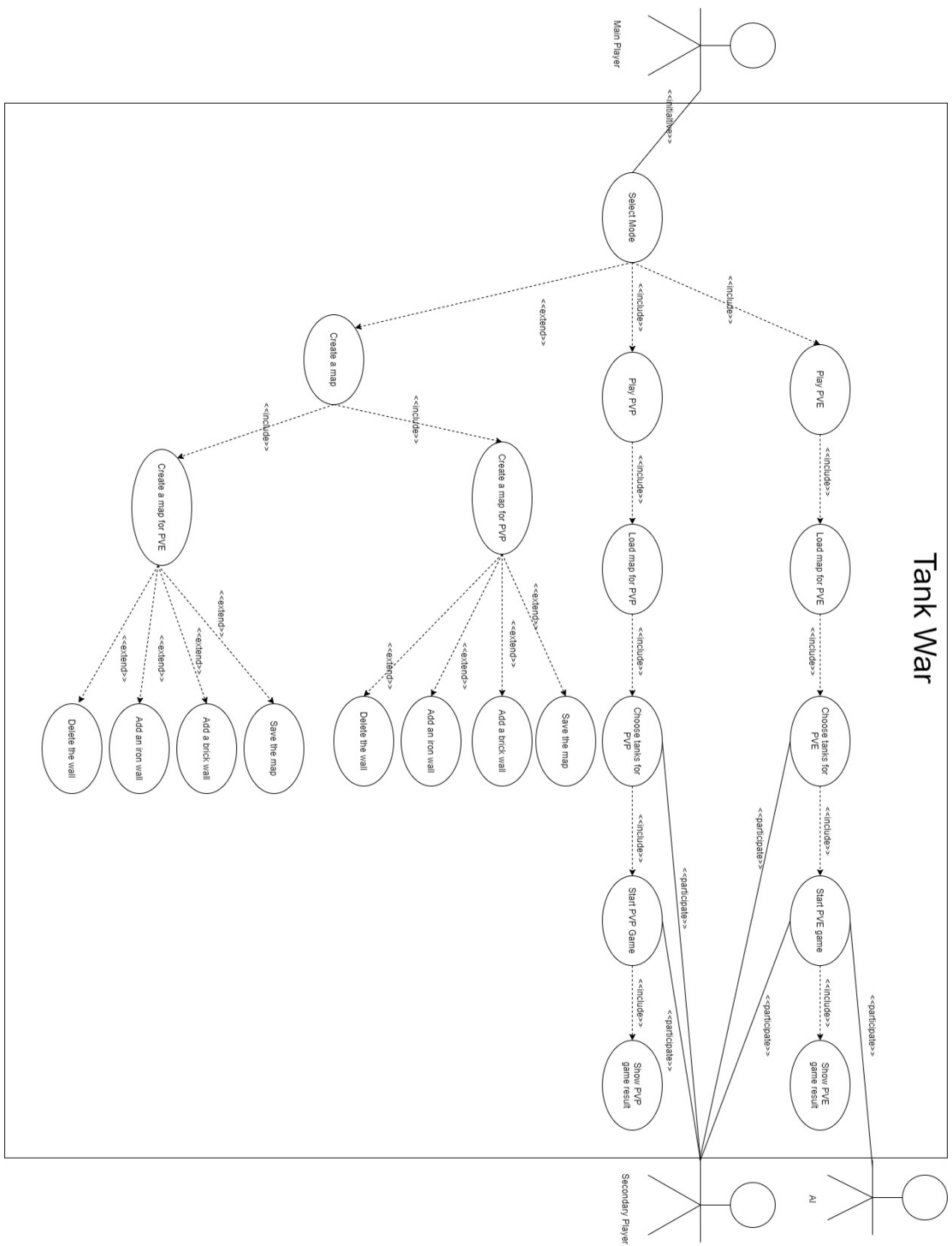


Figure 2: Use Case Diagram.

