Ninja Runner

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Contents

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ABSTRACT

As technology advances, gaming has become more and more influential and profitable. Large games with high quality graphics rise in popularity and sell for copious amounts of money, but "Indie" games or smaller projects also see great popularity as mobile applications or ways to simply kill time. For this project we will produce a sidescroller game, in which players will control a running ninja. Their goal will be to see how far they can make it in the game while jumping over obstacles and deadly, killer robots. The user will press various controls to animate the ninja. Through the production and planning of the project, we decided to follow the agile model. A database of highscores, called the leaderboard, will be kept to create a competitive environment and give users a goal. We hope to produce a fun competitive game that spurs users to challenge friends and keep playing.

1 INTRODUCTION

Technology, a word summation for anything and everything that makes our lives easier. Technology has birthed, light, transportation, comfort and lastly fun.

This fun can come in many forms, but the most popular one being video games. Studies show that the video gaming industry has grown by a whopping 9.3% from 2019 to 2020, and is now estimated to be worth $159.3 Billion [1]. Current estimates predict this growth to continue, with the industry attaining $268 Billion in worth by 2025[1]. Gaming has become such a huge, influential market that even Tech giants like Google, Apple and Facebook have made plans to enter the industry[2]. In fact, Google ran their own "indie" game from their homepage recently, titled *Champion Island*, centred around the user becoming the best athlete on an island. This game was well received with users expressing their gratitude for the game as well as hoping for its return[3]. Despite this being a small scale game, its fun environment and competitive challenges had users craving more.

Through small and lacking complexity indie games and developers can certainly entertain their audience and provide a substantial income. In fact 2020 witnessed 9,866 games released on Steam, a 10.5% increase over 8,930 in 2019[4].

2 HUMAN COMPUTER INTERACTION

2.1 Data Gathering Method

Semi-structured Interview:

The semi-structured interview, found in the Appendix, was conducted to discover people's tastes in games and if they played them often. Since it was semi-structured we could delve deeper into what they thought about games and their various genres, even relatively unknown ones, as well as reveal their various tastes. Any confusion that arose from a question or answer could be easily dealt with and explained allowing us to get accurate data from each interview. This was an effective data gathering method and helped to supply the various information used for "user stories".

2.2 Users' Needs

Through cursory semi-structured interviews we questioned our users about video games and what they find exciting. Leaving the questions open for discussion we could delve deep into what they craved in a game and what would entice them to repeatedly play. What we discovered was this:

- Playing a game needs to be fun.
- There must be a challenge so users can feel accomplished.
- There must be necessary motivation to keep playing.
- The game must be visually alluring.

2.3 User Profiles

User Profile 1:

Epic: "As someone who plays games and enjoys them I look forward to any new and promising games with competitive features."

	Gamer
Age:	12-30 (Average: 21 years)
Gender:	50% Male
Experience:	0-10 years
Location:	Worldwide
Technology:	Computer or Mobile

Figure 1: User profile of a gamer.

User Profile 2:

Epic: "As a software developer I find myself with small periods of free time, I enjoy playing something that doesn't take much time."

Software Developer	
Age:	21-35 (Average: 28 years)
Gender:	50% Female
Experience:	0-10 years
Work hours:	40 hours a week
Education:	Bachelor's degree
Location:	Worldwide
Technology:	Computer or Mobile

Figure 2: User profile of a Software Developer.

2.4 Persona

Leslie is a 26 year old software developer for a small gaming company and is experienced in game development. She finds an interest in playing games and often uses her free time to compare her work to opposing companies by playing their games. In addition she is an avid gamer who enjoys playing competitively. During lunch after eating Leslie finds herself with some free time in which she likes to play games that don't last too long, have no story, and are essentially just pastimes. If they are competitive and have rankings Leslie is even more interested.

Leslie	Works as a software developer for a gaming company. Is 26 years old and holds a Bachelors' in Computer Science Has experience in developing games.	Has a great interest in video games. Works long hours and likes short bursts of enjoyment from games.

Figure 3: Leslie's Persona.

