PUBLIC AWARENESS THROUGH GAME-BASED LEARNING

Project Id: 2020-054

Project Proposal Report

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B.Sc. (Hons) Degree in Information Technology

Department of Information Technology

Sri Lanka Institute of Information Technology
Sri Lanka

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(Proposal documentation submitted in partial fulfilment
of the requirement for the Degree of Bachelor of Science Special (honors)
In Information Technology)

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Declaration

I declare that this is my own work and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Student ID Number	Name	Signature
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The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

Signature of the supervisor: Date

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Dr.Windhya Rankothge

24/02/2020

Abstract

There are a lot of environmental pollution-related problems faced by Sri Lanka right now. Garbage pollution is one of the most widespread social and environmental problem. Most of the time people directly involve in polluting the environment. People in our country have no idea about how to effectively dispose of garbage. Perhaps people deliberately dispose of the garbage improperly or they may not know how damage to the environment is done by improper disposal of the garbage. According to information, this mistake is common for all age categories. In our country, there is no proper program to make people aware of environmental pollution. As a solution, we decide to develop an awareness gaming platform to make aware people about environmental problems using virtual reality technology which will address its impact to the minds of people in an effective manner.

Keyword: Awareness game, Garbage disposal, Virtual reality

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List of Abbreviation

Abbreviation	Description
MSW	Municipal Solid Waste
LA	Local Authority

1 INTRODUCTION

1.1 Background

Pollution from garbage is one of the most widespread social and environmental problems. In this section, what the pollution due to garbage is explained and describe the various types of garbage and also explain the causes, sources, and effects of the waste. In the context of waste disposal, the man-made waste is mainly concerned. Each type of garbage has a specific contribution to and effect on the pollution due to the garbage. There are many types of garbage that can be disposed to the environment by a single person. They are organic waste, paper wastes, glass, bottles, metals, coconut shells, plastics, polythene, E-waste. Due to human negligence improper disposal of garbage has caused and it caused great harm to the environment

The management of solid garbage disposal has currently become one of the major issues in Sri Lanka. Sri Lanka generates 7,000 MT of solid waste per day. Of that amount, the Western Province accounts for nearly 60 percent of waste generation. Every individual generates an average amount of 1- 0.4 kg of waste per day. The Waste Management Authority and the Central Environmental Authority report that only half of the waste generated is collected [1].

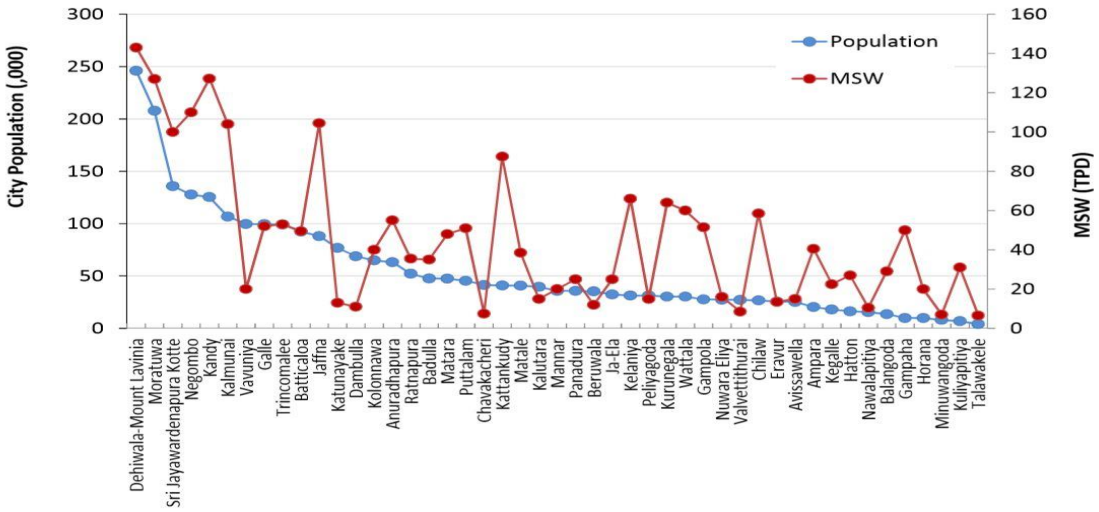

Figure 1.1: Populations and waste collection in LAs of Sri Lanka

As shown in Figure 1.1, the study revealed that the amount of waste generation in 68 cities except for five major cities including Colombo MC is less than 40 Tonnes per day (TPD) [2]. In Sri Lanka, waste collection and disposal responsibilities are vested with the local authorities of the particular Divisional Secretariat, either a municipal council, urban council or local council.