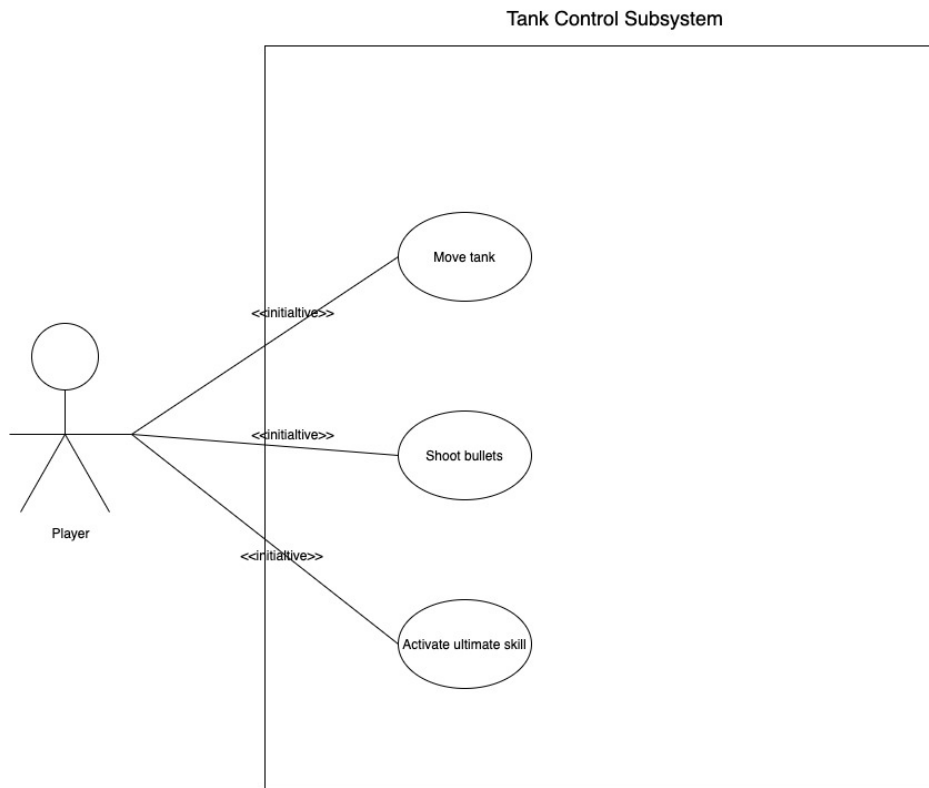


Figure 3: Tank Control Use Case Diagram.

Comments: There are two players in either the PVE or PVP. Only the rules of the the two game mode is different. The player 2 is involved in PVE mode to control the second tank and fight side by side with the player 1's tank.

- **Select mode:** Player shall be able to select mode.
- **Play PVE:** Player selects player-versus-environment mode.
- **Play PVP:** Player selects player-versus-player mode.
- **Create a map:** The map is created in the map-editing mode.
- **Create a map for PVE:** The map for PVE mode is created.
- **Create a map for PVP:** The map for PVP mode is created.

- **Save the map:** Once created, the map is saved on the computer.
- **Add a brick wall:** Add a brick wall on the map creating right now.
- **Add a iron wall:** Add a iron wall on the map creating right now.
- **Delete a wall:** Delete a wall from the map.
- **Load map for PVE:** Load a map for the PVE game.
- **Load map for PVP:** Load a map for the PVP game.
- **Choose tanks for PVE:** Players choose the tank before the PVE game starts.
- **Choose tanks for PVP:** Players choose the tank before the PVP game starts.
- **Start PVE game:** PVE game starts.
- **Start PVP game:** PVP game starts.
- **Show PVP game result:** Game result of PVP mode is display on the screen.
- **Show PVE game result:** Game result of PVE mode is display on the screen.
- **Move tank:** Player moves the tank.
- **Shoot bullets:** Player shoots the bullets.
- **Activate ultimate skills:** Player activates the ultimate skill of the tank.

2.2 Functional Requirements

FR1. The system shall provide three mode to the users including "Player vs. Environment", "Player 1 vs. Player 2", and "Map Editing" at the beginning of the system.

Rationale: There should be three modes in our game. And all the three modes should be shown to the users.

Fit criterion: After opening the game, check whether there is a screen for selecting the modes.

FR2. The system shall allow the users to add brick walls, add iron walls, and delete walls in the map editing mode.

Rationale: These are the main functions in map editing mode. Users can only create their own maps by using these functions.

Fit criterion: After selecting the map editing mode, check whether there is a brick wall or iron wall shown after pressing "J" key or "K" key.

FR3. The system must allow the users to save and load the map they created in map editing mode.

