



The University of Hong Kong

Department of Computer Science

Final Year Project (FYP 16031)

Interim Report

Topic:

A cross platform game or application to promote computer science

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Abbreviations

2D RPG	Two Dimension Role Playing Game
CSS	Cascading Style Sheets
HQ	High Quality
HTML	Hypertext Markup Language
IT	Information Technology
NPC	Non-Player Character

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Abstract

This project will focus on the goal of promoting computer science to secondary school students in an interesting way. To achieve the goal, a two-dimension role playing game called “The Genesis” will be developed. This cross-platform mobile game (Android and IOS) will be developed using a popular game engine called Unity 5 with C# language. The previous stages that have been finished for this project included website development, 2D graphics gathering, sound and background music gathering, game map creation, character animation creation and NPC dialogue system creation. In terms of current working status, the development of game mission system has been started. The current work is to extend the game by including more game maps and NPC missions following the designed story. For the next stages, the save and load system will be developed and then the game will be exported into two mobile platforms. The completed game will be evaluated by interviewing around five students with no computer science background. Their comments will be adopted to create the final version game. Finally, the game will be uploaded to Google Play Store and Apple App Store which allow the public to access the game.

Keywords: Cross-platform game, 2D RPG, Unity 5, C#, game website, story line, character setting, NPC dialogue

Introduction and Background

Every application that we are using in daily life like Facebook, WhatsApp and Google Search has a simple and user friendly interface. Behind all these simple interfaces, there were thousands of computer scientists who built them with very complex codes and logics. These IT professionals are currently in great demand in Hong Kong as the market fails to fulfil this continuously rising demand. According to City University Information System Department report, there are 302 companies were interviewed in 2016 and half of them reported that they can't find the suitable skilled people. One of the solution to solve this problem is to increase the demand of IT professional by attracting the student to study the related fields. Therefore, this project targets Hong Kong secondary school students and aims to raise their interest in computer science. A mobile cross platform 2DRPG called "The Genesis" will be developed in this project. This game will be designed in an attractive and interesting way in order to captivate the students. In the following report, the purposes, methodologies, related studies in the field, development procedures, previous works, encountered difficulties and future works will be outlined.

Project Purpose

The purpose of this project is to promote computer science to secondary school students. As the targeted users are students, a mobile game should be an effective platform. Most students tend to prefer playing a game instead of reading an article as it provides excitement and sense of achievement after they accomplish the game mission. Moreover, accessibility is also considered when a cross-platform mobile game is chosen for this project. Secondary school students who have their personal smartphones can access and install the game through the online application stores easily. The students will be able to download it on Google Play Store and Apple App Store

for two common mobile operating systems, Android and IOS. For mobility, the students will be able to play the game anywhere after they have installed the game on their phone. For the game content, students would be able to understand some basic technical knowledges of computer science after playing the game.

Methodologies

A game engine Unity with C# language will be adopted in this project. Unity is a multi-platform game development engine that allows the developer to export the game to different platforms including our targeted platforms which are Android and IOS. Moreover, Unity has a built-in asset store for the developer to gather the resources needed like environment graphic and background music. The game can adopt different extensions in the assets store as Unity is using a highly modular architecture. For example, Unity Ads extension allows the developer to add the advertisements in specific game scene and it is independent to the game development cycle. The tool provided will be very helpful to increase the effectiveness of the game development process.

After Unity is decided to be used for game engine, the next decision would be selecting one programming language from C# and JavaScript which are supported by Unity. The decision will not be made according to the performance as there are no performance differences. Instead, the languages will be chosen based on their syntax difference. The syntax of JavaScript is more complicated than C# in performing task in Unity. For example, for variable declaration, the code in C# will just simply be `int a = 5;`. But when we look for JavaScript, the code will be more complicated as `var a : int = 5;`. Although it seems to be a minor difference, the

effectiveness of game development may be affected by it. C# should be a better choice for developing a game in Unity.

Apart from that, this project has adopted the idea of gamification which is a concept of applying game design elements and game mechanics to motivate people to achieve specific goal. It targets the human natural desires, like achievement and competition, for increase the motivation of human to achieve goal. In this project, gamification has been adopted for achieving the goal of computer science education.

Related Studies

In the current market, there are few mobile games related to computer programming and they have adopted the idea of gamification. They are helpful for the players to understand the basic of coding. For example, in the game “Human Resource Machine” (Figure 1), players need to drag and drop the programming block in the game and solve problems. Programming was presented as a puzzle game so that the player can solve the programming problem like puzzle solving. However, in the market, there is no game about the general knowledge of computer science. This project is exactly targeting this game type and hopefully motivate the Hong Kong secondary school students to learn about computer science knowledge.