Sri Lanka is faced with huge problems due to garbage. As an example, part of the Meethotamulla garbage dump mountain recently suddenly collapsed. Taking 30 human lives toll as of 16-04-2017, this disaster had left 1,500 homeless and displaced families [3]. Not properly disposing of garbage can also harm human health. Through these activities, individuals are exposed to various diseases.

The Government of Sri Lanka has paid close attention to proper disposal and recycling of garbage in various situations. Figure 1.2 demonstrates some plans and policies / Solid Waste Management Strategies [4].

Year	Policy & Regulation	Description
2000	National Strategy for Solid Waste Management (NSSWM)	■ 3-years action plan, Waste reduction, 3R implementation
2003	Caring for Environment Phase I (2003-2007) Phase II (2008-2012)	■ Funded by United Nations Developing Program; UNDP ■ National Environmental Action Plans
2005	Vision for A New Sri Lanka	■ A Ten Year Horizon Development Framework 2006-2016 formulated by Ministry of Finance and Planning ■ Solid waste and pollution management included in the investment plan
2007	National Policy on Solid Waste Management	■ Waste reduction, 3R implementation, Sanitary landfills ■ Capacity building, Research and development (Best Available Technologies (BAT), Best Environmental Practices (BEP)
2008	Pilisaru Programme Phase I(Jan. 200 –Dec. 2013) Phase II(Jan. 2014–Dec. 2018)	■ National level programme for solid waste management under the chairmanship of Ministry of Environment, CEA, and others. ■ Initial budget amount: 5.675 bil LKR. ■ Target is to introduce small and medium waste treatment system in all local government authorities by year 2018 and to cover 50% by year 2016.
2009	National Action Plan for Haritha Lanka Programme	■ Establishment of National Council for Sustainable Development (NCSD) ■ Sustainable development: Harita (Green) Lanka Programme

Figure 1. 2: Plans and Policies/Strategies related to Solid Waste Management

The “Pilisaru” program is a good example of how to aware people of the garbage disposal properly. “Pilisaru” program includes several activities. They are Project coordinated awareness campaign on waste segregation at Local Authority level, monitoring, and evaluation, conduct education and awareness programs and providing the local authorities with adequate waste management facilities [5]. This section explains the damage done to the environment as well as to the people because people do not properly dispose of the garbage.

1.2 Literature survey

This section explains various systems that have been created in the world to educate people on environmental pollution. Nowadays, with new technology, people tend to do their daily activities. Many things are made available through the internet. Nowadays, people are becoming more and more knowledgeable about different areas as well as technology has created the ability to reach people quickly. The game takes a prominent place among people. Games have been used to educate people on environmental issues.

Trash Attack [6]**.**

This game focused on creating a platform for promoting environmental education, encouraging a sense of connection to the natural world, encouraging the protection of irreplaceable natural resources and raising awareness about the environment. It was built as a video-game action puzzle. Trash Attack is a 2D-based video game that people make aware of Biodegradable waste, non-biodegradable and recyclable wastes.

The development of the game was composed of four levels. The first stage was prototyping where a functional game prototype was created by the team with all the main gameplay elements and assets required to make the game playable. The second stage of development was the Alpha stage, where it achieved continuous testing of output. During this point, more assets have been developed and there have been changes as imagined by

the game designer, to be done in preparation for the next sprint. Next was the Beta stage, where users outside the development team tested the beta version game build as a result of the alpha stage to provide user feedback and information in order to further improve the game, as well as insights into any issues that the development team had missed during the alpha stage. Ultimately, the final stage was where game developers submitted final changes for the assets and improvements needed to be made to fix major found issues during beta testing to prepare the game for the final release.