Rationale: The users should be allowed to save their map so that it can be opened during the gaming.

Fit criterion: Check whether there is the corresponding file in the local computer after saving the map. Check whether the corresponding file can be loaded during the game.

FR4. ~~The system shall include the function of moving the tank to four different directions: forward, back, left, and right.~~ The system shall include the function of moving the tank to four different directions: forward, back, left, and right using arrow keys or "WASD" keys on the keyboard.

Rationale: With this functional requirement, the users can move the tank.

Fit criterion: After entering the game, check whether player 1 and player 2 can move the tank by pressing "WASD" keys and arrow keys.

FR5. The system shall allow the player 1 and player 2 to use the ultimate skill of the selected tank by pressing "K" and "." keys on keyboard respectively.

Rationale: Users should be able to use the ultimate skills.

Fit criterion: After entering the game, check whether player 1 and player 2 can use the ultimate skill by pressing "K" and "." keys.

FR6. ~~The system shall allow the users to shoot the bullet while controlling the tank.~~ The system shall allow the player 1 and player 2 to shoot the bullet while controlling the tank using "J" and "," keys on the keyboard respectively.

Rationale: Users should be able to shoot in order to kill enemy or kill each

other.

Fit criterion: After entering the game, check whether player 1 and player 2 can shoot by pressing "J" and "," keys.

FR7. ~~The system shall allow the bullets to destroy the brick walls.~~ The system shall allow the bullets to destroy the brick walls when the bullets hit the brick wall.

Rationale: The brick wall should be destroyed by bullets.

Fit criterion: After entering the game, check whether the brick wall can be destroyed after a bullet hitting the brick wall.

FR8. The system shall not allow the bullets to destroy the iron walls when the bullets hit the iron wall.

Rationale: The iron wall should not be destroyed by bullets.

Fit criterion: After entering the game, check whether the iron wall can be destroyed after a bullet hitting the iron wall.

FR9. The walls shall block the movements of the tanks.

Rationale: The tank should not be allowed to walk over the walls.

Fit criterion: After entering the game, check whether the tank can move pass the wall while facing the wall and "W" or up arrow key is pressed and held.

FR10. The system shall allow the users to choose one among three different kinds of tanks before the game starts in both PVE and PVP mode which includes double-life tank, high-speed tank, double-bullet tank.

Rationale: The users should be able to choose the tank based on their preference.

Fit criterion: After entering the game, check whether there is a screen of tank selection.

FR11. The system shall display the result of the game after the game ends including winning, losing, and draw.

Rationale: The game should notify the users about the result.

Fit criterion: After finishing the game, check whether there is a result screen.

FR12. The game shall offer different buffs in the map after the game starts, including moving speed enhanced buff, wall enhanced buff, and bullet speed enhanced buff.

Rationale: Buffs should be provided in the game to make the game more fun.
Fit criterion: After entering the game, check whether the system generates buffs and show them on the map.

FR13. ~~The system shall provide enemy tanks in PVE mode.~~ The system shall provide enemy tanks in PVE mode and make them move automatically so that the player can distinguish.

Rationale: The moving ability of enemy tanks is very important in PVE mode.

Fit criterion: After entering the game, check whether the enemy tanks can move by themselves.

FR14. The system shall control enemy tanks and shoot the bullet to fight against the players' tanks in PVE mode.

Rationale: The shooting ability of enemy tanks is very important in PVE mode.

Fit criterion: After entering the game, check whether the enemy tanks can shoot by themselves.

FR15. The system shall allow the enemy tanks to relive immediately after they are destroyed in the PVE mode.

Rationale: Enemy tanks need to be able to relive to keep the PVE game process continuous.

Fit criterion: After entering the game, check whether the enemy tanks can relive after being destroyed.

FR16. The number of enemy tanks on the battle field in PVE mode shall be five at all time.

Rationale: The number of enemy tanks should be controlled.

Fit criterion: After entering the game, check whether the number of enemy tanks is equal to 5.

FR17. The system shall provide a home base for players in PVE mode.

Rationale: Home base is one of the main element for determining the game result.

Fit criterion: After entering the game, check whether home base is provided.

FR18. The system shall provide two home bases for players in PVP mode.

Rationale: Home bases are main elements for determining the game result.
Fit criterion: After entering the game, check whether home bases are provided.

