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| Wits University |
| Tank Battle Game Design |
| ELEN3009 |
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# Introduction

Atari Inc. released the Atari 2600 video game system in 1977. With the system, they released the game cartridge, *Combat*, which was comprised of 27 games including two-player tank and fighter plane games on various maps [1].

The *Tanks!* game designed is based on the Atari tank game, where players can move on a two-dimensional (2-D) maze which contains obstacles.

# Requirements

The developers are required to implement basic functionality [2] as follows:

* The game is two-player with keyboard input controls.
* Tanks can move vertically and horizontally.
* Tanks can fire missiles in straight lines.
* The game is constrained to the map, where tanks cannot move off-screen or pass through barriers.
* Tanks can plant mines which destroy either player’s tank when collided with.
* The game ends when a tank is destroyed by a mine or missile.

# Constraints

The developers were bound to the following project constraints [2]:

* The game must be coded in ANSI/ISO C++ using the SFML 2.1 library.
* The game must run on Windows.
* The maximum screen resolution is 1600x900 pixels.
* OpenGL may not be used.

# Criteria for Success

The criteria for success as per the project brief is implementing all requirements and adhering to the constraints in sections 2 and 3.

The developers wish to implement additional functionality to add to the basic requirements. The extra minor feature enhancements chosen for implementation are:

* There is a scoreboard which keeps track of the number of times one destroys one’s opponent.
* Destructible barriers.
* Good graphics

The additional major feature enhancements chosen are:

* Tanks are able to move and fire missiles in any direction. Missiles can bounce off maze walls.
* Destructible gun turrets rotate and fire missiles at tanks when they move into range.

Furthermore, the developers consider good layer separation, use of inheritance and the DRY (Don’t Repeat Yourself) principle as well as thorough testing with Google Unit Tests, to be of great importance.

# Design Modelling

The screen is modelled as a 2-D plane of x and y coordinates with the origin located at the top left of the screen. Positive y increases downwards and positive x increases to the right.

## Game Objects and their Construction

The game objects are defined as follows:

* Tanks
* Crates and Concrete barriers
* Turrets
* Missiles
* Mines
* Collision objects

Tanks and missiles are moveable objects. Barriers, turrets and mines are stationary. However, the guns of the turrets rotate. Tank objects are able to move and fire missiles in all directions.

# Object Interactions

## Layer interaction

## Movement

## Collisions

# Structure Overview

## Presentation Layer

## Logic Layer

# Critical Analysis

## Layer separation

## Poor Design components

## Design Analysis

# Future Improvements

## Design improvements

The screen resolution was limited to 1600 by 900 pixels. One could enhance the game graphics if the screen were to have a larger resolution. In addition to this, all designed graphics were created with resolution equalling that of the screen. Object graphics were shrunk down for use in the game, which decreased their resolution and thus diminished detail. By increasing the screen resolution, the individual object graphics would appear more detailed.

## Additional Features

SFML allows for the addition of sound clips to the game. The developers could implement a background track and short clips to be played in the event of collisions causing explosions as well as rocket fire.

The design brief suggested a minor feature enhancement of allowing tanks to become invisible for short periods. This feature was written off by the developers, despite being easy to implement as the player controlling the tank would also be unable to see their tank, making it difficult to control. An alternative measure would to be to make tanks intangible for short periods of time, where missiles would pass through them or alternatively not cause any damage.

The original Atari game set had many levels with different maps. A future enhancement would add different maps which could be chosen from a drop down menu. One would read map details from a text file.

The original design incorporated different coloured tanks. Users would be able to choose their tank colour from a list upon start-up of the game. This feature was not implemented due to time constraints.

Another major feature enhancement would be to add computer controlled tanks which target both players.

The developers also implemented moveable crates, which tanks could push around and be protected from turrets. However, the collisions for the moveable crates did not behave as expected and this feature was removed due to time constraints.

# Conclusions

# References

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| [1] | T. R. G. Geek, “Retro Review: Combat - Atari 2600 - 1977,” 18 February 2013. [Online]. Available: http://theretrogaminggeek.blogspot.com/2013/02/retro-review-combat-atari-2600-1977.html. [Accessed 3 October 2014]. |
| [2] | L. S.P., *ELEN 3009: Software Development II. Project 2014 - Tank Battle,* 1.0 ed., School of Electrical and Information Engineering, University of the Witwatersrand, 2014. |