The proponents developed the video game through the use of Unity Engine, Photoshop, Illustrator, Autodesk Maya, and other multimedia editing applications across a span of three to four months. Thirty-six respondents evaluated the game and proved the following points in the game evaluation

- That the game promotes environmental awareness while being entertaining and engaging
- That the game worked efficiently while running showing little or no problems with the frame rate and causing players minimal inconvenience
- That the game was successfully ported to mobile devices enabling everyone to play and learn

Attack of the Recyclops [7]

This research has shown that educational gaming can involve students in the learning of a wide range of cognitive processes, from simple memory to complex problem-solving. In particular, the research team set out the goal of creating a game of educational virtual reality, designed to improve responsible waste management learning.

The research team built a virtual reality educational game, Attack of the Recyclops to examine its effect on undergraduate student learning and pro-environmental behavior. The learning goal put forward by the research team is that the player must know how to choose the right disposal avenue for different types of waste at the conclusion of the gameplay.

The objective of the research is that at the end of the gameplay the player will learn how to choose the correct disposal way for different types of wastes. The Oculus Rift is the VR headset that the team will be using. The researchers will position the player within a virtual campus with this headset, and the player will be able to explore the campus and learn about the importance of waste management.

The team, using previous research, leveraged the revised Bloom's Taxonomy of educational goals to establish the learning outcomes for Attack of the Recyclops game. In the first version of the taxonomy, Bloom points out three areas for learning assessment objectives: cognitive, affective, and psychomotor. The cognitive domain in the revised taxonomy edition ranges from lower to higher-order thinking abilities. This research developed using Unity game engine, virtual reality (VR), 3D, 2D models, photorealistic graphics and JavaScript technologies.

reCyCLOR [8]

ReCyCLOR targets mainly elementary-age children aged 9-11, males and females Children who are still exceptional on environmental issues and more vulnerable to behavioral change or impact and probably in areas where recycling programs and facilities are already in place. ReCyCLOR targets mainly primary-age children between 9 and 11 years of age, male and female children that are still impressionable on environmental issues and are more susceptible to behavioral change or impact, they probably in areas that already have recycling schemes through infrastructure in place.

This is a fast-paced game aimed at improving the processing and cognitive skills of the players over time. In the real world environment, the knowledge and skills acquired in the game hopefully form positive actionable habits

1.3 Research Gap

As shown in Table 1.1 most of the research that have been completed is based on technology 2D and 3D. Some of the games have been used to aware people about garbage categories. A lot of games are designed to enhance the user's abilities at the end of the game. Most research has not collected data from the users before the game was implemented.

The proposed system will be developed under virtual reality (VR) technology. At the level of data gathering, the collected data is to be analyzed. The main research part of proposed system is to create the best game to improve user ability. The human ability to develop is determined by using gathered data. According to this environmental awareness game, it is mainly focused on garbage disposal. It has been decided to create games under environmental pollution, garbage disposal, and garbage collection.

Table 1. 1: Differences between proposed project and other Systems

Researchers / Features	Trash Attack	Attack of the Recyclops	reCyCLOR	Proposed Project (AwareME)
Segregation of garbage (Bio-degradable , degradable , recycling)	✓	✓	✓	✓
Proper waste disposal	✗	✗	✓	✓
Improve user ability	✗	✓	✓	✓
Virtual reality	✗	✓	✗	✓
2D	✓	✓	✓	✓

1.4 Research Problem

Garbage disposal is one of the most serious environmental problems faced by Sri Lanka at present. It is difficult to imagine a pleasant environment where there is no unpleasant garbage heaped everywhere. Garbage generation levels are rising day by day. Sri Lanka generates 7000 MT of solid garbage per day with the western province accounting for almost 60 percent of garbage generation. Each person produces an average of 1-0.4 kg of garbage a day

Municipal councils and government institutions have attempted to figure out a solution for garbage disposal in past decades. By not properly disposing of garbage, the damage to the environment is increasing day by day. These activities also pose a threat to human health. Disposal of garbage inappropriately is a practice of all ages. The reason for this negative attitude is lack of awareness and lack of successful education program to educate the people about the social responsibility of each citizen in keeping the environment clean. Even though there were many programs have been implemented on environment pollution and garbage disposal, unfortunately it has failed to find out permanent solution to the garbage disposal. By using modern technology and creating awareness on environmental pollution among people and convincing the impact of such environmental pollution to human being, this garbage problem can be mitigated to greater extent.