FR19. In PVE mode, the system shall display the lost result if the players' home base is destroyed or the players' tanks died 3 times in 3 minutes, otherwise display the win result.

Rationale: The rules of PVE mode are necessary for PVE game.

Fit criterion: Check whether the corresponding result is shown after finishing the whole game. To be more specific, check whether the win result is shown if both players' tanks did not die for three times or the home base is destroyed. Check whether the lost result is shown if both players' tanks are destroyed three times or the home base is destroyed.

FR20. In PVP mode, the system shall display a win result if the player's tank destroys another player's home base or kills the other player's tank 3 times in 3 minutes. Otherwise it will be a tie.

Rationale: The rules of PVP mode are necessary for PVP game.

Fit criterion: Check whether the tie result is shown if no home base is destroyed or no player's tank is destroyed three times in 3 minutes. Check whether the player 1 win result is shown if player 1's tank destroys player 2's tank three times or destroys player 2's home base in 3 minutes. Check whether the player 2 win result is shown if player 2's tank destroys player 1's tank three times or destroys player 1's home base in 3 minutes.

FR21. All the players' tanks in both PVP and PVE mode shall have only 3 life.

Rationale: Both player's tanks only have 3 life because it is a element for determining the result of the game.

Fit criterion: After entering the game, check whether the tank can still relive after being destroyed three times.

3 Non-functional Requirements

3.1 Look and Feel Requirements

3.1.1 Appearance Requirements

LF1. The TankWar shall be designed as a 2-D game.

Fit Criterion: The TankWar game and system are in 2 dimension.

LF2. The background of the TankWar system shall be black.

Fit Criterion: The background is black.

LF3. The brick walls and iron walls shall be arranged in a grid map.

Fit Criterion: The system displays brick walls and iron walls in a grid map.

LF4. Brick walls shall look like bricks and their colour shall be orange.

Fit Criterion: The brick walls are orange like bricks.

LF5. An iron wall shall consist of 4 iron cube and their colour shall be sliver.

Fit Criterion: The iron walls are sliver and one iron wall has 4 small iron cube.

LF6. Different types of the tanks in the TankWar system shall be used different colour to represent.

Fit Criterion: The system shall display different types of tanks with different colour.

LF7. The icon of the home in TankWar system shall look like an eagle.

Fit Criterion: The system shall display a home which looks like a eagle.

3.1.2 Style Requirements

- LF8. The TankWar system shall follow the drawing style of the original game "Battle City".

Fit Criterion: By surveying 50 test users, 80 percent of the test users consider the drawing style of TankWall shall be more than 90 percent similar with Battle City. ~~By comparing the original game "Battle City" with TankWar, the drawing style of TankWall shall be more than 90 percent similar with Battle City.~~

3.2 Usability and Humanity Requirements

3.2.1 Ease of Use Requirements

- UH1. The system shall provide the photos and descriptions of different types of tanks to give a brief introduction when users are choosing tanks at the beginning of the game.

Fit Criterion: The photos and descriptions are displayed on the screen when users are choosing tanks at the beginning of the game.

- UH2. The system shall display the rules of the game for 3 seconds before starting the game.

Fit Criterion: The rules of the game are displayed for 3 seconds before starting the game.

- ~~UH3. The player's tank in the game shall be controlled by 4 direction keys and two functional keys. The direction keys shall use "wasd" and "up down left right" for each player. The function keys shall use the key "j" and "." as the shoot key, while the key "k" and "?" shall be used to activate the ultimate skills of the tanks.~~

~~Fit Criterion: The tanks can be used "wasd" and "up down left right" to control the movements, while shooting function is activated by "j" and "." and clicking "k" and "?" can activate the ultimate skills of the tanks.~~

~~UH4.~~ ~~The system shall use the buff icons that have the symbolic meaning as same as the function of the buffs to represent a buff.~~

~~Fit Criterion: By surveying 50 test users, 80 percent of the test users consider the icons are relative to the buff function.~~

3.2.2 Personalization and Internationalization Requirements

~~UH5~~ UH3. Not Applicable

3.2.3 Learning Requirements

~~UH6~~ UH4. The system shall display the instruction of the game about basic rules and operations in the game before starting a battle. After reading the instruction, the user shall have basic knowledge about how to play the game.

