

De Montfort University

# AI TANK WAR

IMAT 2800

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Group members

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9 Pages including a title page and a table of content, 7 pages is the body.

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## 1. Introduction

The purpose of this report is to document the aims, objectives and achievements of mechanics and artificial intelligence for simulation project. The project aims to develop an AI simulation to demonstrate real behaviors of game actors.

### 1.1. Team goals

We are aiming to find the perfect path around the environment for the AI tank movement. However, it needs to identify walls and objects and edit the path to avoid them. The turret also needs to move in a pattern that will maximise its visual range. Maybe in a 180-degree arc. Spinning 360 degrees will allow it to see behind it however the full rotation is slow, and could cause issues with it missing objects around it.

If AI Tank hits either the player or an enemy base object it should fire at it rather than pathing around it, to conserve bullets rather than randomly firing, automatically fire at any BLUE base squares found but not red base squares, automatically fire at the player, this should take priority over enemy base block as it gives a higher score. The Tank should fire slightly in front of the player not at where the player currently is.

## 2. System design

### 2.1. The game logic

The game consists of two tanks blue and red, each player has 10 buildings of each colour (red and blue). These tanks cannot leave the screen or go through each other or bases. There are 15 shells per-player and the mechanics of the player uses tank controls. In this game, the human controls the player using the keys; W is forward, S is backwards, D is rotate clockwise, A is rotate counter-clockwise. Right arrow rotates turret clockwise; left arrow rotates turret counter-clockwise. Player can only see what is in front of the turret, however once a base is found it remains on screen. However enemy tank is only visible whilst within the human players field of view.

Shells travel to edge of screen however they cannot hit an enemy tank if it is out of range regardless whether it is a hit. However once the base is visible a hit from any distance it will count as a hit. Score is gain through: 10 points for destroying a building of the opposing colour. 15 points are gained for destroying the enemy tank.

Game Ends when all the squares of one colour are destroyed. Each tank has limited bullets, game ends when neither tank has bullets left.

The Game is won if all the buildings of the opposing colour are destroyed. UNLESS Enemy score is higher. If both tanks are out of bullets highest scoring tank wins. The Maximum score is achieved if player is killed 15 times – 225 however, if all buildings are destroyed you end with – 100, If Player is killed 5 times and all squares are destroyed you end with – 175

### 3. Methodology

The methodology of this project follows agile techniques.

#### 3.1. SCRUM

As a group, we have decided to use the Agile project management (SCRUM), to develop our software project. We will need achieve the best functionality for planning and implementing code. The reason why we have used SCRUM, is because we can change the requirement frequently. The requirements change during the project deadline because, we will need to decide if the game needs improvements. Occasionally when deadlines haven't been met, this entices us to reschedule by utilising the SCRUM method because it is very flexible to work with. SCRUM is a framework for a set of rules which has an analysis, design and implementation stages. We had to associate roles to members of the group, like SCRUM Master, Product Owner and Developer. SCRUM is built with a series of sprints; each sprint has a limit to finish these requirements within a week. We have decided to have seven sprints where we will develop the game.

Our team decided to call ourselves 'Anything', the SCRUM Master was nominated by the rest of the group. There was two group members who was provided the developers role. The product owner role in this project has been given to all members of the group. The product owner provides the team information from the client, with the requirements of the game; which consists of the design, the rules, and how the game works, so our coding team can develop the game. This provides our team to be more compatible to work with to increase better work culture and ethics. The group chose the strongest coders of the group to take the developing roles.

The SCRUM Master associated tasks to the group and deals with the sprint board. The sprint board consists of sprint backlog, product backlog, test log and a velocity diagram. A sprint backlog is a series of requirements set by the SCRUM master, which associates the tasks to the members of the group. This is a breakdown of the work that needs to be done by a set deadline. The sprint backlog allows us to analyse the progression of the work during following weeks so everyone is aware what needs to be done.

A product backlog is the client's requirements which changes depending on the progression of the game. Every sprint stage the product owner will provide the team with a product backlog, which will set new requirements for the developing team; the client may want to change something about the game in the new sprint.

The test log is the testing stage of SCRUM methodology which we test the game so it is bug free. We have tested the game manually.

The velocity diagram is a breakdown of the progression the group has made overall throughout the seven sprints. The diagram will show the line progression going up if we meet a task within the set deadline so this will show us an overall analysis of our progression. If we did not meet the requirement within the deadline the progression line will fall below average requirement line.

