

SERIOUS GAME FOR FIRST AID

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SERIOUS GAME FOR FIRST AID

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ABSTRAK

Asas pertolongan cemas ialah satu pengetahuan yang mesti diketahui oleh setiap manusia. Asas pertolongan cemas boleh menolong mereka yang berada di dalam keadaan kecemasan dan ianya boleh mengelak kecederaan kecil daripada menjadi besar dan mengelak kecederaan besar dari menjadi lebih teruk. Kemahiran ini boleh memberi perbezaan dalam menolong menyelamatkan nyawa orang. Oleh itu, tesis ini memberi tumpuan kepada perkembangan aplikasi mainan yang serius untuk asas pertolongan cemas dimana pemain boleh memilih antara dua mod main iaitu tutorial dan tugas. Mod tutorial ialah satu modul yang membenarkan pemain diberi panduan untuk membina kemahiran baharu. Mod tugas ialah satu modul yang membenarkan pemain untuk menguji kemahiran baharu di dalam satu kekangan masa. Aplikasi mainan ini menggunakan mod ulangan yang membenarkan pemain meningati kemahiran dengan lebih baik.

ABSTRACT

Basic first aid is a must know knowledge that has to be integrate into every human being. Basic first aid can helps those in an emergency and prevent small injuries from becoming big and big injuries from becoming worse. The skill can make a different in saving people life. In order to master this first aid skill, a good basic of what is first aid and what to know first is important. Thus, this thesis is focusing on the development of serious game application for basic first aid in order to help general public learning basic first aid in the most fun way. The game is develops using Unity software. This module implements fun approaches for serious game application where player can choose between two game mode which are tutorial and task. Tutorial mode is the module that allows player to be guide to develop new skills. Task mode is the module that allows player to test new skills within a time constraint. The game application applies repetitive mode that will allow player to memorize the skills better.

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LIST OF ABBREVIATIONS

2D	2-Dimension
3D	3-Dimension
G/P/S	Game/Purpose/Scope
AI	Artificial intelligence
QAS	Queensland Ambulance Service
CV	Curriculum vitae
OS	Operating system
VR	Virtual reality
RAD	Rapid application development
UML	Unified model language
UI	User interface
GUI	Graphic user interface
NPC	Non-playable character

CHAPTER 1

INTRODUCTION

1.1 Introduction

First aid is the initial care provided to someone who has suddenly fallen ill, or who been injured, until more advanced care is provided or the person recovers. There are many situations where we need to provide first aid to others. Being equipped with first aid skills could be the difference between life and death. In an emergency medical situation, knowledge is power.

Emma Hammett, an expert author and speaker on First Aid, Health & Accident Prevention, founder of First Aid Life in 2007, said that during her nursing career, she was inspired as she repeatedly saw the difference first aid could make to someone's prognosis. She was looking after a little boy that was so badly burnt he needed skin grafts during her worked in the Burns Unit. No need for him to admit to the hospital had his family equipped with basic First Aid skills. The situation motivated her to establish First Aid Life in 2007. This accident opened her eyes to the importance of accident prevention, management and support following an accident and the need to empower more people with the skills and confidence to know how to help in those first vital seconds.

Given this scenario, there is a crucial need to educate the public about questions related to first aid, especially children, who represent the future of society. In this context, we can achieve a fun but educational learning environment through games (serious games).

According to Michael and Chen (2007), serious games, as distinct from leisure games, provide users and players with opportunities to explore non-leisure application using games and immersive world application for education and training, as well as

supporting business and medical uses. In other words, a serious game is a game which education is the primary goal; integrate with entertainment to make it more fun and interactive. It teaches the player new adaptive skills that they can apply from the game format to a real life experience.

The purpose of this study, therefore, is to study the design and development of serious game on basic first aid. The serious games, called “The Healer: First Aid”, will be integrated with ways of letting the player experience different scenarios of giving first aid to those that needed.

1.2 Problem Statement

The first problem is that not many people own a first aid kit. Even if they own one, only some of them know the contents of the kit and how to properly to use the items inside. The lack of knowledge about the first aid kit and its content can cause a very huge delay when they want to administer basic first aid on someone that is in need.

The second problem is that most people do not know how to treat injuries using proper first aid skills. Not knowing how to properly treat even a mere small wound can cause serious infection later on.

The third problem is the lack of confidence in helping people in need. In an emergency, people often fail to help someone in need because sometime they are faced with a crisis; often are overcome by fear and anxiety and may panic. They fear that they may do the wrong thing that can cause further injury or they are afraid that they may harm their selves. These reactions can also result in a delay in a casualty receiving the treatment or the quality of the treatment being compromised.

This is why a new method is needed to approach all of these problems. Using a serious game technology in first aid will improve public knowledge, especially young teenagers on basic first aid. They can learn how to perform a simple procedure to keep a person breathing just from the simulation and various storyline in the serious game. They also can learn how to administer basic treatment to stop a person from bleeding by applying the knowledge they had gain through the game. The game also can improve their self-confidence to help someone, knowing that they have the skills to help save a life and also give them the sense of empowerment.

1.3 Objectives

Based on the above problem statements, the objectives of the project are:

- i. To study the implementation of serious game for first aid using 2D game designs.
- ii. To design and develop a serious game application using UNITY and 2D game design technique.
- iii. To validate effectiveness of develops serious games towards player through gameplay.

1.4 Scopes

Target User:

- i. The target user is expected to have a little to none knowledge about basic first aid.

Platform:

- i. PC-based game
- ii. Allow online and offline game connection

Technology:

- i. 2D technology will be used to help player visualize the game situation

First Aid Scope:

- i. Burn: What is burn, three levels of burn, complication, preventions and the outlook of burns.
- ii. Strains and Sprains: The difference between strains and sprains symptoms, causes, how to treat them and preventions.
- iii. Bleeding: Cut and grazes, nose bleeding and severe bleeding and bleeding emergencies such as shock

1.5 Thesis Organization

This thesis consists of five chapters:

Chapter 1 discuss on the introduction to the serious game project which include the brief introduction to first aid and serious game, the problem statement, objective and scope of the project.

Chapter 2 discuss about the literature review where it contains about the study of existing application and comparison between them and the propose project. It also discusses about basic first aid.

Chapter 3 discuss about the methodology where it discusses the overall approach and framework of the project.

Chapter 4 is all about implementation and testing in development of the application.

Chapter 5 discussed the research constraint and suggestions for future work are summarised.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will review about serious games used in medical field and also first aid. The classification of serious game also described in this chapter to give some explanation about the vague detailed of categorizing serious game and what model had been used currently. Three existing serious games application also had been compared to come out with new application for first aid game. The techniques to create a serious game such as the platform, programming language and database also compared to choose the best one for development of the game. The pros and cons of suggested tools of development also have been discussed.

2.2 Digital Game

Most of us have their own way to spend their leisure time. Most of the time this leisure time is spends to play games, specifically, digital games. Games provide engaging and enjoyable activities and the digital games market have expanded to become the fastest growing leisure market even during the worldwide recession. Since the day video gaming had reached mainstream popularity in 1970s through Pong and Space, video gaming had evolved greatly as hundreds of new games released every year created for entertaining but also specifically designed with a purpose with varies objectives.

There are three different types that can be distinguished for computer games which are entertainment, education and serious games. Entertainment games aimed at entertaining player leisurely, engaging them with fun and interactive environment without specific skills or knowledge involved. Then there are educational games, which

is the mixes of video games and education that can be considered as game-based learning. It is designed for information transmission. Finally, there are what we called as serious games, a kind of games that focus more on the development of skills and general knowledge.

2.3 Serious Game

A serious game is a computer based game with a primary purpose other than entertainment, ranging from anywhere between advertisements to military training exercises (Michael & Chen, 2005). The term is used to create a separation between leisure and non-leisure games in order to include all aspects of education such as teaching, training and informing. Serious game can make learning fun, rather than a requirement.

2.3.1 Definition of Serious Game

There are many definitions that can describe serious game but mostly a definition along the following lines is chosen; a mental contest, played with a computer in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy and strategic communication objectives (Zyda, 2005), Djaouti, Alvarez and Jessel break the term up into its parts, “serious” and “game”, and then define serious games as a “game” which has a non-entertaining primary purpose, thus making it “serious” (Djaouti, Alvarez, &Jessel, 2011).

There are many others definition of the term but every each of them highlighted that serious game can be used for learning and teaching process. There also should be a balance between entertainment and education in serious games with “fun” as an essential ingredient. They inherit basic concepts from entertainment but focus on the main objectives such as learning and training with the aim of applying the lessons learned in real-life (Wattanasoontorn, et al, 2013). Serious game is also a technology of information and communication that target multiple learning objectives. It applies in almost every field including education, health, defence and business. It is also intended for all age groups and designed so that even those with little or no knowledge can play. From these definitions, it is clearly apparent that serious game is a broad term covering much different kind of categories.

2.3.2 Classification of Serious Game

There is no classification system that has yet been achieved and fully accepted by the general for serious game. The first classification systems that had been designed were based on single criteria. Sawyer and Smith (2008) pointed out that these models can be divided into two categories which are market-based and purpose-based classification.

Market-based classification is designed to classify games based on the kind of people who play them. As an example, Zyda (2005) divided serious games into five categories which Healthcare, Public policy, Strategic Communication, Defence, Training and Education while Chen and Michael (2005) classified serious games into eight categories which are Military Games, Government Games, Educational Games, Corporate Games, Healthcare Games, Political Games, Religious Games and Art Games. This classification is able only to inform about the use of serious games and not about their content thus making it unreliable.

Purpose-based classification is based on the purpose or the intention of the serious games. But this classification suffered from heterogeneous categories that make it unreliable source for general classification. As an example, Bergeron (2006) proposed seven “purpose” categories which are Activism games, Advergaming, Business Games, Exergaming, Health and Medicine Games, News Games, Political Games while Alvarez and Al (2007) introduced six “purpose” which are Edugames, Advergaming, Newsgames, Activism games, Edumarket games, Training & Simulation games. It is clearly heterogeneous when “Health and Medicine” is tied to “targeted market” of the game while a category such as “Edugames” is based on the “purpose besides entertainment” and its features of the game.

The extends of this “Purpose & Market” paradigm is Game/Purpose/Scope (G/P/S) model that was created using both combination of “serious” and a “game” dimension by addition of a “Gameplay” related criterion. The Game portion refers to the type of gameplay used, or how the game is played. The Purpose portion refers to the designed purpose of the game apart from entertainment. Lastly, the Scope portion describes the targeted use of the game such as the market and audiences. This model

has been implemented in a website that help to categorize serious games and it is successfully implemented.

Video Game Video Toy Both

Purpose

<input type="checkbox"/> Educative message broadcasting <input type="checkbox"/> Informative message broadcasting <input type="checkbox"/> Marketing & Communication message broadcasting	<input type="checkbox"/> Subjective message broadcasting <input type="checkbox"/> Training <input type="checkbox"/> Goods trading <input type="checkbox"/> Storytelling <input type="checkbox"/> Licensed title
---	---

Market

<input type="checkbox"/> Entertainment <input type="checkbox"/> State & Government <input type="checkbox"/> Military & Defence <input type="checkbox"/> Healthcare <input type="checkbox"/> Education <input type="checkbox"/> Corporate <input type="checkbox"/> Religious	<input type="checkbox"/> Culture & Art <input type="checkbox"/> Ecology <input type="checkbox"/> Politics <input type="checkbox"/> Humanitarian & Caritative <input type="checkbox"/> Media <input type="checkbox"/> Advertising <input type="checkbox"/> Scientific Research
---	---

Audience

<input type="checkbox"/> 0 to 3 years old <input type="checkbox"/> 3 to 7 years old <input type="checkbox"/> 8 to 11 years old <input type="checkbox"/> 12 to 16 years old <input type="checkbox"/> 17 to 25 years old <input type="checkbox"/> 25 to 35 years old	<input type="checkbox"/> 35 to 60 years old <input type="checkbox"/> below 60 years old <input type="checkbox"/> General Public <input type="checkbox"/> Professionals <input type="checkbox"/> Students
---	--

Directly playable Downloadable

Figure 2.1 A website that applies G/P/S Model

It is important to understand the category of serious games because a slight change in words can bring completely different meaning. This study focuses on educational game about first aid which falls under both “Games for Education” and “Games for Health”. Both aim to teach the player and promote changes in their behaviour in order to improve their health.