How do we properly recycle the garbage?

What is the right way to educate people on proper disposal of garbage?

2 OBJECTIVES

2.1 Main Objectives

The main objective of this proposed research is to improve the abilities of people making them aware of environmental pollution by using the game-based learning platform.

2.2 Specific Objectives

There are some specific objectives in the proposed system,

- To save the nature by effective awareness on the garbage disposal
- To Identifying the audience to collect research related data
- To create a standard questionnaire for data collection about the garbage disposal awareness
- According to the data analyzed, to identify what are the user abilities can improve using game. User abilities can be make decisions, quickly respond and recall knowledge
- To create a perfect game for increasing awareness of the proper disposal of garbage through the proposed awareness game
- To design interesting interfaces for different age groups and to create games for interest to them
- To identify the improvement of the users by testing their awareness level through the gaming platform

3 METHODOLOGY

3.1 System Overview

The overview diagram shows the basic elements of the overall system in our proposed awareness game platform. According to Figure 3.1, it shows four main game functions based on the single platform of the public awareness game called AwareME.

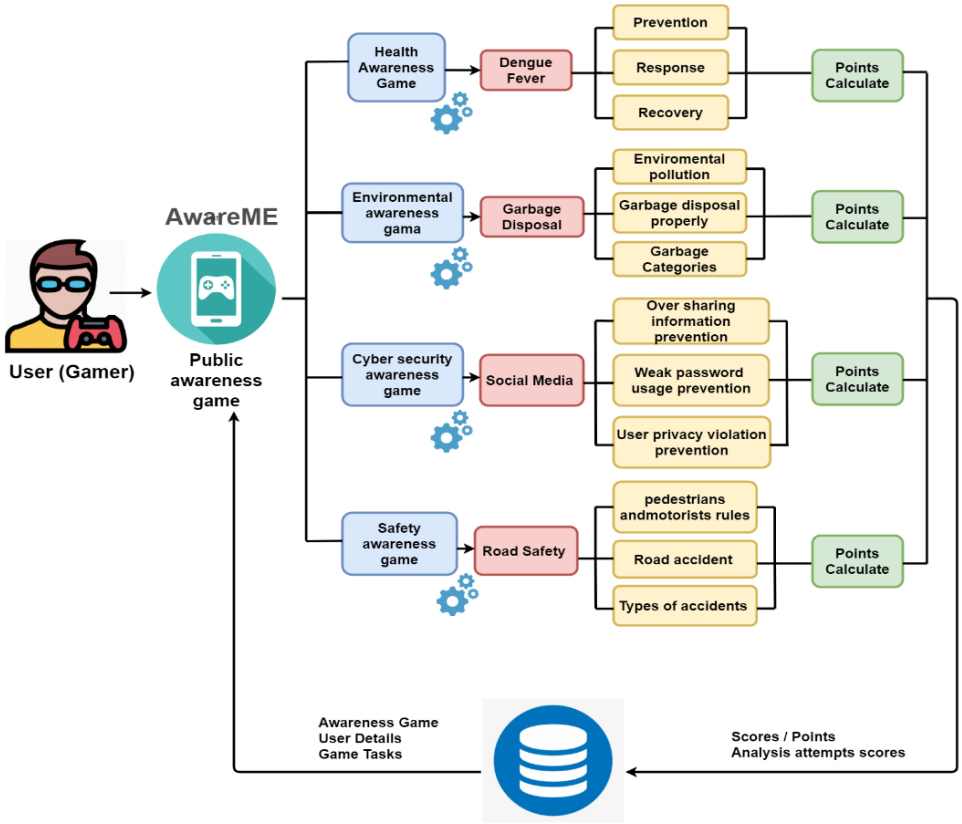

Figure 3 1: System Overview of Group

First, the user has to register and login to the game. After that user (gamer) has to select one of the awareness games to play. The four main games are split up into several sub-areas. The game will cover all the sub-areas already listed.

In this module, the environmental awareness game will mainly focus on garbage disposal awareness. According to the figure 3.2 garbage disposal game also divided in to three sub parts. They are environmental pollution from garbage, how to garbage disposal properly and garbage categories. While playing the selected game, the game will under investigation about awareness of that area of the gamer. Once the user has played the game, they can improve their knowledge, awareness of the selected area and individual ability. The database includes the main game and all game analysis part is done.