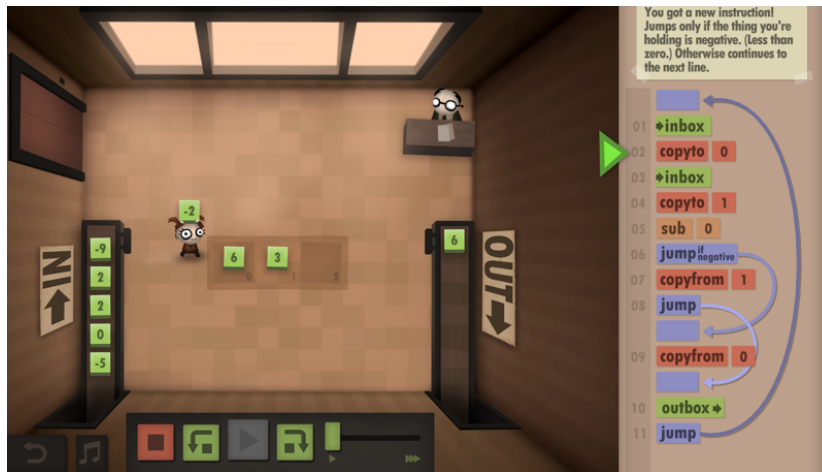


Figure 1 The game play of Human Resource Machine.

Development Procedures

The game development will be mainly based on the game story. A story will be written during the early phase of the project. It will involve technical contents about computer science and the students will understand that after they played the game. Game player will control the main character to complete the missions, collect different items and learn different skills in the game world. For the next step, the required graphics like the characters and background image will be collected from the internet. Moreover, sound effects and background music will also need to be collected after all the required graphics were gathered.

Then, the game development can be started. As “The Genesis” is an offline game, there is no complicated system architecture for it. All the game data and records will be stored in user mobile device locally. This project will adopt the method of iterative development. Different game functionalities, such as save system, skill system and dialogue system, will be built incrementally. For each iteration, one functionality will be built into the game system and carefully tested to make sure the game can work correctly. This method can reduce the dependencies between different game functions and reduce the debugging time. After all the

functions are built, the alpha version of the game will be tested by some students for further feedback and improvement will be made based on that.

Finally, the game will be deployed to the Google Apps Store and Apple Play Store for beta testing. Further improvement will be made according to comments on the store. The beta game will also be deployed as the final product of this project.

Previous Works

In the previous stage, the game website (Figure 2) has been developed and it is available for public online access. It was developed using HTML5, JavaScript and CSS with Bootstrap plugin. The page includes basic game information, game progress and all the currently available project documents. In every page of the website, some RPG images that found on the internet were embedded. Those images will be replaced to different game scenes of this project once they are available. Apart from the webpage, the game plan has already been written and uploaded to the game website which is accessible by everyone through internet. Most of the decision about the game development process were made during the game planning stage. The game development process will follow the plan and schedule.

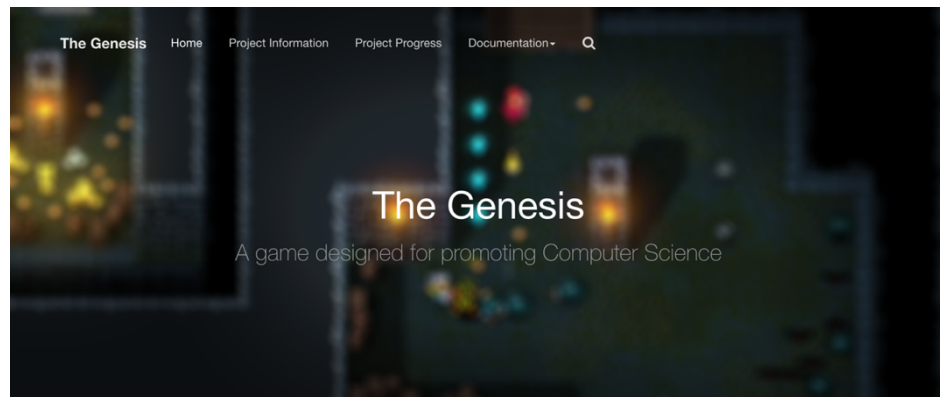


Figure 2 The home page of project website. URL: <http://i.cs.hku.hk/fyp/2016/fyp16031/index.html>