2.3.3 Serious Game in Medical

Serious game is a very widely known new technology in medical healthcare. The application area of serious games in medical health is growing as new technology is developed. It created another approaches for both professional and non-professional in medical field to train and gain more knowledge. Serious game are educational tools

that employ game-thinking and mechanics where the principal intent is not amusement or pleasure, but it intended for the express objective of improving medical education (Ricciardi & De Paolis, 2014). Serious games are intended to provide balanced combination of challenge, new knowledge and skills to learner that wanted to grasp a better understanding in performing the real situations of medical emergencies by making decisions, formulating strategies to face the problems and getting a fast feedback on the consequence of their actions without the cost of real-world errors.

Target player of serious game can be classified as either patient or non-patient as show in the figure below.



Figure 2.2 Serious Game Target Player

There are variety types of applications that are related to serious game for medical and most of them have direct or indirect positive physiological and psychological effects on individual. One example of serious game for medical is the Pulse!! Project—the Virtual Clinical Learning Lab. This project targeted the nurses and medical professionals that needed an environment that allowed them to update their training. The game has virtual patients, created using artificial intelligence (AI) that will respond to the environment and medical techniques and skills used by the trainees in a real lifelike way(Johnston, 2007). Other great example of serious game is Hungry Red Planet. The aim of this game is to teach children nutrition skills and healthy eating habits. There are studies indicating that games can be helpful for patients to adjust their habits and lifestyles to deals with diseases (Michael & Chen, 2006).

There is great diversity of serious games application for medical used. One of the obvious reason is because the number of different stakeholders in this market such as hospitals, clinics, physicians, government and other organizations.

2.4 First Aid

First aid is very important to our daily life, especially when it comes to medical emergencies. But not many of us actually have the knowledge to perform first aid treatment during an emergency. First aid is the earliest care given to someone who is ill or injured. It can be administered by anyone with proper training that range from ordinary person to advanced medical practitioners. First aid can greatly stop something small from becoming serious and also increase the chances of saving someone else life in serious situations.

The objectives of first aid are to preserve life, protect the unconscious, prevent a victim's condition from becoming worse and promote the recovery of the victim. It is important for the first aid providers to feel confident in providing assistance to others. Queensland Ambulance Service (QAS) stated that in life-threatening situations, any form of assistance is likely to be of greater benefit than no assistance at all.

Different basic aid skills are applied on many different kind of emergency situation ranging from small injuries to life-threatening one. So it is important to learn all different of skills to be prepare for various kind of situations.

The advantage of learning first aid is that it can make you feel safer wherever you go including your home and workplace. It also can act as a safety net when someone you are close with is in a vulnerable situation. It also will make you more employable as first aid is a life skill and can greatly enhance your CV and job applications.

This research will focus on three types of injuries that required first aid treatment which are burns, strains and sprains and lastly, bleeding.

2.4.1 Burns

Burns are one of the most common household injures. The term burn means more than the burning sensation associated with this injury. Burns are characterized by

sever skin damage that causes the affected skin cells to die. Most people can recover from burns without serious health problem, depending on the cause and degree of injury.

There are three levels of burns which are first-degree, second-degree and third-degree. Each degree is based on the severity of damage to the skin, with first-degree being the most minor and third-degree being the most severe.

First-degree burns cause minimal skin damage as they only affect the outermost layer of skin. Treatments for a first-degree burn include soaking the wound in cool water for five minutes or longer. The best cream to be applied on this minor burn is Aloe Vera gel that can help to sooth the skin. Antibiotic ointment and loose gauze can also be used to protect the affected area.

Second-degree burns are more serious because the damage extends beyond the top layer of skin. This type of burn causes the skin to blister and become extremely red and sore. For the treatment, run the skin under cool water for 15 minutes or longer. Applied antibiotic cream and cover the affected area with bandages. Due to delicate nature of these wounds, keeping the area clean and bandaging it properly is required to prevent infection. It can take longer than three weeks to heal. However, if the burn affects a widespread area such as face, hands, buttocks, groin and feet, medical treatment is required.

Third-degree burns are the most severe. They cause the most damage, extending through every layer of skin. There is a misconception that third-degree burns are the most painful. However, with this type of burn the damage is so extensive that there may not be any pain because of nerve damage. Immediate medical treatment is required. First aid or attempt to self-treat a third-degree burn will only worsened the injury.

2.4.2 Strains and Sprains

A sprain is an injury to a ligament. When a sprain happens, one or more ligaments is stretched or torn. A strain is an injury to a muscle or tendon. In a strain, a muscle or tendon is stretched or torn. Anyone can get a sprain or strain if they are not careful.

The symptoms of a sprain included pain, swelling, bruising and not being able to use the joint. In addition to pain, the symptoms of a strain include muscle spasms, swelling, cramping and trouble moving. The amount of time you need to fully heal after a sprain or strain depends on the person and the type of injury.

Treatments for sprains and strains are the same. To reduce the swelling and pain, the first step is to rest the injured area. Then, put ice on the injury for 20 minutes 4 to 8 times a day. After the swelling goes down, compress the injury using bandages. Patient can take medicines, such as aspirin or ibuprofen for the pain.

Professional medical treatment is required if the swelling does not goes down after a while or the pain is too much to be handle. It could be that the muscle or joint are torn badly and required medical assistant.

2.4.3 Bleeding

Injuries and certain medical conditions can result in bleeding. Before begin to treat an injury, it is required to identify the severity of the injury first. There are some situations in which first aid cannot be administered such as internal bleeding or there is an embedded object surrounding the area of the injury. Profuse bleeding also can causes shock that indicate the blood loss.

Cut and grazes are a type of minor wounds that can cause bleeding. When this happened, firstly stop the bleeding by applying direct pressure on the cut or wound using clean cloth. If the wound is on arm or the leg, raise limb above the heart, if possible, to help slow the bleeding. Once the bleeding stop, gently clean the area with soap and warm water. Lastly, apply antibiotic cream to reduce risk of infection and cover with sterile bandages. The bandages needed to be changed daily to keep the wound clean and dry.

A bloody nose is quite common in both children and adults. Most nosebleeds are not serious but sometimes it required medical assistant when the bleeding happen quite often. To treat a nosebleed, have the person sit down and lean their head forward, this will reduce pressure in the nasal veins and slow the bleeding. Once the nose stops bleeding, instruct the person not to blow the nose for several days as this could dislodge the clot and cause bleeding to begin again.

2.5 Existing Game Application

2.5.1 First Aid Game

The first aid game was created by e-UCM Research Group using e-Adventure, an authoring platform for the creation of educational games. It is distributed under a Creative Commons license and commissioned by Aragonese Center for Educational Technologies (CATEDU). The game is used as a tool to teach high school students basic first-aid and reanimation procedures. This game also created to study its potential deployment alongside the ongoing effort to organize sessions in different high school where medical professional visits the school to arrange a tutorial.

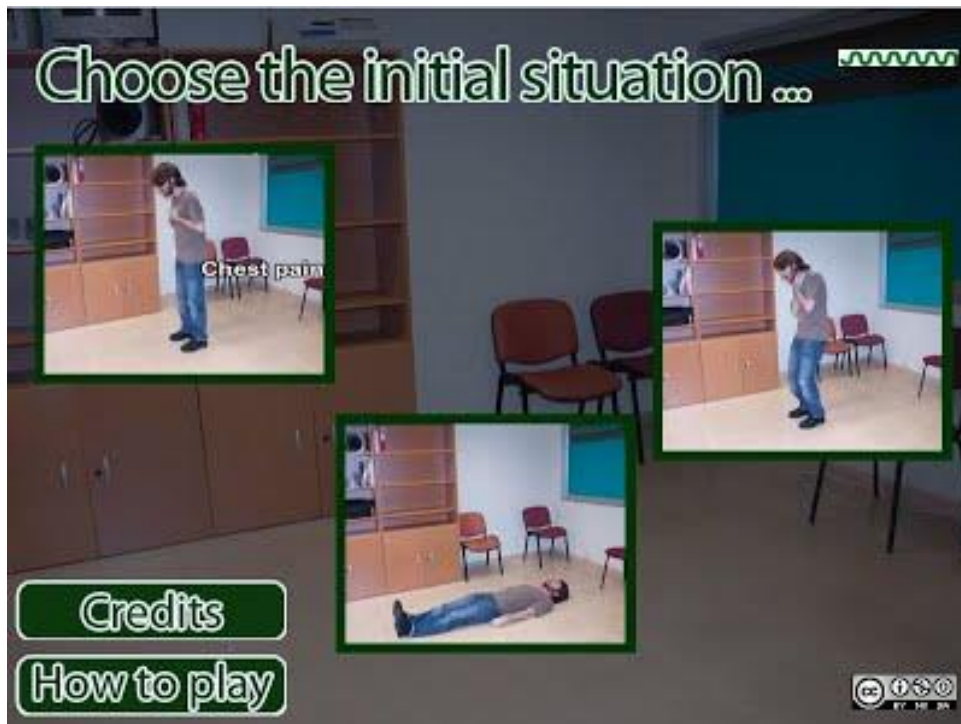


Figure 2.3 First Aid Game First Interface

The objectives of the game are to study the effectiveness of educational video game to teach the theory of basic life support to high school students. There is also the need to compare video game instruction to the traditional teaching of basic life support manoeuvres through practical demonstrations by healthcare professionals.

The game starts with a simple interface asking player to choose an initial situation. From that, a situation of the victim is given and player needs to choose the correct step to assist the victim. It also demonstrates the used of different medical tools

such as electro pad. At the end of the game, individual scores are given based on their chosen answers. There are also different paths that player can explored. Random changes are also applied to encourage replayability.



Figure 2.4 Player is require to click on the electrode pads

The game is considered more as an educational video game than serious game but it applies the basic intention of the game, which is basic first aid. It used a simple interface using real life images rather than 3D or 2D models.

2.5.2 Red Cross – First Aid

Red Cross game targeted younger audiences around 6 to 8 years old. This game teaches kids how to recognize everyday hazards they may come upon in different situations and places. It also teaches kids on what steps to follow to prevent them, how and when to call emergency number and how to provide assistance for different types of accidents.

They are around 11 different scenarios which kids can explore by acting out each simulation however they like and see the consequences of the actions on the spot. The game also teaches kids how to prevent falls, avoid cuts and burns in the kitchen, to be cautious at the park and how to recognize toxic products that may be found at home.

They also learn how to avoid traffic accidents, drowning at the beach or in pools, heat stroke and sunburn.



Figure 2.5 Red Cross-First Aid Game

2.5.3 Rescue Run

Rescue Run is a fun interactive game that set the player with a goal. The task is to practice the player basic first aid skills by getting to the cinema on time whilst helping out casualties on the way. The game also has different levels to choose from including easy (Accident Avenue), medium (Calamity Close & Risky Road) and hard (Disaster Drive & Mishap Mile).