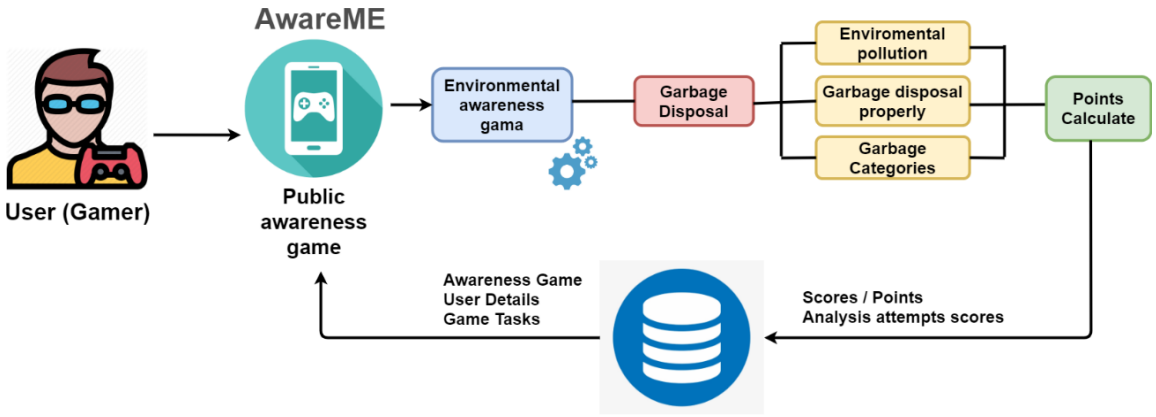

Figure 3 2: Overview Diagram for Environmental Awareness Game

3.2 Flow of the Project

This segment discusses all steps planned for the gaming platform. In the end, every step helps to deliver a good product. This Figure 3.3 shows in detail all the steps required to create the game.

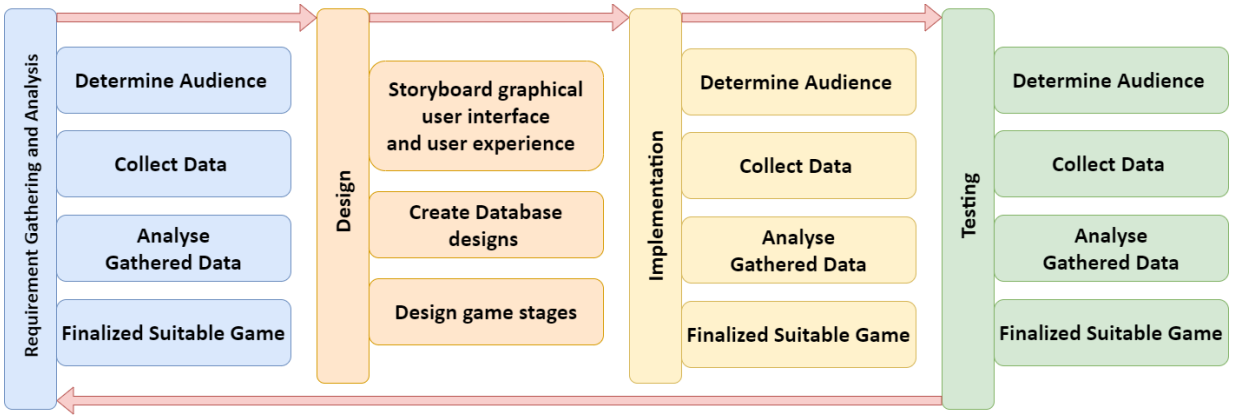

Figure 3 3: Steps of the System

3.2.1 Requirement collection and analysis

At the beginning of the research, the first thing that needs to be done is the process of data gathering and analysis. Analyzing and study the research area is very important to get an idea about implementation. According to this game, it needs to identify the audience to gather data. In this study, it has been decided to collect data by school children. The reason why school children are used is that we can easy to reach a lot of people at once.

After selecting the audience, a standard questionnaire should be created under the garbage disposal awareness. The questionnaire is going to prepare using information from the World Health Organization (WHO), the Central Environmental Authority.