For the next stage, a complete game story had been written. The game story is about the adventure of main character who aimed to be “The Genesis” in the game world. For the way to become “The Genesis”, player is required to solve the hardest problem in the game world, which is “The Truth”. During the adventure, player required to learn different skills to solve this final problem. In fact, those skills are representing the HKU Computer Science core courses and they are divided into “Basic Level”, “Intro Level”, “Advance Level”, “Special” and “Genesis” shown in skill tree (Figure 3). The different levels are representing the level of courses. For example, “Basic Level” skill includes COMP1117 Intro to Programming and “Intro Level” skills include COMP2121 Discrete Maths. “Special” and “Genesis” are representing COMP3412 Internship and COMP4801 Final Year Project respectively. The meaning of the skill tree is that after the player learnt all the skills, which are all the CS courses, they will be able to become “The Genesis”, who create this virtual game world. Apart from the skill tree system, the dialogue system (Figure 4) between main character and NPCs also helps player to learn about technical contents of computer science. Those contents are specially designed for the students who do not have any background of computer science, so that they can understand the meaning of some technical terminologies after they have read the dialogue.



Figure 3 The skill tree in game menu.

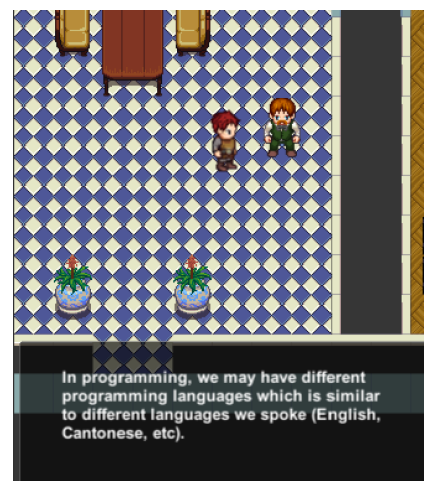


Figure 4 Dialogue between player and NPC.

Apart from the game story, the required game graphics, sound and background music have already been gathered. All the above resources are found in OpenGameArt website which is providing copyright free resources. The 2D graphics of environments, characters and interfaces which matched the RPG style have been selected and used for the game. For the sound and music, the resources which can match the scene requirements have also been selected and used.

After the above preparation stages, the iterative process of game development has been started. For the previous iterations, the starting animation, starting menu, game maps, character animations, player movement controller, camera controller, item system, skill system and NPCs dialogue system have been created. For the starting animation, when the player opens the game, the logo of HKU CS department and some info of this FYP (Figure 5) will be shown for around ten seconds and the starting menu interface (Figure 6) will be shown. The player can choose start a new game, load the previous saved game and leave the game from the interface.

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Figure 5 Game Starting Animation.



Figure 6 Game Starting Menu.

For the game map, there are around fifteen different game scenes. In each scene, there are some components that will collide with the player character like the desk and wall shown in Figure 7. Those components can be used for preventing the player walk outside the game boundaries. For the animation, it was created in Unity with the built-in animation creation function. The animation was generated by putting the different states of static character 2D images into the timeline with short interval (Figure 8). The player can control the character move around the game world with movement controller script. The animation will also be triggered when a specific Boolean parameter “isWalking” was set to true in that controller script. The game camera will follow the position of the character, so that the character has always been displayed in the centre of the game like Figure 7.



Figure 7 Game Scene - Home.



Figure 8 Unity Animation Timeline

The game has a menu (Figure 9) that allow player to view their items, skills, and save the game. The item system allows the player to receive the items from the mission and view those items in the bag (Figure 10).



Figure 9 In-game Menu



Figure 10 Player Bag that Storing Items

If the player click the “Skills” button in menu, the skill tree will be shown (Figure 11). The skills that have been learnt by character will be shown in the skill tree. And the player can click the skill icon to view the detail of that skill (Figure 12).



Figure 11 Player Skills Tree

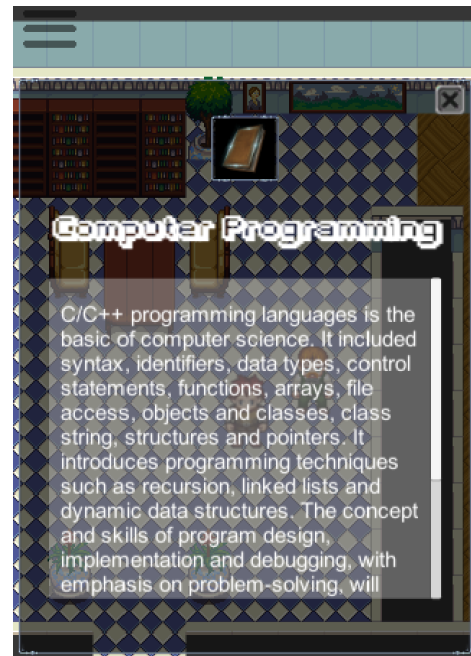


Figure 12 Detail of the skill

The player need to finish the mission provided by the NPCs. When the player entered the talking zone of NPC, the dialogue interface (Figure 12) will be opened and player need to finish the dialogues if they want to continue the game. The dialogue content is stored in a text file like “NPC5” file displayed in Figure 13. The content will be loaded from the file during runtime.