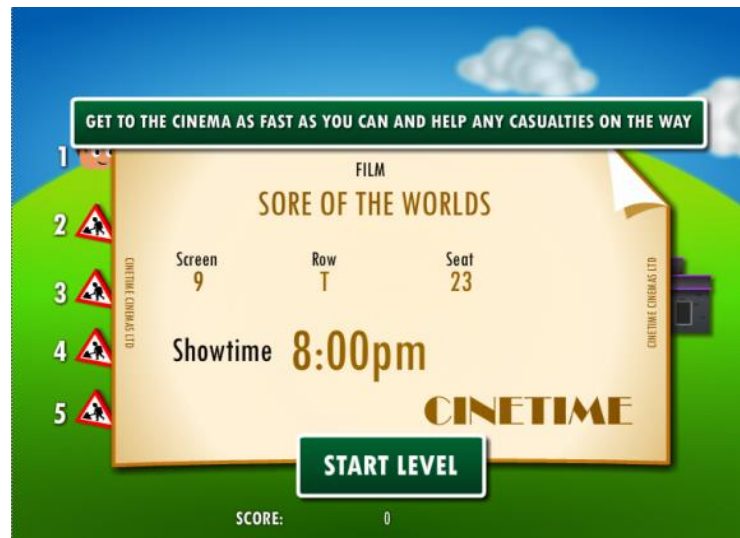


Figure 2.6 Rescue Run Game Interface

Player required starting level one and finish them in a given time constrain. Along the way, a casualty will appear and player is required to help them to gain points. Player has to click on the casualty and help them based on the given task. If player late in helping the victim, player will gain “lateness” points which are regard as the punishment. If player manage to help the casualty, they will gain “goodwill” points.



Figure 2.7 Player is require to click on the right picture

2.5.4 Comparison of Existing Games

Table 2.1 Comparison of Existing Games

	GAMES		
	First Aid	Red Cross - First Aid	Rescue Run
Platform	PC-based and Web-based	Mobile-based	Web-based
Operating System	Generic Java version (multiplatform)	Android OS, iOS	All operating system that has web browser
Connection Type	Offline and Online	Online	Online
Input Hardware	Mouse	Touch-screen	Mouse
Technology	Video game with real image of real situation.	2D	2D
Strength	<ol style="list-style-type: none"> 1. Have real life images as characters that allow player to see the real situation. 	<ol style="list-style-type: none"> 1. The elements of the game interface are easily identified and are illustrative of the functionality they perform (buttons, images, etc). 2. Has many interactive storyline for player to choose from 	<ol style="list-style-type: none"> 1. It is easy to know the position in the game ranking (you can always know if you are winning or losing). 2. Easy to understand the different functionality of the game. 3. Has element of fun and provide a lot of interaction with the games 4. Has repetitive movement that allow player to remember the important information
Weakness	<ol style="list-style-type: none"> 1. Visual representations are difficult to interpret. 2. Need to be assist by real life professional. 3. Does not allow enough customization 4. Poor support for text and poor communication interface 	<ol style="list-style-type: none"> 1. Does not allow enough customization 	<ol style="list-style-type: none"> 1. The time taken that is given to perform a task is small. 2. Problems with finding, joining or starting games.

The three existing games focus on the implementation of basic first aid. First Aid game is a basic educational video based game that does not use many interactions between the player and gameplay other than clicking on the right answers based on the situation given. Red Cross game gives player many different situations in a storyline form and beautiful and functional interface that allow player to interact more with the gameplay. Rescue Run game balanced both fun but educational theme. It has a goal that player need to reach while performing tasks.

As a suggestion for our game development, it is important to take note of user usability. It is including user interface, inputs, controllers and configurations that should be intuitive so that users should be able to complete at least basic tasks early on with little to no instruction. The feature that will be included in this game development is the platform game from Rescue Run. Player has to run throughout the gameplay to answer questions and collect scores. As from improvement, tutorial section will be added so player can read the tutorial before starting the task.

2.6 Tools of Development

The most important factor in a development of a games or serious game is the suitable tools of development that can make sure the game is built accordingly to the plan and it is develop in effective and quality way. There are pros and cons for each tools of development and it is important to choose the correct tools. The table below shows the suggested elements of tools used to develop a game.

Table 2.2 Tools of Development

	Features	
Tools	Advantages	Disadvantages
Unity	i. Support both 2D and 3D in game development ii. Support three programming languages - C# - JavaScript - Python (Boo) iii. Supports many types of platform including mobile, desktop and console iv. 3D engine produces high	i. The engine source code is not available ii. Unity has expensive asset server product to help with teams collaborate iii. The compilers are not at all well optimized for the ARM processors that exist in almost all mobile devices.

	<ul style="list-style-type: none"> v. quality results Widest export support game engine such as Windows, Mac, Linux, Android, iOS, WebGL, Facebook, all kinds of VR systems like Oculus Rift and Steam VR 	
3D Maya	<ul style="list-style-type: none"> i. Can handle higher level of complexity ii. Great with tasks that involve character rigging and animation iii. Great for creating 3D animation because it has greater capacity for simulating realistic animations and effects. iv. Operates on Windows, Mac and Linux 	<ul style="list-style-type: none"> i. Rendering takes a lot of times. ii. No live feedback when concerning lights iii. Technicality in nodes and crashing
3Ds Max	<ul style="list-style-type: none"> i. Good for texturing and meshing models ii. Great for game development iii. Operates on Window 	<ul style="list-style-type: none"> i. Tend to get unstable when the models become complex ii. Does not work well with anything that involves movement iii. Restricted to Windows based systems only.

2.7 Summary

In conclusion, serious game market is rapidly growing worldwide and gaining many interests from almost all kind of professional fields. In this chapter, the serious game in medical field is discussed and three existing first aid games are compared. Tools of development for the game are also suggested at the end.

CHAPTER 3

METHODOLOGY

3.1 Introduction

In this chapter, a methodology used to develop First Aid Game is study and discuss. A methodology can be defined as a guideline system that help the project runs efficiently and smoothly with specific requirement such as phases, tasks, methods, techniques and tools. Methodology is an important part in a system development since it helps in controlling the flow of the project in terms of time. In this project, a suitable approach used to develop the serious game, which is Rapid Application Development (RAD) methodology, is discussed.

3.2 Methodology

Each methodology that exists has pros and cons. In order to ensure that the software is being developed properly, a good methodology has to be chosen in order to save time and budget. The suitable approach that suggested after proper research is Rapid Application Development (RAD) methodology.

There are many reasons as why RAD selected for this project. One of the reasons is that if one method implement in the game does not meet the stakeholder requirement, developer can easily re-implement one step back before analysis phase. This is because RAD involved user in every phases of RAD. RAD also does not need a perfect or complete requirement to be implemented at the start of the phase. This is because the requirements from the user are obtain bit by bit as each phases (especially User Design and Construction phases) are repeated until the user is satisfied with the outcome. This can help the developer to develop the game faster with lesser cost.

3.2.1 Rapid Application Development (RAD)

A number of people see RAD as a complete approach as it covers the entire life cycle of system development and it heavily emphasizes on rapid prototyping and iterative delivery. The RAD generally follows cyclical process that includes four basic steps; planning requirements, user design, rapid construction and cutover. Figure 3.1 below shows the RAD model cyclical process.

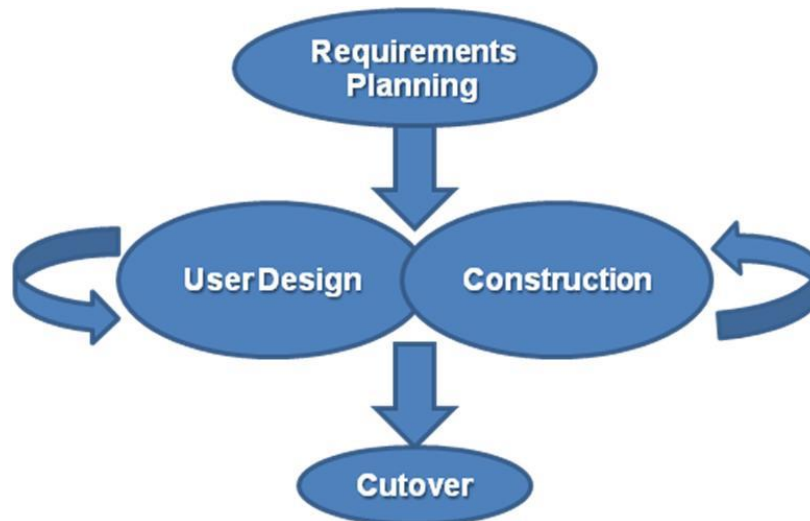


Figure 3.1 Rapid Application Development (RAD) Model

3.2.2 Requirement Planning Phase

The first phase of RAD is the requirement-planning phase. During this stage, designers, developers and users come to a rough agreement on the project scope and the system requirements so that a development of a prototype can begin in the future stages.

During the start of this project, the game requirements were obtained from the through research and consultant from medical professional. The problem statement and the objectives of the game development are defined at the start. The scope of the game system is also discussed. It includes the target user of the First Aid Game which is those that have a little to no knowledge about basic first aid. The game content including the game genre and a brief overview of the game world is briefly stated. The technology used to develop the game, 2D or 3D is also discussed and it has come to an agreement that 2D game technology will be develop. PC-based platform is also chosen as the official platform for the game. The mobile-based is suggested to be tested once the PC-

based is successfully developed. The hardware and software used for this project also briefly discussed at the end.

After that, a research regarding serious game took place. A brief studied about basic first aid also took place in this phase. After that, three existing games application that related to first aid is compare in term of strengths and weaknesses. It is suggested that the strengths of each games application is apply on the First Aid Game as an improvement of the previous applications. Three suitable tools of development are also discussed. Unity, 3D Maya and 3D Max are suggest while comparing both the advantages and disadvantages of the software. After weighing out the pros and cons, Unity is choose as the main tool of development as it can develop both 2D and 3D game application for both PC-based and mobile-based platform. Lastly, the database platform for the game also discussed.

For details requirements of both software and hardware tools used for this project, refer to sub-chapter 3.3.

3.2.3 User Design Phase

The second phase of RAD is user design phase. During this phase, Unified Model Language (UML) is design based on the requirements gather in the previous phase. This includes flow chart of the application. In addition, the storyboard of the game is design so user can see the flow of the game visually. The database for the game is proposes to meet the requirement stated in the previous stage. After that, user feedback is gathered and it is heavily emphasis on determining the game architecture. This will allow the creation of initial prototype.

This phase is repeated as often as necessary as the project evolves to allow user to modify and improve the requirements. For details requirements of design of this project, refer to sub-chapter 3.3.

3.2.4 Construction Phase

The third phase in RAD is the construction phase, which also known as the developments phase. The goal of this phase is to complete the detailed design of the proposed system. It is also where most of actual system coding, testing and integration

takes place. Along with the previous stage, user design phase, construction phase is repeated as often as necessary to meet the needs of the project. User continues to participate in this phase to give suggestion, improvement or feedback about the system as the actual screens or reports are developed. The detailed discussion on this phase, refer sub-chapter 3.6 and chapter 4.

3.2.5 Cutover Phase

Cutover phase is the final phase of RAD. During this phase, the development team is allowed to move the system to live test with real environment as full-scale testing or team training can take place. Any problem arise during this phase is immediately resolve. The detailed discussion about the testing, refer sub-chapter 3.7 and chapter 4.