Fit Criterion: The rules and operation instruction are displayed on the screen before starting a battle. By surveying 50 test users, 80 percent of the test users knows how to play the game.

3.2.4 Understandability and Politeness Requirements

~~UH7~~ UH5. The system shall use words and icons which are easily understandable by common users who are above 12 years old.

Fit Criterion: By surveying 50 test users above 12 years old, 80 percent of the test users consider that the words and icons in the product are easily understandable.

3.2.5 Accessibility Requirements

~~UH8~~ UH6. Not Applicable

3.3 Performance Requirements

3.3.1 Speed and Latency Requirements

- PR1. The system shall respond to a user operation input less than 100 milliseconds.

Fit Criterion: The system responding is less than 100 milliseconds.

- PR2. The system shall take less than 5 second to load or save a map.

Fit Criterion: Both the map loading and map saving process need less than 5 second to be completed.

3.3.2 Safety-Critical Requirements

- PR3. Not Applicable

3.3.3 Precision or Accuracy Requirements

- PR4. Floating point numbers shall be in double precision as same as the feature of python 3.

Fit Criterion: The precision of floating point numbers is double precision in 64-bit.

3.3.4 Reliability and Availability Requirements

- PR5. The system crashes shall not exceed 3 times within 6-hour constantly running.

Fit Criterion: By starting a test, 10 TankWar games are constantly played by 20 test users in group of 2 for 6 hour, while crashing happens less than 3 time each game.

- PR6. The system shall be available in Windows, Mac OS and Linux system with python and pygame.

Fit Criterion: The system is able to run under Windows, Mac OS and Linux system with python and pygame.

3.3.5 Robustness or Fault-Tolerance Requirements

- PR7. When users try to save a map with a existing file name, the system shall be able to prompt the users and say "File Already Exist".

Fit Criterion: When users try to load a map with a nonexistent file name, the warning message is displayed on the screen to show that the file does not exist.

3.3.6 Capacity Requirements

- PR9. The game shall support the operations up to two players.

Fit Criterion: The game is able to respond to the operations of two players at the same time.

3.3.7 Scalability or Extensibility Requirements

- PR10. Not Applicable

3.3.8 Longevity Requirements

- PR11. Not Applicable

3.4 Operational and Environmental Requirements

3.4.1 Expected Physical Environment

- OE1. The TankWar system should be able to be used on the personal computers with the minimum requirements for 2-cores processor and 1GB RAM.

Fit Criterion: The TankWar is able to run on a personal computer with 2-cores processor and 1GB RAM.

3.4.2 Requirements for Interfacing with Adjacent Systems

OE2. Not Applicable

3.4.3 Productization Requirements

OE3. The product shall be wrap up as a file package in order to be distributed easily.

Fit Criterion: The file package can be easily download.

3.4.4 Release Requirements

OE4. The TankWar system and development documentation shall be released on GitLab as an open source project.

Fit Criterion: The TankWar project and documentation is on GitLab and allow everyone to access it.

OE5. The system shall be released after full verifying and validation.

Fit Criterion: The system completes the testing plan and meet the standard required in the plan.

3.5 Maintainability and Support Requirements

3.5.1 Maintenance Requirements

MS1. Not Applicable

3.5.2 Supportability Requirements

MS2. A consistent naming convention shall be followed in the software development.

Fit Criterion: The naming convention are the same.

- MS3. The code implementation shall include the comments that generates Doxygen documentation.

Fit Criterion: Every function in the program is commented with the information to generate the Doxygen documentation.

3.5.3 Adaptability Requirements

- MS4. The product shall be able to run under Windows, Mac OS, and Linux system with python and pygame.

Fit Criterion: The product can be run under Windows, Mac OS, and Linux system with python and pygame.

3.6 Security Requirements

3.6.1 Access Requirements

- SR1. Not Applicable. The product is open source and allow every one to have access on the data stream of the game.

3.6.2 Integrity Requirements

- SR2. The system shall not allow any loss of information when the map is read from or written to the device.

Fit Criterion: The map saving and loading process has mechanism to prevent data loss.

3.6.3 Privacy Requirements

- SR3. The system shall not gather any personal information from users.

Fit Criterion: The system does not have any mechanism to save personal information from users.

