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Game for Teaching and Learning Programming

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Abstract

It has been suggested by researchers and educators learning occurs naturally while playing games. Although generally what first attract people to games is the fun and entertainment, the engaging learning experience of game playing is contributed to by the effective principles or approaches embedded in game designs to facilitate positive learning outcomes [1]. This proposal will cover an overview of the project “Game for teaching and learning programming.”

1. Introduction

Computer programming involves problem solving skills and is considered as an essential skill for today's digital world [2]. Game based learning has been considered as an effective way for helping others to construct knowledge by playing games, by taking this approach learners are more engaged in their learning and have high learning motivation which they can use to apply their gained knowledge to real-life situations [2].

This project will involve designing a game to teach programming concepts and implementing the game. This project will be conducted using Agile methodology. Agile is an iterative approach to project management and software development that helps to deliver the product effectively and efficiently [3]. Some user testing will take place within fellow students to gain feedback on the design and implementation.

2. Problem

Sometimes it is hard to keep individuals interested or motivated when it comes to learning and teaching technology related courses. Many people might find it dry and boring which lowers their motivation and interest in learning the concepts of programming [4]. Over the years an increasing number of teachers have endeavored to integrate educational computer games into training and teaching as it has been recognized that well-designed game-based learning is an effective means to help individuals construct knowledge and skill [5].

3. Proposed Solution

The project aim is to implement a game that teaches beginners to learn the basic concepts of programming. This project will be a simple game that will teach the basics of the programming language Java.

An initial game idea is that the player will help a dog find all its bones which will be spread across the board, and once the bones are all picked up the game will go to the next level. The player is required to write Java code in the editor which would be next to the board, and this code will help the dog move around the board. When the player has successfully written code that helps the dog pick up all the bones the game goes up a level, each level will introduce new concepts such as if statements, for loops, while loops etc.

Starting off with research is crucial as it will help to understand the effects of game-based learning as well as gaining knowledge on the various ways it can be implemented into a game to teach programming concepts. This game idea will help build a more secure foundation for the basics for the programming language Java which will help people easily grasp more in depth understanding of programming. Having each level introduce new concepts will help the player build their understanding of the programming language as the game progresses.

3.1. Initial Findings

The framework React has been chosen for this project using the programming language JavaScript. This game will be hosted on Heroku so it can be accessed through the web browser.

This will be a browser-based game as this will make user testing an easier experience in comparison to a mobile application which would require a lot of preparation in order to test the functionalities. Web browser will help cater the project to many people where a mobile application will cater for only Apple or only Android which is a big disadvantage of making the game mobile based.

The reason the framework React has been chosen is because there has been previous experience with this framework for both web development and mobile development which will be beneficial during the development process as the basics will be known to get started on the game implementation. Having experience with React will speed up the learning time that would potentially come with learning a new framework or platform. As well as experience React is a very popular framework currently and there is a lot of research and support online that will be a guide during the project.

4. Proposed Method

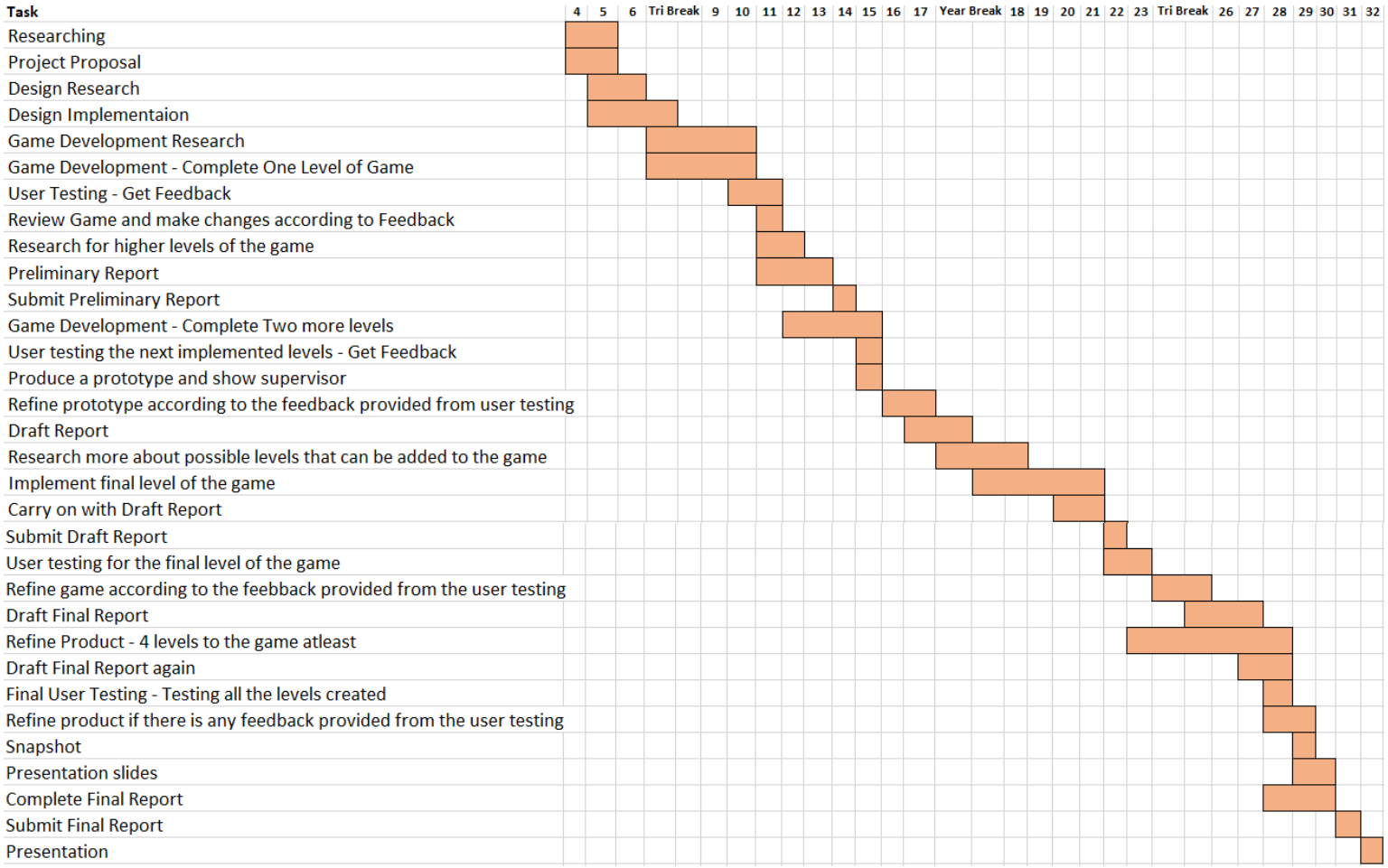
The method Agile will be used to achieve the final product for this project. Agile method is an iterative process that requires flexibility to jump between different stages of the development process. Agile would be the most effective methodology because it will allow you to work more flexibly with the project process which would include constant testing, feedback and refinement.