3.3 User Requirement & Design

This section will goes on detailed about user requirement and the design of the system for this serious game application.

3.3.1.1 Game Content

Game content is the space or the content of the game.

1. Game Genre

The genre of this game is serious game with tutorial and platform-based and quizzes game as a gameplay.



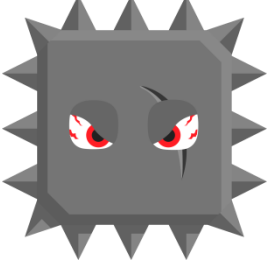
2. Game World

The game takes place in 2D real world. The player is an alien that will be guide during tutorial by a NPC character called Dr. Aid. During task, player has to go through a gameplay to test the knowledge they had gain during tutorial. The gameplay is a platform-based game where player has to run through the platform, avoiding obstacles and enemies while answering questions to collect score. Each level has different views and background. The questions are given in the form of quizzes during the platform gameplay. Player has to choose the correct answer to gain scores.

3. Characters

The list of the characters is as below:-

Table 3.1 List of Characters

Characters	Brief Description
 <p data-bbox="363 813 448 842">Player</p>	<p data-bbox="627 663 1222 696">Player can move around in the platform game.</p>
 <p data-bbox="357 1207 453 1238">Dr. Aid</p>	<p data-bbox="579 994 1362 1061">Dr. Aid is a non-playable character that will guide player through tutorial.</p>
 <p data-bbox="352 1507 461 1538">Enemies</p>	<p data-bbox="579 1344 1315 1411">Enemies will roam the platform game and perform as obstacles for player to avoid.</p>

4. Storyboard

Storyboard is design to visualize the requirements given by user. It also visualizes the flow of the system. It is easy to detect the system flaw when the flow does not meet the eyes. The figures below show the storyboard for this project and the initial design for the interfaces.

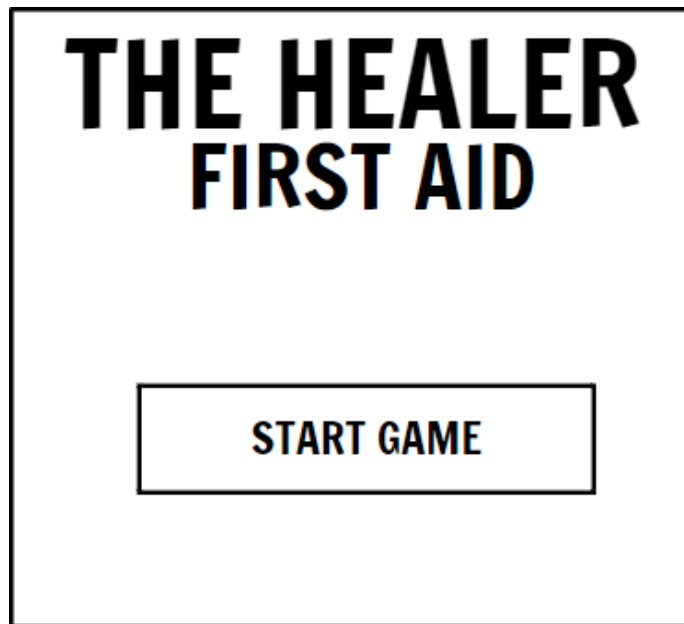


Figure 3.2 Storyboard: Interface 1 (Start Page)

Description

This is the first page that appears when player join the game for the first time. Player can click on the START GAME button to go to the next page (Menu Page, see Figure 3.3)

Multimedia Elements

1. Images

An image of the game logo “The Healer: First Aid” is applied on top of the interface. Background image is a sky and green bushes.

2. Audio

Audio is applies within this interface. Background music and a special sound effects are applied when player click on the ENTER button.

3. Button

Player has to click on the “Enter Game” button to go to next page

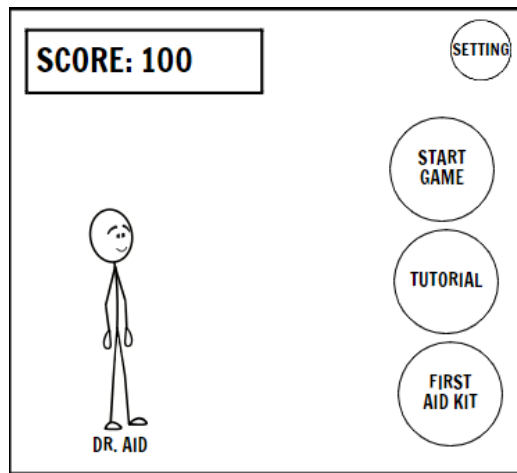


Figure 3.3 Storyboard: Interface 2 (Menu Page)

Description

This is the main interface of the game. If it is the first time player joins the game, this page will appear after Figure 3.2. Player can choose to navigate to four other interfaces. If player click on the SETTING icon, it will lead to the setting page (see figure 3.4). If player click on START GAME button, it will lead to the TASK page (see figure 3.5). If player click on TUTORIAL button, it will lead to the TUTORIAL page (see figure 3.5). If player click on the FIRST AID KIT button, player will navigate to the FIRST AID KIT page (see figure 3.12).

Multimedia Elements

1. Images

An image of Dr. Aid is applied on top of the interface.

2. Audio

Audio is applies within this interface. Background music and a special sound effects are applied when player click on the buttons.

3. Icon

A SETTING icon is set on the top-right corner of the interface. Player can click on it to view the setting page. Other icon such as START GAME, TUTORIAL and FIRST AID KIT.

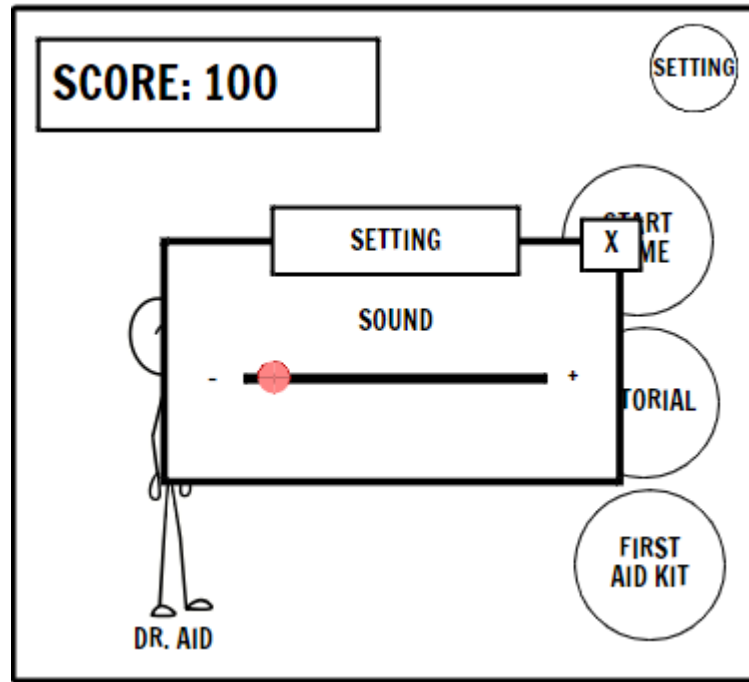


Figure 3.4 Storyboard: Interface 3 (Setting Page)

Description

Setting page will appear as pop-up page when player click on SETTING icon in the previous interface (see figure 3.3). In this page, player can set setting on the volume of the game. Player can slide the volume from low to loud and vice versa. Player can exit the page by clicking on the “x”. It will lead player to the main interface (see figure 3.3).

Multimedia Elements

1. Icon

Speaker volume icon is use to show the player the loudness of the volume. The left icon indicate it is low while the right icon indicate it is loud.

2. Audio

Audio is applies within this interface. Background music still play when player enter this page.

3. Text

“Volume” label is puts so player knows which setting it is.

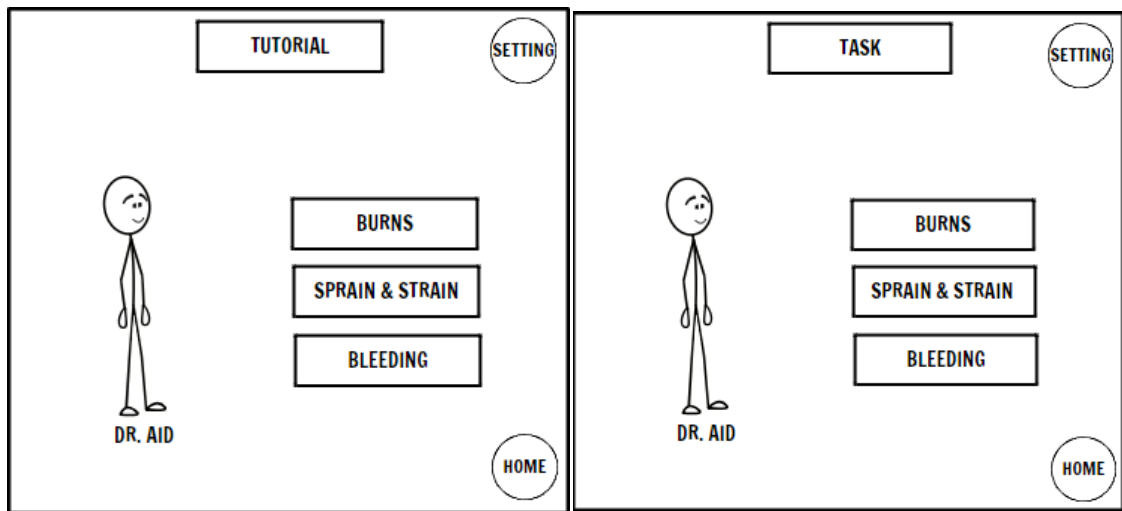


Figure 3.5 Storyboard: Interface 4 (Left: Tutorial & Right: Task page)

Description

These pages will appear when player click on TUTORIAL icon and START GAME icon on the main page respectively (see figure 3.3). It has setting and home buttons. It also has 3 main functions that will lead player to different page. In tutorial, clicking one of the buttons will lead player to tutorial page (see figure 3.10). In task, clicking one of the buttons will lead player to level page (see figure 3.6).

Multimedia Elements

1. Images

An image of Dr. Aid is applied on top of the interface.

2. Audio

Audio is applies within this interface. Background music is play in the background.

3. Icon & Button

Icons and buttons are used as navigation to go to different scenes.

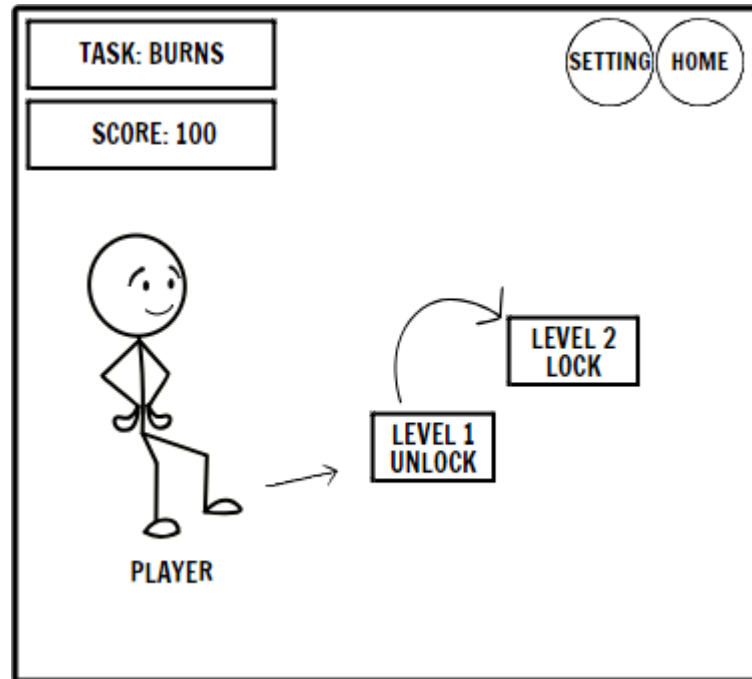


Figure 3.6 Storyboard: Interface 5 (Level Page)

Description

This page will appear when player click on one of the buttons option in TASK page (see figure 3.5). It has setting and home icons. It also has player current score display on top of the page. There is also levels buttons where player can click on to go to the game page (see figure 3.7). Level 2 button will automatically unlock only once Level 1 is completed.