3.6.4 Audit Requirements

- SR4. Not Applicable

3.6.5 Immunity Requirements

SR5. Not Applicable

3.7 Cultural Requirements

CR1. The game shall not contain any content that could be considered offensive.

Fit Criterion: By surveying 100 test users, more than 80 percent of the test users do not feel offensive.

CR2. The system shall be in English with Canadian spelling.

Fit Criterion: The system is in English with Canadian spelling.

3.8 Legal Requirements

3.8.1 Compliance Requirements

LR1. Not Applicable

3.8.2 Standards Requirements

LR2. Not Applicable

3.9 Health and Safety Requirements

HS1. Not Applicable. Any health and safety issue will not be concerned now, but they will be considered in the future. Problems like game addiction and eye soreness concern are included in the Section 4.9 Waiting Room. The product is not able to have impact on health or safety.

4 Project Issues

4.1 Open Issues

The new game is designed to run on Windows, Mac OS X, and Linux. However, the systems will be updated in the future and we are not able to test the compatibility now, and it may lead to some unexpected problems on the updated systems.

4.2 Off-the-Shelf Solutions

The following off-the-shelf solutions are required:

- The original open source project, Tankwar, which is implemented in python. Available from <https://github.com/wangxingyao/TankWar>
- The pygame plugin. Available from <https://www.pygame.org/download.shtml>

4.3 New Problems

Some players may be addicted to the new game, and this can result in eye problems includes eye soreness and eye strain.

4.4 Tasks

The tasks for our project are based on the deliverable outline, which is set by the professor. The schedule can be referenced from the Table 3 and the gantt chart below.

Table 3: Tasks

Task	Timeline
Project Approval	Week of Jan 20
Problem Statement	Jan 24
Development Plan	Jan 31
Requirements Document Revision 0	Feb 7
Proof of Concept Demonstration	Feb 11
Test Plan Revision 0	Feb 28
Design and Document Revision 0	Mar 13
Revision 0 Demonstration	Week of Mar 16
Final Demonstration(Revision 1)	Week of Mar 30
Final Documentation(Revision 1)	Apr 6

The project is divided into three phases as well, the first phase is to design the project, we decide all the things to be done in this phase. The second phase is implementation, and a running new game shall be provided at the end of this phase. The last phase is the testing, all the functions of the new game shall be tested and improved.

The gantt chart is provided in the following links.

TankWarSchedule.pdf



TankWarSchedule.gan



4.5 Migration to the New Product

None.

4.6 Risks

One of the problems is to implement the map editing mode. The map editing mode requires developers to design a user interface to create maps and a mean to saving map in the local machine. All group members did not have experience to construct a similar game map editor before. It required

developers to learn amount of design knowledge and coding implementation skill in pygame. Testing is also a problem since there are too many functions and branches, and they are hard to be completely covered.

4.7 Costs

The only cost to develop the project is time. All three developers will spend about 6 hours every week on this project and it will be about 72 hours in total for each one.

4.8 User Documentation and Training

A user guide will be shown during the game. It will introduce the tank operation instruction and game rules to the players in order to let players have a basis knowledge about the game.

4.9 Waiting Room

The new possibilities of the game can be made in the map editing mode, tanks, and prevention of game addiction. In the map editing mode, it can be added more different types of land form to give more choices. For the tanks, more types of tanks can be added to the game so that the players will have more choices. Moreover, the health and safety issue would be considered. The game addiction prevention system would be developed and added into the game.

4.10 Ideas for Solutions

The new land forms can be implemented in python. For example, there may be grass and pools in the map. The tanks can hide in the grass, and the river can limit the movements of the tanks. For the new tanks, they can also be designed and implemented in python. Moreover, an achievement system can be developed in order to track player's gaming progress. After getting a special new achievement, players can get a corresponding new tank as a reward. Additionally, the game addiction prevention system shall be able to count the daily playing time and continuous playing time. If the daily playing time is more than 4 hours, the game will be locked for 24 hours and will not allow anyone to play the game. If the continuous playing time is

more than 1 hour, the game will be locked for 14 minutes to let the players rest for their eyes.

References

James Robertson and Suzanne Robertson. Volere Requirements Specification Template. Atlantic Systems Guild Limited, 16 edition, 2012.

5 Appendix

None

5.1 Symbolic Parameters

None.