We decided to have requirement of two meetings a week, to improve the effectiveness of communication. We also had regular, daily message exchanges through Facebook Messenger). We also allocated tasks using Google Drive so everyone was on the same working platform. We could share our work on this platform so everyone in the group had a regular update the work.

Requirement	To Do	Doing By	Done
<ul style="list-style-type: none"> <li>Pathfinding- start on having an absolute path to follow. And should be first choice some obstacle avoidance needed but only on the right side of the screen.</li> </ul>	 <p>understanding program making notes about rule sets and possible goals to work towards. Information passed to the group</p>	All members	15/03
<ul style="list-style-type: none"> <li>Movement –When the dumb tank is created, choose a random location on the left side of the screen (the players area) and move to it.</li> </ul>	 <p>Discussion on pathfinding. And talking about firing techniques. Start the report and write the structures</p>	<p><b>Sarah:</b> start the report.  <b>James:</b> start to think how to implement movement and started on avoidance.</p>	Done by 22/03
<ul style="list-style-type: none"> <li>Firing - given rough pseudo code just going for simple aiming and shoot. Focus on smart aiming. Make the dumb tank only fire when it can see a base or a player</li> </ul>	 <p>Start to implement the pathfinding</p>	<p><b>James:</b> implement pathfinding movement and started on avoidance.  <b>Sarah:</b> continue working with the report,  <b>Jamie:</b> start the testing, and presentation.</p>	Finish by 29/03
<ul style="list-style-type: none"> <li>Presentation- Make the presentation along with talking points for each member of the team, ideally letting each person speak about what they have contributed to the most</li> </ul>	 <p>While firing is being implemented we will work on obstacle avoidance code</p>	<p><b>Sarah:</b> continue working with report.  <b>James:</b> explain the firing for William.  <b>William:</b> start working with the firing code.</p>	All group members still working Nothing to be done
<ul style="list-style-type: none"> <li>Report – detailing and explaining the design decisions of your software, level of functionality achieved and the testing regime used.</li> </ul>	 <p>After finishing the code, report and the presentation We should be able to submit our work by</p>	<p><b>Sarah:</b> Finished the report  <b>James:</b> Implement all the code  <b>Jamie:</b> Finish the presentation</p>	Done by 18/04

		<b>William:</b> helping Jamie with testing	
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3.1.1. Sprint board

3.1.2. Team roles and responsibilities

Date					Required?
<b>Saturday 11<sup>th</sup>/03</b>	James	Sarah	Will	Jamie	no
<b>Wednesday 15<sup>th</sup>/03</b>	James	Sarah	Will	Jamie	Yes
<b>Thursday 16<sup>th</sup>/03</b>	James	Sarah	Will	Jamie	yes
<b>Wednesday 22/03</b>	James	Sarah	Will	Jamie	yes
<b>Thursday 23/03</b>	James	Sarah	Will	Jamie	yes
<b>Wednesday 29/03</b>	James	Sarah	Will	Jamie	yes
<b>Thursday 30/03</b>	James	Sarah	Will	Jamie	yes
<b>Wednesday 05/04</b>	James	Sarah	Will	Jamie	yes

Name of team members	Team roles	Starting date	Expecting finishing date
<b>Sarah</b>	Report/ Testing (SCRUM Master)	15/03/2017	13/04/2017
<b>James</b>	Movement/ Firing (Developer)	15/03/2017	12/04/2017
<b>William</b>	Movement / Firing (Developer)	15/03/2017	12/04/2017
<b>Jamie</b>	Presentation (Testing)	15/03/2017	21/04/2017

3.1.3. Attendance

3.1.4. Product Backlog

<b>Date:</b>	15/03/2017
<b>Development Team Name:</b>	Anything

Product Owner Name:	Anything
Priority	User stories or features
1	As a game player, I would like to have an AI technique to controller the AI red tank
2	As a game player, I would like to have perfect movement path for the red tank
3	As a game player, I would like the red tank to only fire the blue tank and base
4	As a game player, I would like to have a report detailing and explaining the design decisions of your software, level of functionality achieved and the testing regime used.
5	As a game player, I would like you to present me the implementation for the final product

## 4. Implementation

### 4.1. Movement

The method we have decided to use is finite state machine which makes the red tank choose one of three absolute paths to follow whichever is closest and available, when the red tank is created it will rotate towards the centre of the map and then move towards it, it will then travel to the left of the screen into the player's base area.