Multimedia Elements

1. Images

An image of Player is applied on top of the interface.

2. Audio

Audio is applies within this interface. Background music and a special sound effects are applied when player click on the icons.

3. Icon& Buttons

Icons and buttons are clickable. They will lead player to different pages.

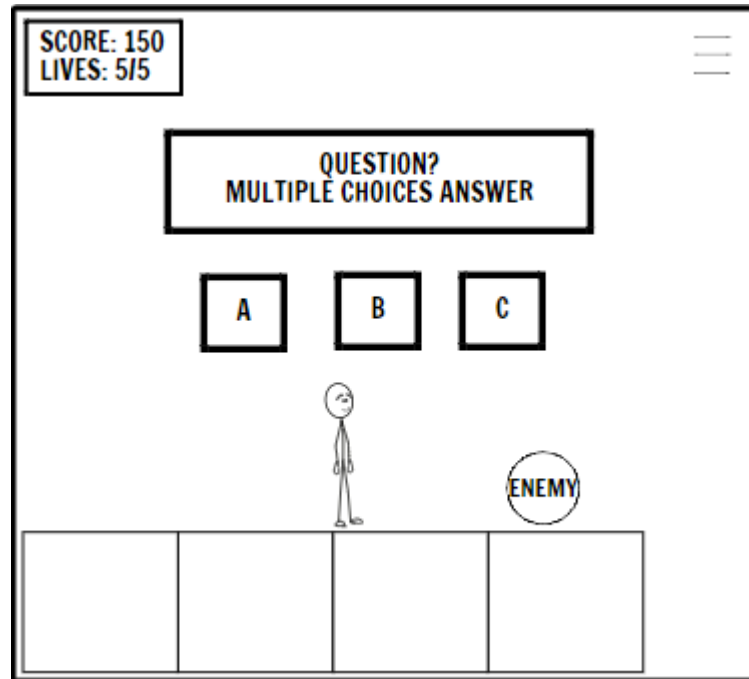


Figure 3.7 Storyboard: Interface 6 (Game Page)

Description

This page will appear when player click on one of the level in LEVEL page (see figure 3.6). In this gameplay, the surrounding is a platform game where player has to run and avoid the enemies and obstacles. Along the way, player has to answer the questions display. Score will be given if the answer is correct and deduct if it is not. Player will lose and gain lives. Player also can click on the OPTION icon (see figure 3.8).

Multimedia Elements

1. Images

An image of the game character is applies in this interface. Background, platforms and enemies are in this interface.

2. Audio

Audio is applies within this interface.

3. Icon

OPTION icon is clickable. The icon wills pop-up an option panel.

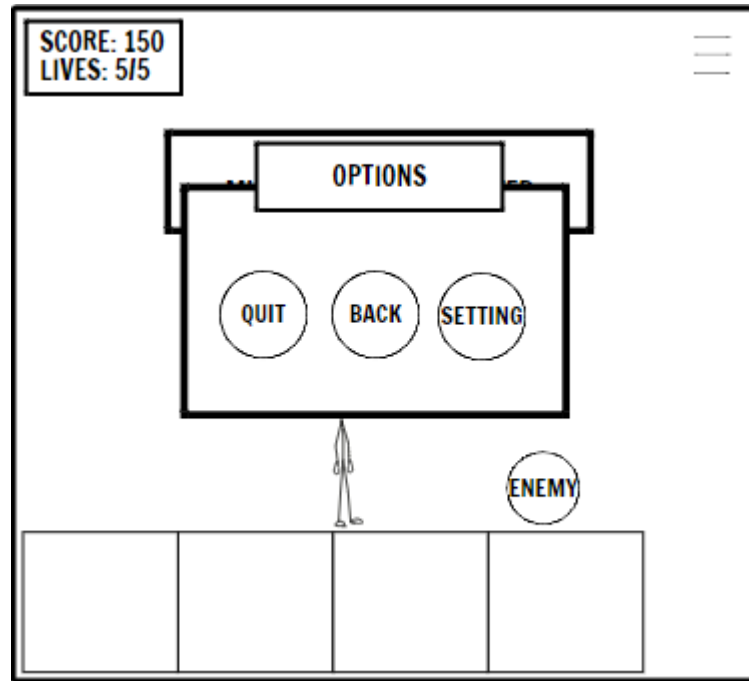


Figure 3.8 Storyboard: Interface 7 (Option Panel)

Description

This panel will appear when player click on the OPTION icon in the GAME page (see figure 3.7). There are three functioning buttons which are Quit button, Back button and Setting button. Quit button will let player to quit the game. Back button will let player to continue the game. Setting button will lead player to the setting panel (see figure 3.4).

Multimedia Elements

1. Audio

Audio is applies within this interface. Background music and a special sound effects are applied when player click on the HOME and ENTER icon.

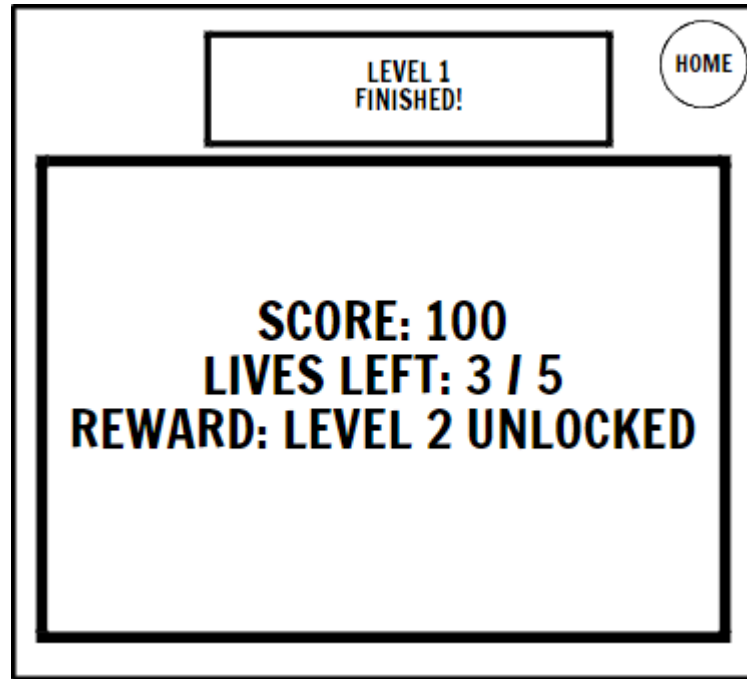


Figure 3.9 Storyboard: Interface 8 (Reward Page)

Description

This page appears when player has completed the level. Score, lives and reward will be display at the end of the game.

Multimedia Elements

1. Audio

Audio is applies within this interface. Background music and a special sound effects are applied when player click on the PLAY and BACK button.

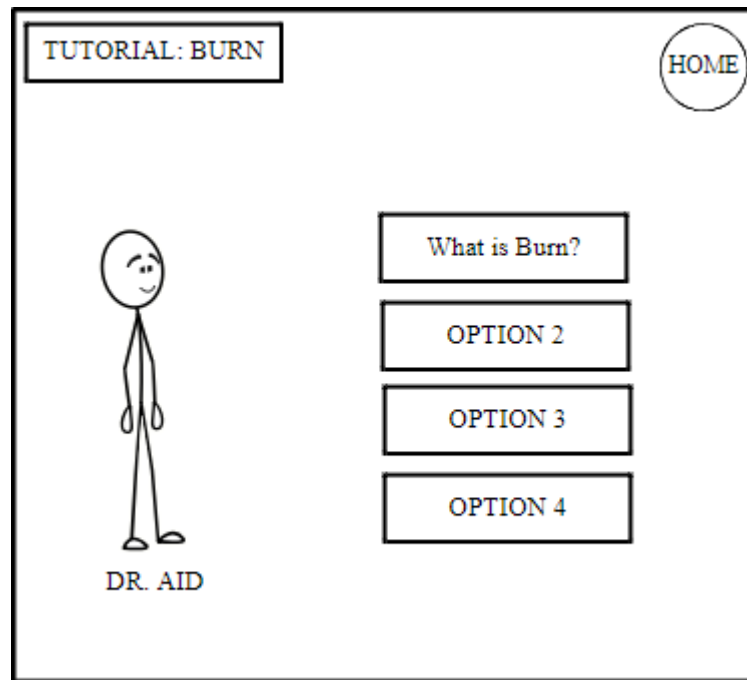


Figure 3.10 Storyboard: Interface 9 (Tutorial page)

Description

This page appears when player click on one of the buttons in the TUTORIAL page (see figure 3.5). There are options buttons on the main page. Player can click on them to view the information (see figure 3.11).

Multimedia Elements

1. Audio

Audio is applies within this interface. Background music and a special sound effects are applied when player click on the HOME and ENTER icon.

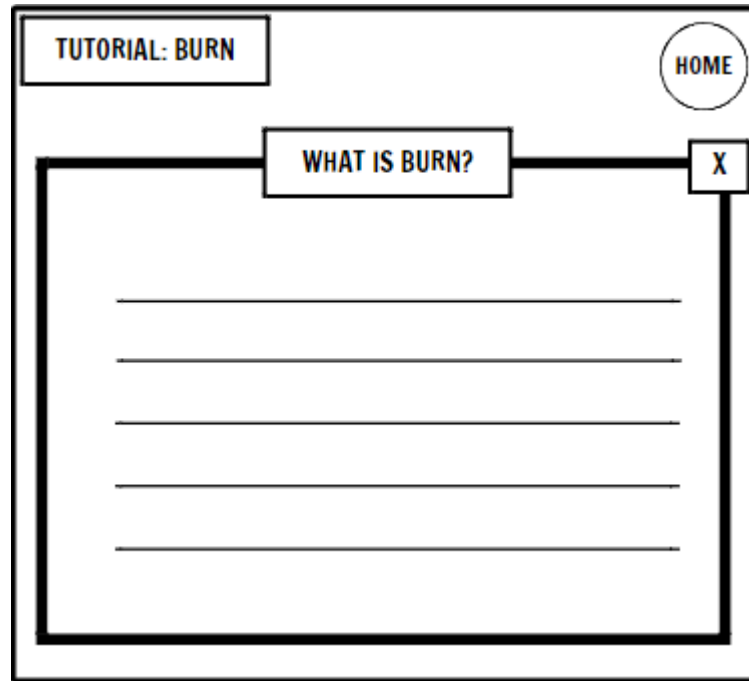


Figure 3.11 Storyboard: Interface 10 (Tutorial info panel)

Description

This panel will appear when player click on one of the buttons in tutorial page (see figure 3.10).

Multimedia Elements

1. Text

Display information about the subject in tutorial.

2. Audio

Audio is applies within this interface. Background music and a special sound effects are applied when player click on the PLAY and BACK button.