2.5 Conceptual Models

Conceptual model 1:

The interface metaphor for the sidescroller game will be a dashboard which will provide a graphical summary, easy to understand, of the key information relating to progress and performance of the game. The sidescroller game will support a multimedia type of interface and sequential forms of activities. Since the user is going to be the one controlling the running ninja, the type of interaction will be manipulating. The sidescroller game will have a username button where the human has to enter her/his name and save it before the game begins, and then after that the game will start, there will be input controls for the user to use in order to play the game, and at the end there will be a view leaderboard containing the score. The relationship between these functions will be sequential. The information requirements are enter name, input controls and view leaderboard.

Conceptual model 2:

The interface metaphor for the sidescroller game will be a desktop in which the user interacts directly with objects on the display screen. The sidescroller game will support a multimedia type of interface and sequential forms of activities. Since the user is going to be the one controlling the running ninja, the type of interaction will be manipulating. The sidescroller game will have a username button where the human has to enter her/his name and save it before the game begins, and then after that there will be input controls for the user to use in order to play the game, and at the end there will be a view leaderboard containing the score. The relationship between these functions will be sequential. The information requirements are enter name, input controls and view leaderboard.

Conceptual model 3:

The interface metaphor for the sidescroller game will be a dialog in which interacting with the computer is much like carrying on a conversation or dialog. The sidescroller game will support a multimedia type of interface and sequential forms of activities. Since the user is going to be the one controlling the running ninja, the type of interaction will be manipulating. The sidescroller game will have a username button where the human has to enter her/his name and save it before the game begins, and then after that the game will start, there will be input controls for the user to use in order to play the game, and at the end there will be a view leaderboard containing the score. The relationship between these functions will be sequential. The information requirements are enter name, input controls and view leaderboard.

Selected model:

We choose conceptual model 2 because of its interface metaphor, desktop. This type of interface metaphor will make the sidescroller game interactive meaning the user will be able to interact with the objects displayed on the screen when playing the game.

2.6 Storyboard

Leslie has some free time and wants a way to relax. She enjoys games and loads up the application. She plays independently and inputs commands and makes the ninja move. She receives a score and inputs her name which appears on the leaderboard. She is happy from her achievement and returns to working with gusto.

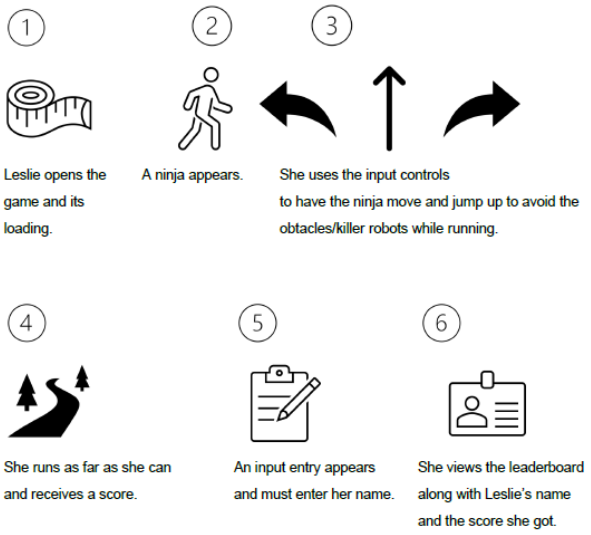


Figure 4: Leslie's storyboard

Cards/Stickynotes:

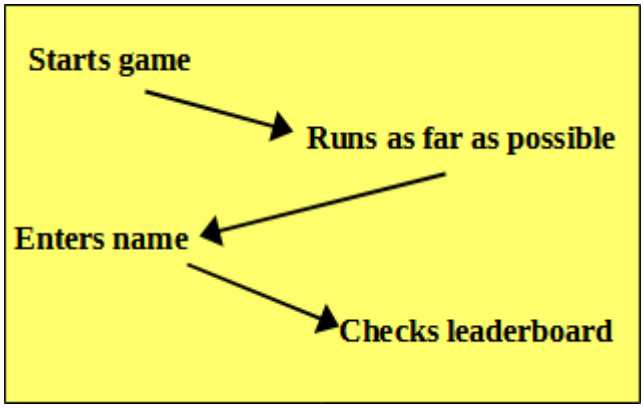


Figure 5: Stickynote describing the process of playing the game.

The feedback received was very positive as this is precisely what users expected from the initial interview.