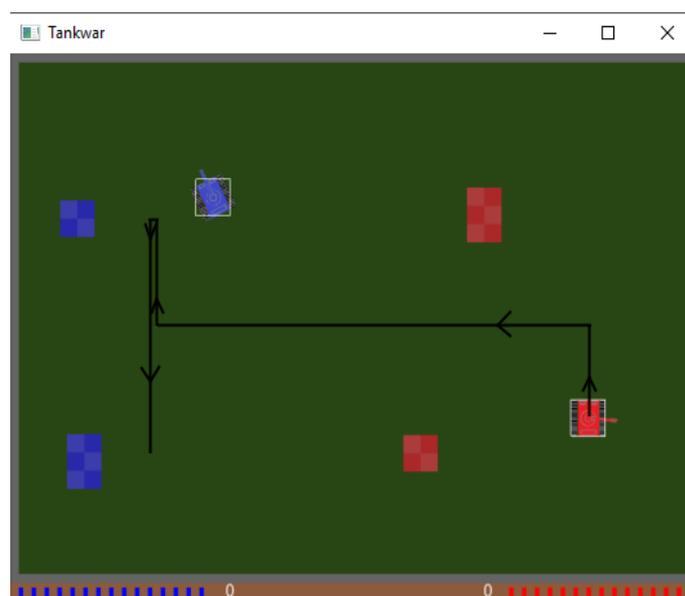
If there are any bases in the way it will start by travelling left then when it is half way it will do one of two things, if the tank is in the top half of the screen it will aim towards the bottom left then move towards it, if it is in the bottom it will aim towards the top left and move forwards.

### 4.2. Firing

The tank aiming to fire the closest enemy or bases, If the tank does not see anything will rotate and if not see any thing will go horizontal, it does not fire randomly anymore.

### 4.3. Result

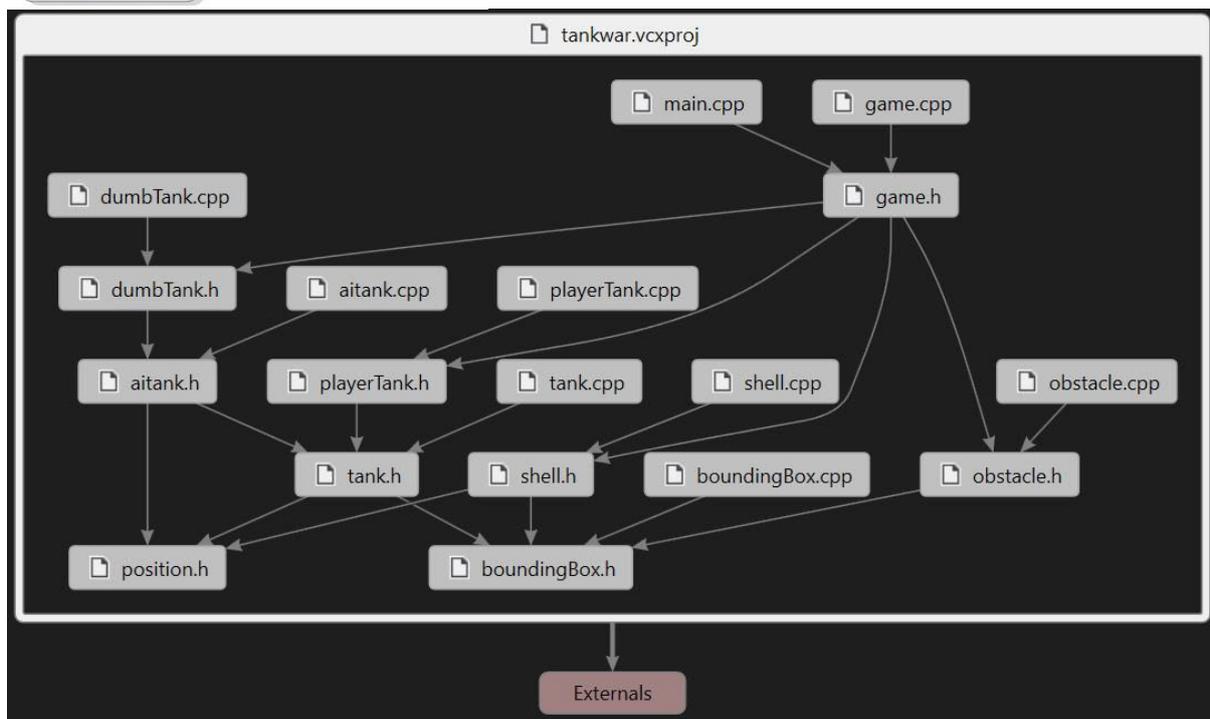
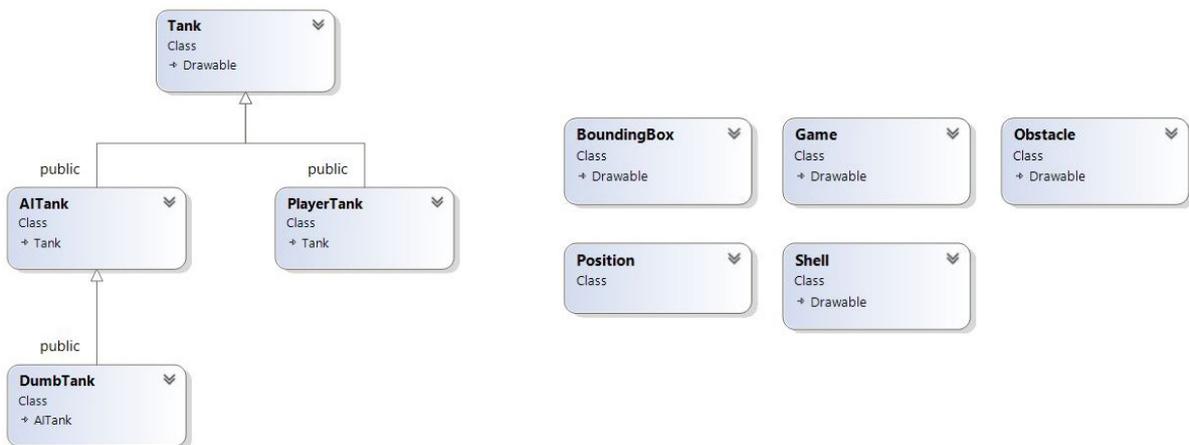
The screenshot shows the default path movement for the red tank.