Figure 13 Dialogue between NPC and Player

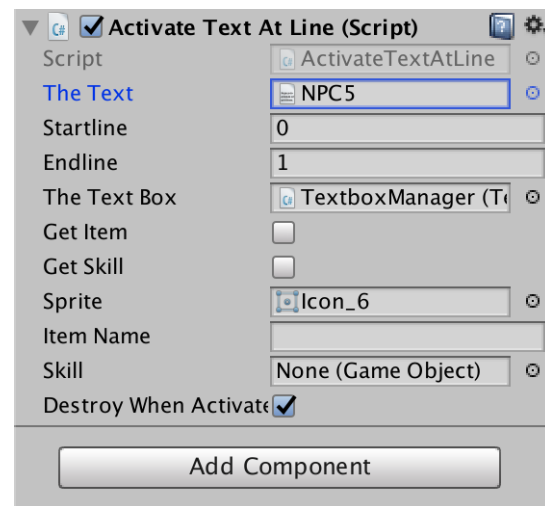


Figure 14 Script of Dialogue System

Encountered Difficulties

The main difficulty in game story design is to merge the computer science knowledge into the story and all dialogues. The game is supposed to promote computer science and help players to understand some knowledge related to different fields in computer science. It is hard to present those technical terms which are not familiar to people who do not have computer science background as it is hard to know whether the term is easy enough to be understood. So, during the game story writing process, some friends who do not have computer science background were invited for testing the comprehensibility of the acquisition of knowledge and story. And they have given a lot of ideas about how to merge those technical representations into the story like some metaphor suggestions. The opinions from others have further improved the game story.

Another difficulty was encountered during game environment development stage. There are fifteen different game scenes in the game environment. To include all scenes, the simplest solution is to create fifteen high quality images and store them as static contents. However, large amount of HQ images will highly increase the required storage spaces for the game. So, I have adopted the idea of dynamic map generation. Instead of loading scene images directly, a game scene will be dynamically generated during the runtime. All environment objects, such as a tree, will be loaded to each scene according to their positions that were defined in development process. It will reduce the storage space used as there are no redundant environment objects included. For example, if the scene (Figure 15) included eight tree A and five tree B, we only need to store one instance for each tree A and tree B. And we can also store multiple environment objects into a single image (Figure 16) to reduce more storage spaces used by the game. This dynamic map generation technique can be achieved by using an external software called Tiled Map Editor. It provides simple interface which allows users to drag and drop multiple components in single image to game scenes. After a scene is created, another software called Tiled2Unity will be used for switching all Tiled format scene to Unity format and import those scenes into Unity development environment.



Figure 15 A dynamic generated scene included in this game



Figure 16 Image included multiple environment objects.

Future Works

This is the up-coming working schedule for the remaining part of this project.

Heading	Content	Deadline
Extend game content	Create more game map and game mission with computer science game content. Develop the multiple-choice answer system to test the player learning outcome.	1 st March, 2017
Save and Load Function	Players can stop their current playing environment by saving the game in the menu. To continue the game, players can load the game at the starting menu. The saved data will be stored as a JSON file in persistent path of player device local storage.	15 th March, 2017
Build to Mobile Platform (Alpha Version)	Export the game to two mobile platforms with correct runtime on mobile device. It will be tested with some students and ask for their comment.	1 st April, 2017
Final Product and Final Report	Finalized tested game with complete game feature and functionality based on the comment of alpha version will be developed. The final detailed report of the game will be written.	16 th April, 2017
Final Presentation	Present the product which is the game and demonstrate the game.	18 th – 21 st April, 2017
Project Exhibition	Exhibit the complete product which is the game to the public.	2 nd May, 2017

Conclusion

The game development progress is on schedule. For the upcoming stages, the game logic development will be more difficult. Developing a high quality game is really hard and challenging, but the incremental development process will separate this pressure into small elements and make the development become easier. It is hoped that this project can finally achieve the goals of promoting computer science to secondary school students.

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