2.7 Initial Interface

Where am I? The user will open to a colourful background of a mountain that will make the game look interesting and appealing and increases the user's focus and immersion on the game.
What's here? The ninja will appear in the bottom left corner of the screen while robots will appear from the bottom right.

Where can I go? The ninja, who faces to the right of the screen, will begin running in that direction. The user will then understand that the goal is to move further that way.

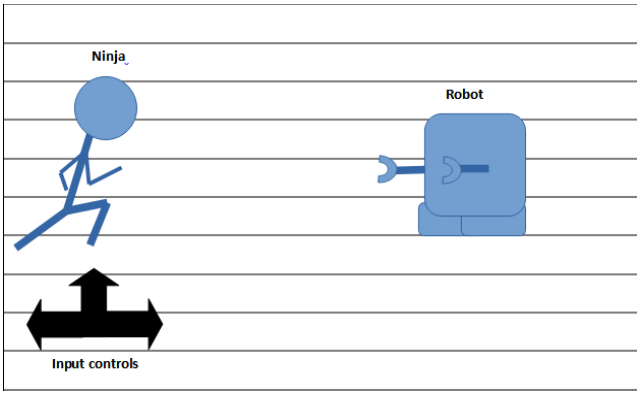


Figure 6: Initial interface of Ninja Runner

2.8 Experience Map

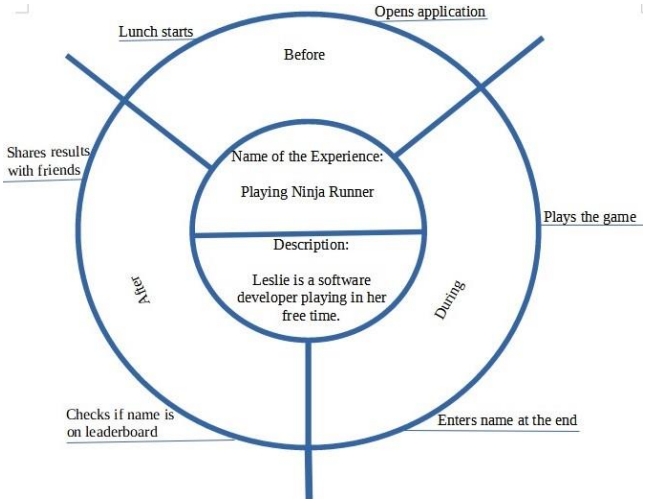


Figure 7: Experience map, Leslie plays Ninja Runner

Lunch starts and Leslie opens the application, Ninja Runner. While playing she has the ninja jump to avoid the robots so she can make it as far as possible. Once she makes contact with a robot the game is over and she enters her name. After, she checks if her name appears on the leaderboard and shares the results with her friends.

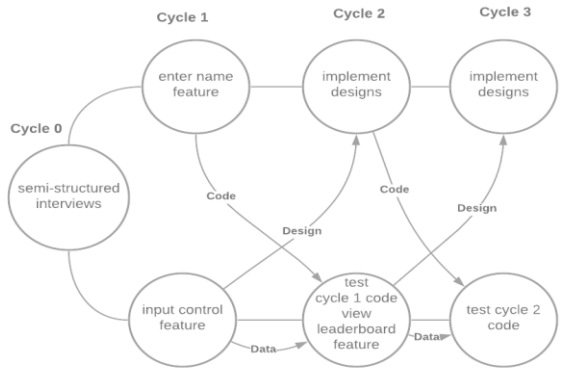
2.9 Originality and Uniqueness

The design with two aspects, namely conceptual and concrete for our sidescroller game will make it different from applications that might emerge from the "maker movement". The layout or navigation as well as the outline of what users can do and what ideas are needed to understand the product for our game is going to make it different from other applications that might emerge. The role of

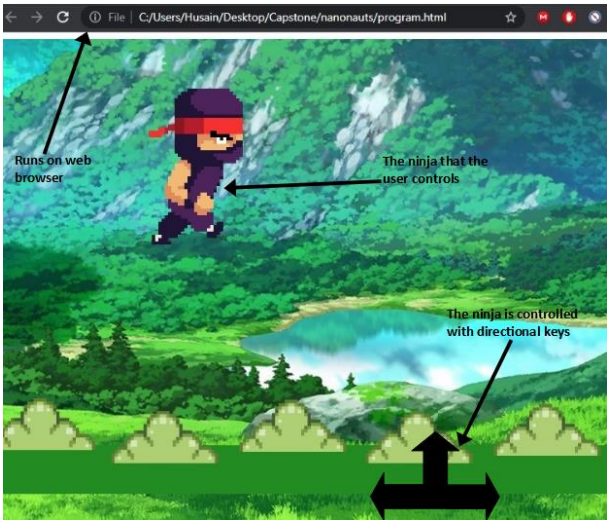
the software development kit is to facilitate the transformation from design to construction of the application.