The following class diagram shows the project level structure; we have not added new class.

The diagram shows the important class inherit that we have developed was the Tank, we have implement our code for the pathfinding.

To view the relationship between the classes and the interactions I have used the map feature of Visual Studio to produce the following diagram, which shows clearly the objects relations.



## 5. Testing

The testing was carried out in a robust manner throughout various discussions in the team, via brainstorming, actual code amendments and working together overall. When something did not work correctly we worked together to fix it towards the end goal making it work as intended.

After doing extensive testing the AI tank won around 2/3 of the time, the game was ran over 50 times displaying only three minor glitches. These all focused around issues with the bottom left of the screen.

These glitches are a simple fix, and will be addressed in the final updates to the code. Each update to the code was thoroughly tested in a similar way. this testing allowed us to identify issues with the code and fix the code in stages slowing approaching our final product.

Everything worked as it should, we conducted several tests, when the Red tank fired 2 out of the several tests we did the red tank was invisible completely to the player but it was not enough to justify a fix; see table in appendix.

We also did some other testing, where we pushed other keys at random, programmed key stroke instances at the same time, and clicking all over the place on the game scene with our mouse cursor, we additionally used Macro's (Using a program called Jitbit macro recorder) automating the process thus improving the timings of the clicks and key strokes, a computer could do these faster than our hands could. We did the delay between each key press at 100ms where there are 1000ms to a second (result for the test can be found in appendix 1). The team fed back that this was a good approach in comparison to the rest of the team's approach to come at it from a different angle.

## 6. Discussion

The project achieved its aims and objectives to use artificial intelligent to solve game simulations. We have make certain decisions and alternatives to make sure everyone was satisfied for example Re allocated roles (jobs) depending on group meeting, change the deadlines.

### 6.1. Challenges and future improvements

Although we have used agile methodology, working in a group was a challenge since we were involved in different projects, which made timing an issue.

For future improvement, we should associate more developers to code as it would have given less work load for our 2 current programmers.

The most challenging thing was finding the perfect path for the AI tank.

Also, the firing tank was firing randomly, so it was very difficult to make it fire in a specific place chosen by the developer.

## 7. Conclusion

Making time for everyone to meet, as people has other things to do, so it made it difficult to arrange a time where everyone was available.