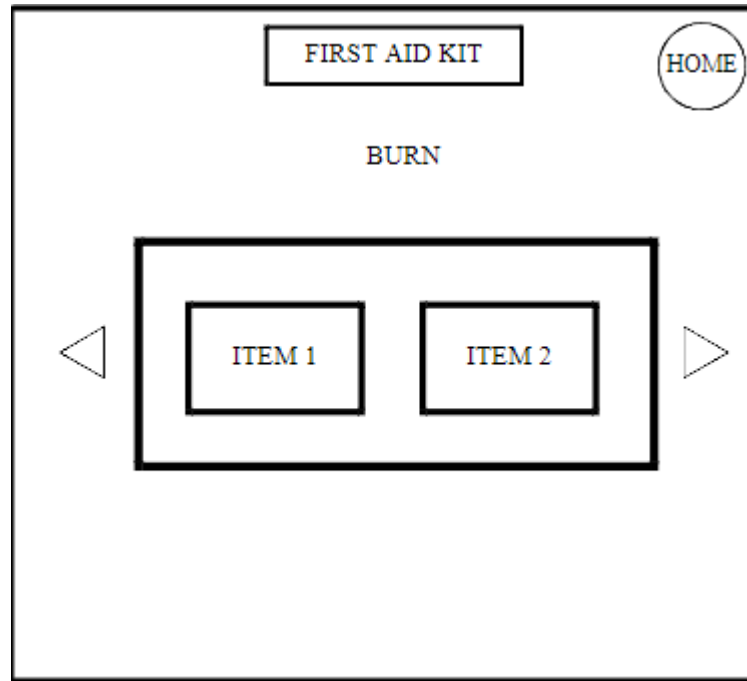


Figure 3.12 Storyboard: Interface 11 (First Aid Kit page)

Description

This page will when player click on the FIRST AID KIT icon in the menu page (see figure 3.3). Player can click on the next and previous buttons to view more first aid kit items based on the sub-modules such as burns, bleeding and sprains and strains.

Multimedia Elements

1. **Images& Buttons**

An image of the first aid kit items are display in the box based on the sub-modules. Previous and next button is used to navigate between different sub-modules such as Burns, Bleeding and Sprain & Strains first aid kit items.

2. **Audio**

Audio is applies within this interface. Background music and a special sound effects are applied when player click on the items and BACK button.

5. Controls

Table 3.2 Game Controls

Controls	Description
Keyboard	<ol style="list-style-type: none"> 1. Left Key – Move to the left 2. Right Key – Move to the right 3. Up Key – Jump 4. Space Bar Key - Shooter
Mouse	To click on the buttons on the user interfaces.

6. Level Design

The level is divided based on module and sub-modules. There are two modules and three sub-modules for each module. The table below shows the details of the level design.

Table 3.3 Level Design

Module	Description	Sub-Modules	Level
Module 1	Module 1 also known as the “Tasks”. The Tasks module will challenge player on the first aid knowledge that they had gain previously during the tutorial.	Burns	None
		Strains & Sprains	
		Bleeding	
Module 2	Module 2 also known as “Tutorials”. The Tutorials module will tutor player on first aid by teaching them systematically on how to apply first aid. A NPC call Dr. Aid will help as guide to explain about the treatment. There is no gameplay in this module. Player can use this module to	Burns	Level 1
			Level 2
		Strains & Sprains	Level 1
			Level 2
		Bleeding	Level 1

	study the First Aid based on the information given.		Level 2
--	---	--	---------

For Module 2 game level, each sub-module will have 2 levels which are level 1 and level 2. Each level has specific questions that player need to answer. The requirements of the level design are as table below.

Table 3.4 Level Description

Level	Description
Level 1	General questions about the sub-modules. Example: How much type of levels do Burns have?
Level 2	Specific questions regarding how to treat certain injury using first aid. Example: What is the first step of treating a burn?

3.3.1.2 Game Mechanics

1. Player Rules

Storyboard is design to visualize the requirements given by user. It also visualizes the flow of the system. It is easy to detect the system flaw when the flow does not meet the eyes. The figures below show the storyboard for this project and the initial design for the interfaces.

2. Rewards and Punishments

The detail of game rewards is as below:

Table 3.5 Rewards

Reward	Description
Points	Player will receive points for every correct answer. Each question value +10 points.
Lives	Player can collect lives during gameplay.
Level Unlock	The next level only will unlock once the previous level is finish.

The detail of game punishments is as below:

Table 3.6 Punishments

Punishments	Description
Points	Points will be deducted for every wrong answer. Each deduction will cost -5 points.
Lives	Player will lose one lives if collided with the enemy and give the wrong answer.
Game Over	The game is over when player lose all 3 lives.

3. Victory Condition

For each sub-module, player will win a badge once they completed both of the levels. Once player finish all sub-modules, the points collected will decide which level of mastery the player win.

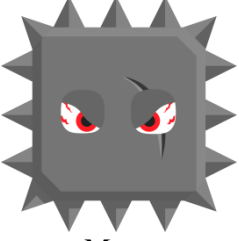
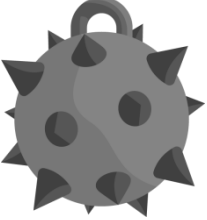

Table 3.7 Punishments

Points	Level of Mastery
700-1000	The Healer
400-699	Junior Healer
100-399	Noob Healer

4. Challenges

There are many enemies and obstacles located in each level. The table below shows the type of enemies, obstacles, level they appeared and brief description about them.

Table 3.8 Enemies and Obstacles

Enemies		
Name	Level Appearance	Description
 Mace	Level 1	If player collide against Mace, player will lose 1 lives.
 Mace-Chain	Level 1, Level 2	If player collide against Mace-chain, player will lose 2 lives.
Obstacles		
Name	Level Appearance	Description
Hole	Level 1	A hole appears between platforms. If player fall down, game over.
 Water	Level 1, Level 2	Water appears between platforms. If player fall down, game over.

3.3.1.3 Game Technology

Table 3.9 Game Technology

Technology	Description
Audio	Free audio is used for background music and button clicking.
Network	Offline gameplay
Type of player	Single player

3.3.1.4 Schedule

The Gantt Chart is created in the Requirement and Planning Phase. It shows the planning of the development of the game in a certain timeline (Refer to Appendix A for Gantt Chart).

3.3.1.5 Database Design

For this project, SQLite is integrated into the game. There is no actual design for the database.

3.4 Hardware and Software

Table 3.2 shows the advantages and disadvantages of using RAD methodology on this system.

Table 3.10 Advantages and Disadvantages of RAD

Advantages	Disadvantages
Constant user feedback during each phase.	Required skilled developers to adapt quickly to the system and components evolve.
Urging developers and designers to create component that are functional and independent on their own in early stage so it can be test earlier.	Difficult to be implementing a large-scale project as the method can reduce control and restrictions.
Quickly produce prototype and working on code to illustrate examples in a short time.	Demands frequent user interfacing that required willing user and the team to communicate and reach an agreement.
Changing requirements can be easily accommodated using RAD.	Requires modular system.

3.5 Hardware and Software

This section will focus on hardware and software that is use in the process of developing this game application. Proper hardware and software is considered based on the functionality.

3.5.1 Hardware

Hardware is the tool that is used to develop this project and help in managing all the data and information of the project. The table below shows the hardware that is use in this project.

Table 3.11 Hardware Description

Hardware	Function/Purpose
Laptop	<ol style="list-style-type: none">1. Prepare the proposal and documentation for the project2. Designing and developing game3. Hardware platform for operating system and software to run
External Hard Disk	<ol style="list-style-type: none">4. Data transfer5. Act as a backup data for the project
Drawing Pad	<ol style="list-style-type: none">6. Drawing illustration for the game art7. Connected to FireAlpaca, Adobe Photoshop and Adobe Illustrator

3.5.2 Software

Software is the tool that is used to assists the development of the project and helps to maintain the design when it is come to error. The table below shows the software that is use in this project.

Table 3.12 Software Description

Software	Function/Purpose
Mockflow	Free online software that allow user to draw storyboard. In this project, Mockflow is used to design the initial storyboard and interfaces.
Microsoft Office 2007	Use to perform documentation work for the project.
3D Unity	To develop and construct the game using 2D technology. The database used in this software is SQLite database.
GanttChart Pro	To create the Gantt Chart for the project.
Draw io and LucidChart	Designing UML diagram for documentation.
Microsoft PowerPoint 2007	To create slideshow for presentation for the project.
FireAlpaca	Free software that allow user to draw art. Used to create graphic art for the game.
Adobe Photoshop and Adobe Illustrator	Used to create graphic art (character design and others) for the game.

3.6 Implementation

Implementation of the game system occurs during the Construction Phase. As the phase for the project has not reach yet, this chapter will discuss the planning for the implementation of the game system.

In this project, Unity is use to develop the game. As an initial plan, the latest free version of Unity is download into laptop and the software is explore first to get use to the interface and the functionality. The implementation of the game mostly uses C# to code and Mono or the Microsoft .Net Framework to run the code thus the knowledge about C# language is required to continue the development of the game.

Steps in designing a game in Unity are plan beforehand. Firstly, all the assets such as the sprite, game character and so on are import into the Unity. All the assets are in 2D. Then, the codes to control the objects, scenes and game logic are written in C#. The game is runs to test the code on the game objects. The steps are repeats until there are no errors. Once the system is fully develops, the system is export to a platform and tested in the next phase.

For database implementation, this project will use SQLite, as the code is portable to C#. Figure 3.23 shows the bit of SQLite code that can be place in a C# file. The code script can be attaches to a game object. The code gives the basic setup for

how to create a database. When the project is build and run, it will create a database in the root of the game folder.

```
using UnityEngine;
using System.Collections;
using System;
using System.Data;
using System.Data.SQLite;

public class CaptureObjects : MonoBehaviour
{
    // local variables
    SQLiteConnection con = new SQLiteConnection("Data Source=gamedata.db;Version=3;New=False;Compress=True;");
    SQLiteCommand cmd;
    string buildTableInfo;
    string sql;
    // Use this for initialization
    void Start () {
        buildTableInfo = string.Empty;
        sql = string.Empty;
        StartCoroutine(SetupDatabase());
    }
    // Update is called once per frame
    void Update () {
    }
    void FixedUpdate()
    {
    }
    IEnumerator SetupDatabase()
    {
        con.Open();
        cmd = con.CreateCommand();
        cmd.CommandText = "create table IF NOT EXISTS tblMASTER(PID, OBJECTS, VALUE)";
        cmd.ExecuteNonQuery();
        // Test its creation or if it exists see row count
        cmd.CommandText = "SELECT COUNT(*) FROM tblMASTER";
        int result = Convert.ToInt32(cmd.ExecuteScalar());
        con.Close();
        Debug.Log(result);
        yield return new WaitForSeconds(0);
    }
    void OnApplicationQuit()
    {
        // cleanup anythin gopen
        if (con != null)
        {
            con.Close();
            con.Dispose();
        }
        if(cmd != null)
        {
            cmd.Dispose();
        }
    }
}
```

Figure 3.13 SQLite Database Coding

3.7 Testing

During testing, experienced testers start to test the system against the requirements. The testers aim to find defects within the system as well as verifying whether the application behaves as expected and according to what was documented in the requirements analysis phase. Testers can either use a test script to execute each test and verify the results, or use exploratory testing which is more of an experience based

approach. It is possible that defects are identified in the testing phase. Once a defect is found, testers inform the developers about the details of the issue and if it is a valid defect, developers will fix and create a new version of the software which needs to be verified again.

3.7.1 Testing Technique

It is important to use the right testing technique to get a good result. There are many testing techniques out there but there are two basic techniques that is used to test a system especially a game application. The two basic techniques are called White Box and Black Box testing technique.