2.10 Using the Agile Approach

Before iteration cycles begin we'd conduct an interview, preferably a semi-structured interview, with the users. This kind of interview will help us dive deeper into the issues, that may be good or bad, concerning the sidescroller game and it will provide a good balance between richness and reproducibility.



2.11 Mock-up



2.12 Interaction Patterns

After a user enters their name, they can hit a share button to share a screenshot of their score and whether or not they made it onto the leaderboard to their various social media accounts. This way they can interact with other players who enjoy the game, despite the game's lack of communication functions.

2.13 Standard Task

The system is going to be used by users who enjoy short games just to take a quick break. The tasks that the users have to perform are starting the game, controlling the running ninja, which is basically moving it up or sideways to avoid the obstacles or killer robots, and as well as entering names which will appear on the leaderboard along with the score that the users got. Playing the game will be a little bit tricky since there will be challenges so the users will have to learn to become better at avoiding the challenges. The relationship between the users and the game will be based on interface metaphor which in our case is desktop and the kind of tools they will use in the game are the input controls. There will be in-person communication between the users and the tasks will be performed each time a user plays. There will be no time limit for the user in the game and if the ninja comes in contact with the obstacles it will be game over.

USERS	USER 1	USER 2	USER 3
BACKGROUND	Leslie is at home, and she is bored, she wants to play the ninja runner game.	Brian is at work, and it is lunch time. He wants some little entertainment, so he plays the ninja runner game.	Monica is at home with some friends. She challenges them to play the ninja runner and if one wins, they will buy her ice cream. They start playing the game.
WHAT THEY WANT	She wants to start the game.	He does not know how to avoid the obstacles/killer robots, and he wants to know	They want to view their score.
TASK	Open the game and it will start.	Use the input controls to make the ninja jump/move sideways.	Must enter their names when they have reached the destination/when its game over, which will then appear on the leaderboard along with their scores

2.14 Field Study

Planning for a field study; how often the participants play the game in a day, how long the participants stay in the game for every time they play and analyse their scores to understand the difficulty of the game would analysed. We would study the game on six participants of different genders, three males and three females. The participants information would be kept confidential. There would be a survey afterwards to be answered by participants based on their satisfaction with the game on a scale of 1 to 5. Data collection would be quantitative as observation would be for measuring the interaction of participants with the games and surveys would be for measuring the satisfaction of users. Data about interaction of participants would be analysed using a pie chart. It would make it easy to display different aspects of the game. A pie chart is the best way to display quantitative data.

2.15 Problems users encountered

Each user resulted in game over almost immediately on their first attempt, not accustomed to how fast the ninja runs or how fast the robots approach. Once they cleared this hurdle after playing a few times they found the game relatively easy and managed to keep

running for longer than a minute. Through feedback they suggested more difficult levels, faster robots or more frequent robots, claiming the game isn't challenging once you get used to it.

2.16 Controlled Study vs. Natural Setting

Some of the main benefits of conducting a controlled study rather than a natural setting are that in a controlled environment the evaluations are carried out in an orderly manner meaning that it is easier to test specific hypothesis about an interface as many factors that influence the interaction are controlled in contrast to a natural study where almost every aspect of the evaluation in not structured and is "Free flow".
Some of the problems that may arise with a controlled study are that ultimately this is not how your product will be used which gives the conductor of the evaluation a false image on how the product is going to be received in the real world and how people are going to interact with it which in contrast with a more natural setting where one can really get how people will think about and interact with their product

2.17 Heuristics Evaluation

The heuristics set for the prototype evaluation are visibility of status, match between system and the real world, visual clarity, customisation, error prevention, help, challenge, feedback, controls. visuality of status, the distance covered by the user is displayed throughout the game in the top left corner of the screen. Match between system and the real world, the obstacles are robots and they align to real world robots. Error prevention, users are not given format to enter their names, they are free to use any characters. And the game must allow the user to confirm exit to prevent quitting the game by mistake [5]. Help; the game does not show help to the user. Challenge; the game is easy to play. The avatar speed is consistent, and the robots are also consistent. Reward; the scores of the top performers are displayed on the leader board [6]. Controls, the avatar is easy to control. The controls relate to moving basics [7].