To design a game there would be some of researching involved as research would help to understand the benefits of game-based learning and help learn the many ways it can be incorporated into a game to teach concepts and critical thinking.

For this project we will be carrying out user testing as it will be the best way to test the game and obtain feedback. A prototype will be created as it will help us to understand the functionalities of the game and if something fails after user testing, it will aid in creating another iteration of that prototype. User testing is the process through which the interface of a website, app etc. are tested by real users who preform specific task in realistic conditions [6]. The purpose for user testing is to evaluate the usability of the product. User testing will be done by fellow 300-400 level students from Victoria University. The group of students that will be testing comes with limitations as these students will have prior knowledge of the basic concepts, so the user testing will not be fully testing if the teaching is effective but more if there are bugs within the game and if the functionality of the game works.

4.1. Gantt Chart

Below is the proposed timeline. This timeline is very flexible and can be altered according to situations. As the Agile Methodology is being followed this Gantt Chart involves a lot of steps that occur multiple times this is because in Agile it is a constant iteration between planning, implementing, testing and back to implementing.



5. Ethics and Resourcing

5.1. Ethics

The ethics considerations around this project are that the project is open source so after completing the development of the game, the code can still be accessible to the supervisor and others. According to the IP agreement 300-400 level students are able to use the product for testing purposes, this is covered by the ethics application (application id: 0000029386). This is agreement is beneficial for the project as it is based on teaching programming concepts and having students that have had prior experience with the language can help give feedback to improve the developed game or to find the bugs within the implementation.

5.2. Budget

There is not budget for this project as there is no need for a budget. However, resources are needed for the project for example, the Victoria University Library. The books and articles that are necessary for researching more about game-based learning for the project are best found in the Campus library. Another resource needed for the project is having accessibility to the ECS Lab computers to test the game on. Testing the game on multiple devices will help understand the speed and capabilities of the game.

6. Risks and Hazards

According to the current circumstances Covid is a pretty big risk, seeing as it is a software project not much will change apart from changing it to keeping it all virtual. If the primary supervisor is unavailable to some reasons, for example, not feeling well due to covid I am expected to reach out to my secondary supervisor Simon McCallum.

Risk	Likelihood	Severity	Mitigation
COVID Lockdown/Isolation	Moderate	Low (The severity is low as this will not impact my project as much as I will still be in contact with my supervisor virtually and will be able to carry out the project at home.	Have weekly video call meetings with supervisor and email updates and questions regularly.
Supervisor is ill/ Access to supervisor is limited	Moderate	Moderate	Reach out to secondary supervisor and communicate with them until primary supervisor is not well.
Losing code	Low	High	Be sure to keep copies of the developed code and be sure to always commit the code to GitLab repository to avoid losing code.
Underestimation of project life cycle	Moderate	High	Need to break down tasks into reasonable blocks and be sure to create and complete those tasks in a estimated timeframe.

Hardware failure	Moderate	High	If the device I am working on crashes or breaks down have the code on the cloud such as GitLab, so you are able to access the code from a different device such as the University lab computers.
RSI or other strain injury from equipment overuse	Moderate	Medium	Ensure that breaks are taken often. Maintaining good posture and ensure seat, keyboard and screen are positioned as such to minimize strain.

7. Reference

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