Table 3.13 Testing Technique

White Box	Black Box
Examining internal structures or workings of a program with knowledge about the system.	Examining functionality without any knowledge on internal implementation
Concentrate on how the system does it.	Concentrate on what the system supposed to do.
Usually the tester is the developer	Usually the tester is the user

3.7.2 Test Case

Test case is a set of conditions or variables under which a tester will determine whether a system under test satisfies requirements or works correctly. The process of developing test cases can also help find problems in the requirements or design of an application. This test case is design under User Acceptance Test (UAT). Below shows an example of design of a test case:-

ID	Test Case Name	Activity	Steps	Expected Result	Status (Pass/Fail)	Comment
M1_01	Checking Task for Module 1: Bleeding	Checking Task 1	Click on Play button.	Display module list.	Pass	
			Click on Bleeding button.	Display patient's information.	Pass	
			Click on Play button.	Narration 1.	Pass	
			Click on Next button.	Narration 2.	Pass	

Figure 3.14 Example of Test Case

CHAPTER 4

RESULT AND DISCUSSION

4.1 Introduction

The purpose of this chapter is to discuss in details on the process of the game application First Aid. To relate to the methodology used, this process occurs during the construction phase which are implementation process, test process and result analysis. All the function and implementation of the coding used to achieve the main objective has been justified in details. Implementation and testing phase are essential for every project because it shows the error or vulnerabilities of the system during implementation and state the level of system successfulness.

4.2 Implementation

The implementation phase is about completing the project based on all collected requirements and specific details on game design, functionality and layout to make sure that the result meets the expectation and satisfactions of user. For the development of First Aid, we focused on using programming language C Sharp (C#) and a game engine software called UNITY. By using both of this on the project, we are able to meet the system requirements and create many interactive movement and game design.

4.2.1 Development

After gathering user requirement and design, we can now start to create the start page of the game. The basic of creating scene is with Canvas acting as background, with Main Camera attached on it. The panel is created to hold background image and other function on top of it.

The start scene is name as “StartPage”. The panel has one functioning buttons which is “Start Game”. This button will navigate player to the next scene called “Menu”. For the button to function, a script of code is created in Notepad using C#. Below is a part of the coding for the button to navigate to the specific scene.

```
public class SceneNav : MonoBehaviour {  
  
    public void startBtn() {  
        SceneManager.LoadScene(1);  
    }  
}
```

Figure 4.1 Code for Start Game button (SceneNav.cs)

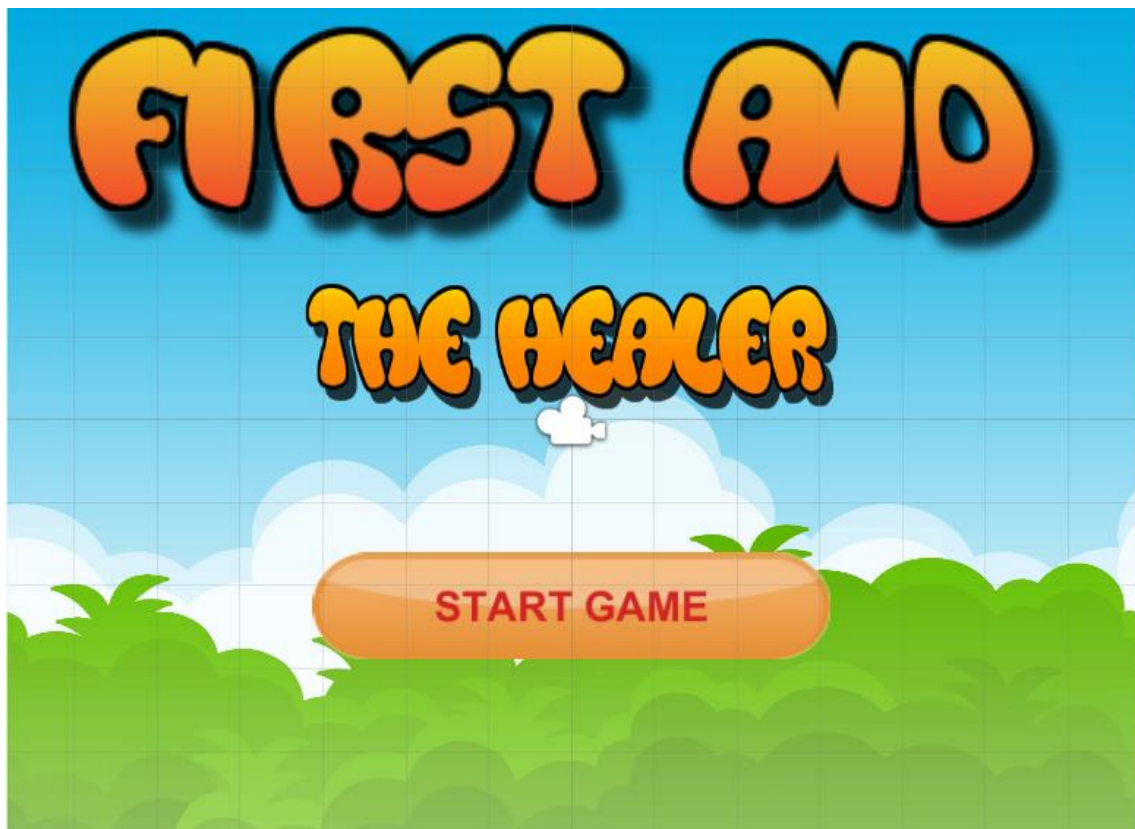


Figure 4.2 StartGame page

Next scene is the “Menu” page. This page has four functioning buttons which are the “Setting”, “Start Game”, “Tutorial” and “First Aid Kit” buttons.



Figure 4.3 Menu page

“Setting” button allowed user to view option page where they can adjust the volume of the game. The option page is created using another panel where it will appear when player click on it and close when player click on the exit button.



Figure 4.4 Setting page

To make the panel appear and disappear when the button is click, simply use OnClick() in the inspector to activate the panel by clicking on the SetActive. This method is used on the setting button. To close the panel, the same thing is done to exit button but the blue box is left unchecked.

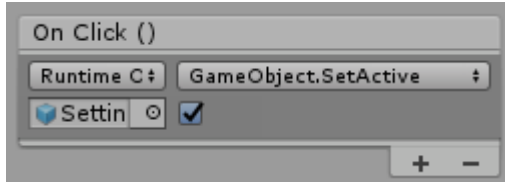


Figure 4.5 SetActive panel

“Start Game”, “Tutorial” and “First Aid Kit” buttons will navigate player to “Task”, “Tutorial” and “First Aid Kit” scenes respectively. The same script as in Figure 4.1 is used to navigate between scenes.

Next scene is the “First Aid Kit” scene. This scene will allow player to view the first aid kit item based on three different injuries such as Burns, Sprain and Strain and Bleeding. The next and previous button is used to navigate between these three panels. The same method is used as in Figure 4.5. The “Home” button will lead player back to “Menu” page.



Figure 4.6 First Aid Kit page

Next Scene is “Tutorial” and “Task” page. These pages have three main buttons that will navigate player to different sub-modules. The coding used is the same as Figure 4.1.

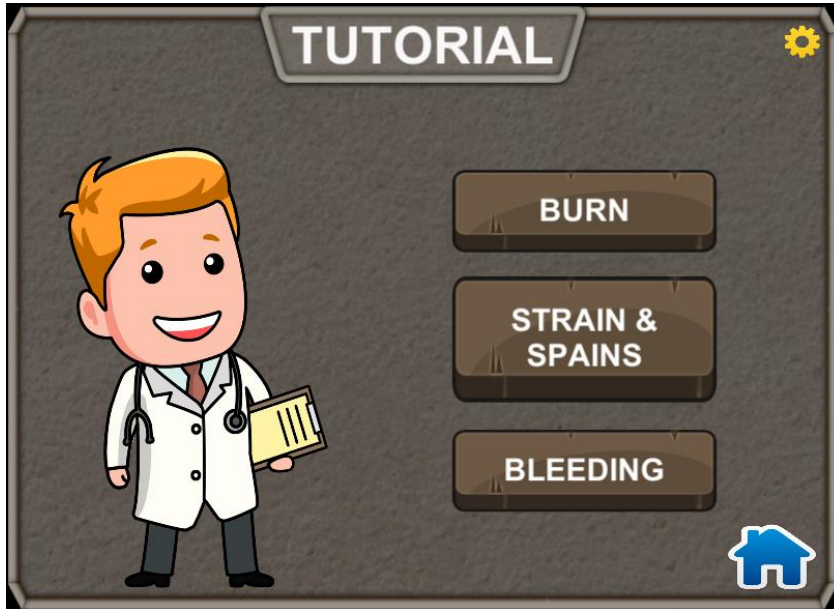


Figure 4.7 Tutorial page

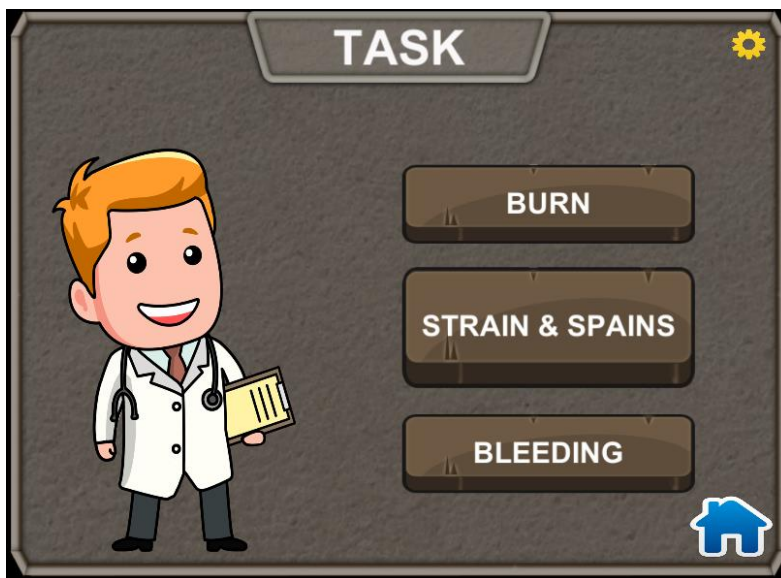


Figure 4.8 Task page

Next scene will show the layout of each sub-module in the tutorial page. In these sub-modules, player can click on the buttons to read the information contains.