2.18 Redesigned Prototype

After receiving and reviewing users' feedback it was apparent they were looking for a bigger challenge from the game. Thus we implemented increased difficulty in the form of the robots speeding up as the ninja proceeds further into the game.

2.19 Heuristics Evaluation vs. Usability Testing

For heuristic evaluation we did the testing ourselves, we understood the game and maybe that's because we developed it but for the users it would not be so easy to, and secondly, we would not know if there is a problem with the game because we missed it or something whereas in field study evaluation we involved users in order to get feedback about the game and got to watch them play it. With the field study evaluation we got positive feedback and the users even suggested that we modify the game by adding difficult levels, faster robots or more frequent robots, and that was a good thing but we wouldn't have known that with the heuristic evaluation. And because of this I prefer the field study evaluation rather than the heuristic evaluation because with it you will know whether or not there are problems in the application, and if you developed a friendly-user application.

2.20 Analytical Evaluation

The Approach	Findings	Benefits	Costs	Limitations
Field Study	Observation, interaction, and understanding of users	Provides detailed data about how users interact with the product	Time consuming	Time consuming. Can be very expensive to collect.
Usability Testing	Structured with main aim of helping the team come up with action plans	Can identity issues quicker as it is very easy to see the changes that need to be made	Time Expensive equipment may need to be used	Only possible to conduct with a small sample of potential users. Requires significant commitment by participants. Costly in terms of time and recruiting participants
Analytical evaluation/Heuristic	Interpretation of data gathered	Able to predict user behavior Time saving as this approach involves analyzing and interpreting data	May be expensive as there may need to be a specialist brought in Expensive equipment may need to be used	Not a hundred percent accurate Not able to get real ideas and feelings about the user's experience Depends on the analysis of an analyst or computer

3 SOFTWARE ENGINEERING

3.1 Process Model

The approach we'll follow will be to use the agile model over the waterfall model, since this is a large project over a short period of time, which can benefit from flexibility and allows our goal to adapt. Agile also has a greater success rate than waterfall and flexibility for developers, reduction in development time and functionality can be developed rapidly and demonstrated. All of which greatly benefit our project.

3.2 SE Software Principles

Software engineering follows several core principles. For this project we applied them as follows:

1) Manage using a phase life-cycle plan: By applying the Agile method a phase life-cycle plan is achieved.
2) Perform continuous validation: Constantly reviewing all work.
3) Maintain disciplined product control: This is achieved through constantly assessing if our work is of the required quality.
4) Use modern programming practices: Though using the latest technologies available.

5) Maintain clear accountability for results: Each member is given their own portions of work to manage and is responsible and accountable for producing results.
6) User better and fewer people: The members assembled are few and resourceful.
7) Maintain a commitment to improve the process: Every group member wishes to produce better and better results.

Modularity, a complex system must be broken down into smaller modules:

- Decomposability: The system is broken down into smaller manageable parts for each group member.
- Composability: The smaller parts that each group member handled is then brought together to create the system.
- Ease of understanding: Understanding each individual piece of the system.

3.3 SE Quality Goals

- Reliability: In the event of an error, all database information is safely backed up.
- Performance: Measuring that the game runs smoothly and starts up quickly.
- Functionality: To judge if the game achieves the set out requirements.
- Supportability: Testing and maintaining the software to enhance capability to support software.
- Usability: Through consistency and aesthetics the game will satisfy and appeal to users.

3.4 Goals

We strive to develop a sidescroller that will entrance and entice our users, compelling them to play frequently during their down time, and to create a competitive spirit that strives for 1st place on the leaderboard.

The non-functional requirements that must be achieved are:

- The game must function on both computers and smartphones.
- The game must run smoothly.
- The game must be aesthetically pleasing.
- The software must be able to handle errors.
- The software must be maintained

3.5 Umbrella Activities

Software Project Tracking and Control

- Creating milestones, tracking progress, setting the pace for each phase of the project.