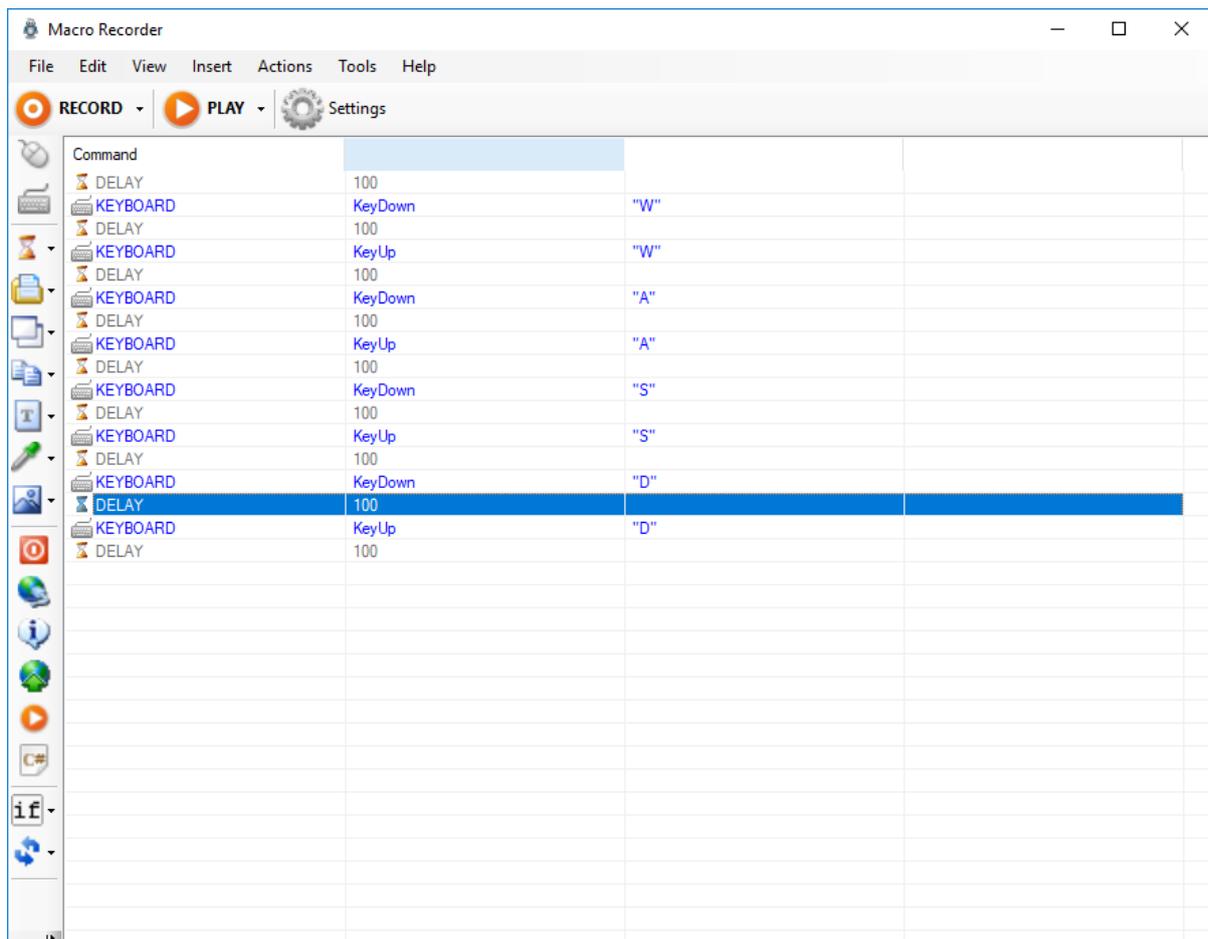
Deadlines was hard to meet for some members as they had other commitments, but eventually was met after deadline extension.

## 8. References

Agilemethodology.org. (2017). *The Agile Movement*. [online] Available at: <http://agilemethodology.org/> [Accessed 18 Apr. 2017].

Scrum.org. (2017). *What is Scrum?*. [online] Available at: <https://www.scrum.org/resources/what-is-scrum> [Accessed 18 Apr. 2017].

## 9. Appendices



Game Mechanic	Does it work as intended?	If no what happens?	Expected fix?
Scoring	YES	N/A	N/A
Firing	YES	N/A	N/A
Bullets	YES	N/A	N/A
Obstacles	YES	N/A	N/A
Bounding boxes	YES	N/A	N/A
AI mechanics	NO	Sometimes it went invisible	N/A because it did not effect the gameplay enough to justify a fix in terms

		when shooting at player.	of adding value or quality to the game and finished product therein.
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