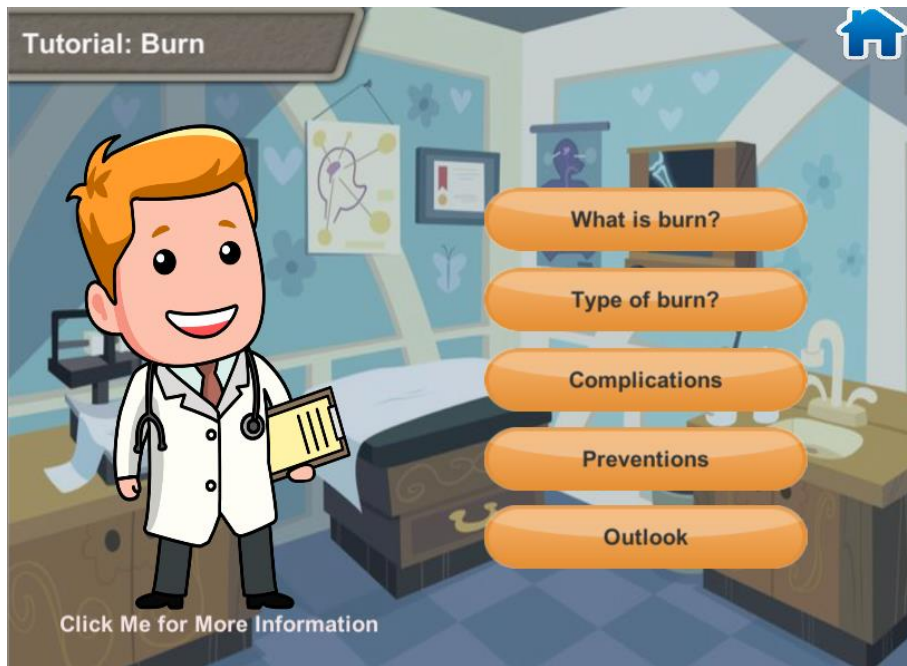


Figure 4.9 Task page

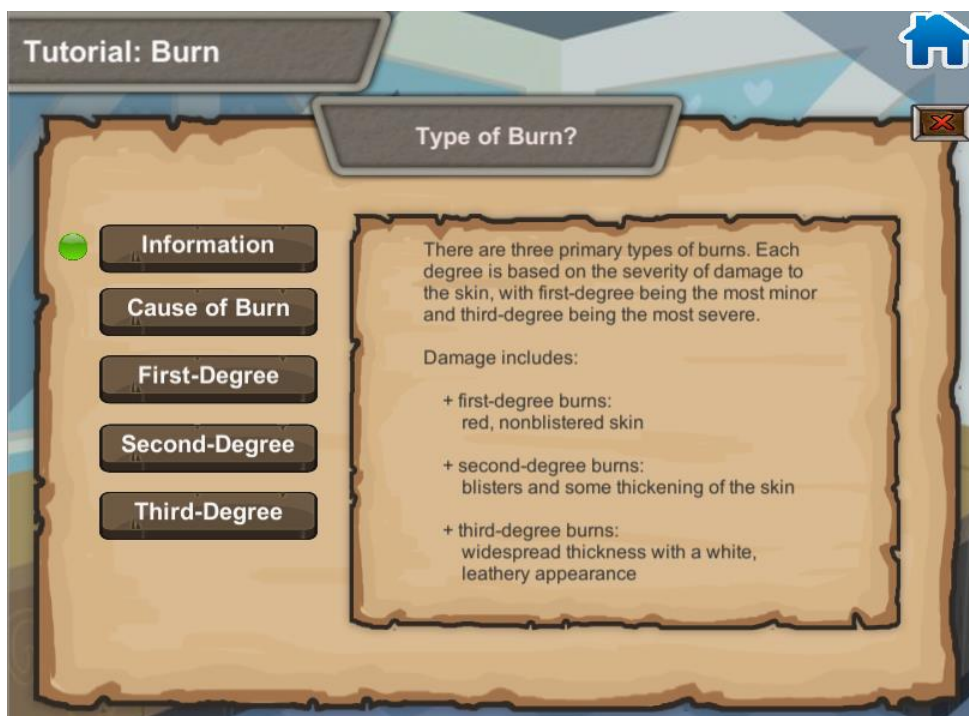


Figure 4.10 Task page

Next scene will show the layout of each sub-module in the tutorial page. In these sub-modules, player has to play games based on level. Player has to run across the platform to answer questions while avoiding obstacles and enemies. There are a lot of coding and animations used for this gameplay.



Figure 4.11 Task page

Player will gain scores if they answer the question correctly when they collide with the correct treasure box and lose score otherwise. Player will lose lives if they collide against enemies and obstacles. There are also codes for player and enemies' movement.

```
public class PlayerMovement : MonoBehaviour {
    public CharacterController2D controller;
    public float runSpeed = 40f;
    float horizontalMove = 0f;
    bool jump = false;
    //bool crouch = false;
    // Use this for initialization
    void Start () {
    }
    // Update is called once per frame
    void Update () {
        horizontalMove = Input.GetAxisRaw("Horizontal") * runSpeed;
        if (Input.GetButtonDown("Jump"))
        {
            jump = true;
        }
    }
    void FixedUpdate()
    {
        //Move our character
        controller.Move(horizontalMove * Time.fixedDeltaTime, false, jump);
        jump = false;
    }
}
```

Figure 4.12 PlayerMovement.cs

```

public class movingEnemy : MonoBehaviour {

    float dirX, moveSpeed = 1f;
    bool moveRight = true;

    // Use this for initialization
    void Start () {

    }

    // Update is called once per frame
    void Update () {
        if (transform.position.x > 4f) {
            moveRight = false;
            transform.RotateAround (transform.position, transform.up, 180f);
        }

        if (transform.position.x < -1f) {
            moveRight = true;
            transform.RotateAround (transform.position, transform.up, 180f);
        }

        if (moveRight) {
            transform.position = new Vector2 (transform.position.x + moveSpeed * Time.deltaTime, transform.position.y);
        }
        else {
            transform.position = new Vector2 (transform.position.x - moveSpeed * Time.deltaTime, transform.position.y);
        }
    }
}

```

Figure 4.13 movingEnemy.cs

```

public class heart : MonoBehaviour {

    public GameObject heart1, heart2, Player;
    public static int health;

    // Use this for initialization
    void Start () {
        health = 2;
        heart1.gameObject.SetActive (true);
        heart2.gameObject.SetActive (true);
    }

    // Update is called once per frame
    void Update () {
        if (health > 2)
            health = 2;

        switch (health){
            case 2: heart1.gameObject.SetActive (true);
                    heart2.gameObject.SetActive (true);
                    break;

            case 1: heart1.gameObject.SetActive (true);
                    heart2.gameObject.SetActive (false);
                    break;

            case 0: heart1.gameObject.SetActive (false);
                    heart2.gameObject.SetActive (false);
                    break;
        }
    }
}

```

Figure 4.14 heart.cs

```

public class gain : MonoBehaviour {

    public GameObject gainHealth;

    // Use this for initialization
    void Start () {

    }

    void OnTriggerEnter2D (Collider2D col){
        heart.health += 1;
        Destroy (gameObject);
    }
    // Update is called once per frame
    void Update () {

    }

}

```

Figure 4.15 gain.cs

```

public class enemy : MonoBehaviour {

    // Use this for initialization
    void Start () {

    }

    void OnTriggerEnter2D (Collider2D col){
        heart.health -= 1;
    }

    // Update is called once per frame
    void Update () {

    }

}

```

Figure 4.16 enemy.cs

```

public class CameraController : MonoBehaviour {

    public GameObject Player;

    private Vector3 offset;

    // Use this for initialization
    void Start () {
        offset = transform.position - Player.transform.position;
    }

    // Update is called once per frame
    void LateUpdate () {
        transform.position = Player.transform.position + offset;
    }
}

```

Figure 4.17 CameraController

4.3 Testing and Results

There are two basic techniques that are used to test a system especially a game application. The two basic techniques are called White Box and Black Box testing technique. Black box required User Acceptance Test (UAT) where user test the whole game without knowing the functions of each pages beforehand. White Box test is being done by the developer themselves.

To test the user, test case is created as a manual for user to check each function in the application. Refer to the Appendix to see the test case.

The results of the test is positive including the criticism to improve the gameplay and adding more fun functionality to make it more interactive. A few bugs were found and fix.

CHAPTER 5

CONCLUSION

5.1 Introduction

The purpose of this chapter is to conclude the findings of Serious Game application First Aid in order to achieve the objectives and find the solution for the problem. The problem statements, objectives and project scopes are identified in order to provide a solution for each problem derived. The main objective is to develop a serious game application which is incorporated with basic first aid. In order to complete system, Rapid Application Development (RAD) is chosen as a software development process model. First Aid has fulfilled these project objectives:

- i. To study the implementation of serious game for first aid using 2D game designs.

There are discussion on the existing systems in order to identify all of the problems exists in the system. Study on the First Aid was also conducted in order to narrow down the scope of injuries to be cover in the game.

- ii. To design and develop a serious game application using UNITY and 2D game design technique.

First Aid game has been created using UNITY and 2D game design technique. C# is used as the programming language in UNITY to create more interactive and fun animation and interactions.

- iii. To validate effectiveness of develops serious games towards player through gameplay.

User Acceptance Test (UAT) is conducted and user gives some feedback about the system functionality.

5.2 Research Constraint

Some of the constraints to develop First Aid are as follows.

5.2.1 Time Constraint

The main constraint is to allocate enough time for the research and development of the project. Time management is very important in developing. As a student, there is a lot of responsibility that should be done at the same time as the project. Therefore, all the works must be planned properly on the schedule.

5.2.2 Development Constraint

To create new content or expansion on the existing game design, the development will be difficult as the games with large design need larger space in laptop.

5.2.3 Limited Source of Reference and Knowledge

Having a limited source of reference on the internet is a major issue to develop First Aid. As the knowledge is limited, some early design and function has to be discard and change because it cannot be done.

5.3 Further Research

This topic will discussed and focused on idea for future research.

5.3.1 Future Work

Several enhancements for further development need to be done especially by adding more gameplay to engage player with fun experience while learning.

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APPENDIX A

GANTT CHART

Task name	Start date	End date	Duration (hour)	Estimation (hours)
Total estimate	12/02/2018 ...	30/11/2018 ...	1680	3412
PSM	12/02/2018 0...	30/11/2018 1...	1680	3412
Meeting with Supervisor	12/02/2018 0...	30/11/2018 1...	1680	1680
Requirement & Planning Phase	19/02/2018 0...	07/03/2018 1...	97	97
Identify Problem Statement	19/02/2018 0...	20/02/2018 1...	16	16
Identify Project Constraints	21/02/2018 0...	23/02/2018 1...	24	24
Identify Project Scope	26/02/2018 0...	07/03/2018 1...	57	57
User Design Phase	12/03/2018 0...	16/04/2018 1...	201	209
Propose a Methodology	12/03/2018 0...	13/03/2018 1...	16	16
Design UML Diagram	13/03/2018 0...	19/03/2018 1...	40	40
Identify Game Modules	20/03/2018 0...	26/03/2018 1...	40	40
Design Storyboard	27/03/2018 0...	16/04/2018 1...	113	113
Construction Phase	16/04/2018 0...	28/09/2018 1...	960	953
Coding 1	16/04/2018 0...	27/04/2018 1...	80	80
Unit Integration 1	30/04/2018 0...	11/05/2018 1...	80	80
System Testing 1	14/05/2018 0...	25/05/2018 1...	73	73
Coding 2	28/05/2018 0...	08/06/2018 1...	80	80
Unit Integration 2	11/06/2018 0...	22/06/2018 1...	80	80
System Testing 2	25/06/2018 0...	06/07/2018 1...	80	80
Coding 3	09/07/2018 0...	20/07/2018 1...	80	80
Unit Integration 3	23/07/2018 0...	03/08/2018 1...	80	80
System Testing 3	06/08/2018 0...	17/08/2018 1...	80	80
Coding 4	20/08/2018 0...	31/08/2018 1...	80	80
Unit Integration 4	03/09/2018 0...	14/09/2018 1...	80	80
System Testing 4	17/09/2018 0...	28/09/2018 1...	80	80
Cutover Phase	01/10/2018 0...	09/11/2018 1...	233	233
Full System Testing	01/10/2018 0...	12/10/2018 1...	80	80
System Maintenance	15/10/2018 0...	26/10/2018 1...	80	80
User Training	29/10/2018 0...	09/11/2018 1...	73	73
Full Report	12/11/2018 0...	23/11/2018 1...	80	80