Formal Technical Reviews

- Evaluation of the software after each phase iteration.

Software Quality Insurance

- Quality control through definition of the scope and establishing management methods.

Software Configuration Management

- Identify work products that are likely to change and establish relationships among them

Document Preparation and Production

- Through Google Docs collaboration is achieved amongst all members of the group and documentation can be prepared.

Re-usability Management

- Backing up earlier versions of the project code, allowing for "rollback".

Measurement and Metrics

- Determining how long tasks will take and by when they should be completed.

Risk Management

- Project can become more complex than anticipated, work can be delivered late, levels of collaboration can become unstable, requirements can change.

3.6 Use Case Diagram

User: The targeted user who will be making use of the application.

- The user may input their name which is stored alongside their score in the database.
- The user may input controls to animate the ninja.
- The user may view the leaderboard to see where they placed.

Admin: The person administrating the game.

- The admin may log in and view the leaderboard.

Database: A service keeping track of high scores.

- The database saves the names and scores of players.

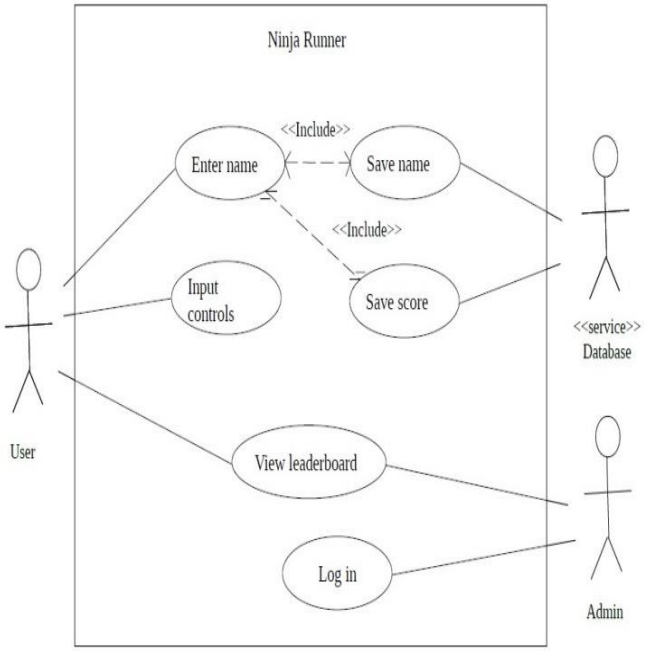


Figure 8: User diagram

3.7 Class Diagram

User: Is allowed to enter their name.

- Has a UID that marks them as a unique player.
- Has a name that they entered.
- Has a score they earned during the game.
- Will have on and only one admin.

Admin: Is allowed to log in.

- Has an ID marking them as the admin.
- Has a password to log in with.
- Can have zero or many users.

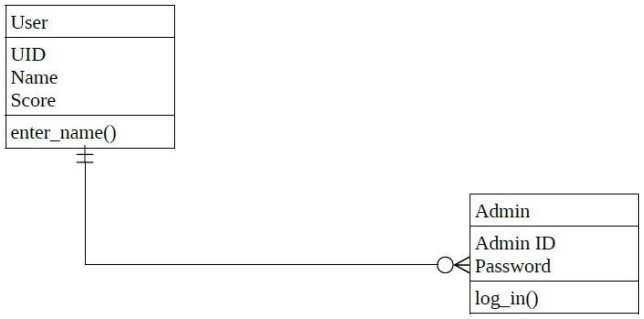


Figure 9: Class diagram

As observed in figure 9, each user has one and only one admin.
As observed in figure 9, each admin can have zero or many users.

4 DATABASES

4.1 Entities

User
Admin

4.2 Attributes

- **User**: UID(User ID), Name, Score
- **Admin**: Admin ID, Password

4.3 Relationships

- A single admin can have zero or multiple users.
- A single user can have one and only one admin.

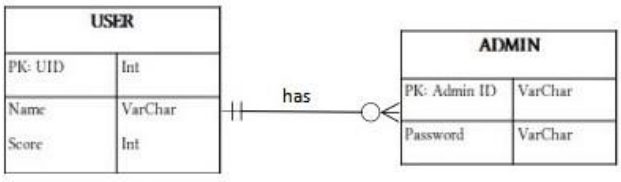
4.4 Business Rules

- There cannot be more than one admin
- Users cannot log in.
- Any number of users can play.
- A user can appear an unlimited amount of times on the leaderboard.

4.5 Constraints

- Lack of budget for high quality graphics.
- Lack of time and budget for a more complex level based system.
- Lack of time and budget for more intricate controls.

4.6 Crow's Foot ERD



4.7 Internal Model

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APPENDIX A

Semi-structured Interview

1. Do you enjoy video games? Why?
2. Do you find plenty of free time to play?
3. What genre of game do you like most?
4. Are you aware of "indie" games?
5. Would you refer to yourself as competitive?
6. Do you enjoy competing with friends?
7. Do you share accomplishments? Would you?

APPENDIX B

Consent Forms

INFORMED CONSENT FORM

I, _____ sign the consent form on _____, 20__

and consent to the following:

- I understand that my meeting can be recorded.
- I understand I will not advantage legitimately from taking an interest in this research.
- I understand that there is data being recorded from me.
- I understand that the data will be used for research.
- I understand that regardless of whether I signed the consent form or not I can still pull back.
- I understand that I can have access to the data being recorded from me.

Consenter's signature: _____ Date: _____

Print Name:_____

Releasee's signature: _____ Date: _____

Print Name:_____

INFORMED CONSENT FORM

I, KAAMILAH NAVSA sign the consent form on 20 OCTOBER, 2021

and consent to the following:

- I understand that my meeting can be recorded.
- I understand I will not advantage legitimately from taking an interest in this research.
- I understand that there is data being recorded from me.
- I understand that the data will be used for research.
- I understand that regardless of whether I signed the consent form or not I can still pull back.
- I understand that I can have access to the data being recorded from me.

Consenter's signature: _____ **Date:** 20/10/21

Print Name: KAAMILAH NAVSA

Releasee's signature: _____ **Date:** 20/10/2021

Print Name: HUSAIN NAVSA

INFORMED CONSENT FORM

I, YASMINA JOHNSON sign the consent form on 20 OCTOBER, 2021

and consent to the following:

- I understand that my meeting can be recorded.
- I understand I will not advantage legitimately from taking an interest in this research.
- I understand that there is data being recorded from me.
- I understand that the data will be used for research.
- I understand that regardless of whether I signed the consent form or not I can still pull back.
- I understand that I can have access to the data being recorded from me.

Consenter's signature: _____ **Date:** 20 OCTOBER 2021

Print Name: YASMINA JOHNSON

Releasee's signature: _____ **Date:** 20/10/2021

Print Name: HUSAIN NAVSA

INFORMED CONSENT FORM

I, FAZEL NAVSA sign the consent form on 20 OCTOBER, 2021

and consent to the following:

- I understand that my meeting can be recorded.
- I understand I will not advantage legitimately from taking an interest in this research.
- I understand that there is data being recorded from me.
- I understand that the data will be used for research.
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- I understand that I can have access to the data being recorded from me.

Consenter's signature: _____ **Date:** 20/10/2021

Print Name: FAZEL NAVSA

Releasee's signature: _____ **Date:** 20/10/2021

Print Name: HUSAIN NAVSA

Friday 23 October 2021

Computer Science 312
Capstone Project

Assignment 5

Team Project **Team Number**	16
STUDENT NO.	**STUDENT NAME**
3755311	Husain Navsa
3875841	Mihlali Nonyukela
3875509	Siyamtanda Vusani
3859082	Lukhanyo Mhlifili
3727204	Mafadi Godfrey Lephaka

TOTAL MARKS **/ 50**
What contributed?
Revisions for HCI, SE, DB Presentation, Demo
Presentation
Presentation
Presentation
Presentation

	Possible Mark	**Mark achieved**				
		Excellent	*Good*	*ok*	*Poor*	*0*
Revise HCI portions based on feedback. Highlight changes.	**10**	10	8	5	3	0
Revise DB portions based on feedback. Highlight changes.	**10**	10	8	5	3	0
Revise SE portions based on feedback. Highlight changes.	**10**	10	8	5	3	0
Presentation	**10**	10	8	5	3	0
Demo	**10**	10	8	5	3	0
TOTAL	**50**					