The questionnaire is to be created as needed. The questionnaire gives to a selected group of people and marks each answer. After collecting the data we need to analyze the data as required. Based on the information obtained, our members decide what the best game is

to implement for each separate game. The main target of our research is to create a perfect game to enhance people's abilities in thinking, decision making. Four weeks will be set aside for this purpose

3.2.2 Design

In this stage, the game will be designed. System design helps to gather the system requirements and come up with the overall architectural design. In this stage of the game, how to give scores, how the interface appears, sounds, 3d models, database and interface design should be built. Three weeks will be set aside for this step.

3.2.3 Implementation

In the implementation phase, requirement specifications and design specifications will be implemented in the proposed game. The overall Gaming platform will be implemented following the waterfall model. Virtual reality is the main technology in our research. In addition technologies, 3D Modeling, Full Motion Video and Game Audio are used. Five weeks will be set aside for implementation

3.2.4 Testing

Testing stage is the most important to this research. In this stage we need testing to see how well the user is aware about each component of the game.

User Acceptance Testing

After creating the game, users must be able to play the game. Three opportunities are given to each player. Players are the same group who participated in the information gathering stage. The data collected at requirements gathering stage will be compared with the scores obtained after playing the game.

After analyzing every user's data and get idea about how far this game helps to aware people from each areas and how far the users have developed the abilities through the game. If this game not successful repeat the model with appropriate modifications again and again until the expected results are obtained.

If we can't get good results from the game, we should repeat the model with appropriate modifications again and again until the expected results are obtained.

All the task should be tested and check whether they run without any bugs.

Unit Testing – Each team member will have to do unit testing for each of the parts they are implementing.

Component Testing - By combining several Units, component testing will be done.

Integration Testing – To test whether the communication between each component working together, Integration Testing will be done.

System Testing – After the components are finished and they will be integrated and the whole system will be tested to test if the complete system is working perfectly.

Test Cases

These test cases are used to test the game after its implementing and helps to see if the system is working properly.

Table 3. 1: Test cases for proposed system

Test Case #	**Test Case Description**	
1	Check background music and sound effects	• ON/OFF sound • On/OFF background music
		Verify if sound effects are in sync with action
2	User Interface	Check • Landscape / Portrait mode
		Check • Animation / Movement of character / Graphics / Zoom In/Out (all gestures)
		Check scrolling
		Check for message title, message description, label (should be appropriate)
3	Performance	Check • Loading time of a game
		Make sure no action takes a considerable amount of time, game flow should be fast
4	Score	Calculation of the score
		Check • Score registration functionality
		Check • Level finish synchronizes with score

3.3 Requirements

3.3.1 Functional Requirements

Programming language and development software

- The games must be implemented with C# Script
- The games must be developed in Unity3D

Display control and audio

- The games must be controlled with Xbox Bluetooth controller
- The games must be played on mobile then display resolution will be high. Ex:(1920 X 1080)
- The games must be feature music and sound effects

Games must be played on Android Operating System

- Android OS compatible with Virtual Reality

Levels, contents and messages

- Games must help user to build strategy
- Games must have 3 Levels for each
- Games must convey four special messages about Health, Environmental, Cyber Security and safety awareness

3.3.2 Non-functional requirements

Performance of the Product – Performance of this product can be determined by its responsive time and the expecting time ranges to complete the given task. According to the AwareME Gaming Platform we are expecting 5 seconds to load the initial screen and about in 15 min to end up the whole tasks as well as user current awareness status

Scalability of the Product – In this product we are providing an option to the user to select the game user wants to play and improve their current awareness. Then user doesn't need to play all four games and waste their time. And this product recommends to the users about these four games and if user have time to play all four games and improve their current awareness of these four hazards

Reliability of the product – after user played the game of his 3 attempts user can see a notification summary of their current awareness and list of the mistake, he/she done through the game

Availability of this Product – Users can download this game-based application in the Play Store and can be rate it. And share among the friends, and recommend to the friends who has less awareness of these topics

Screen Adaption: In these days lot of mobile phones comes with different sizes and different layouts.in this application we are render it for different screen sizes. And automatic adjustments of gaming screen to different screen sizes.

3.3.3 Usecase Diagram

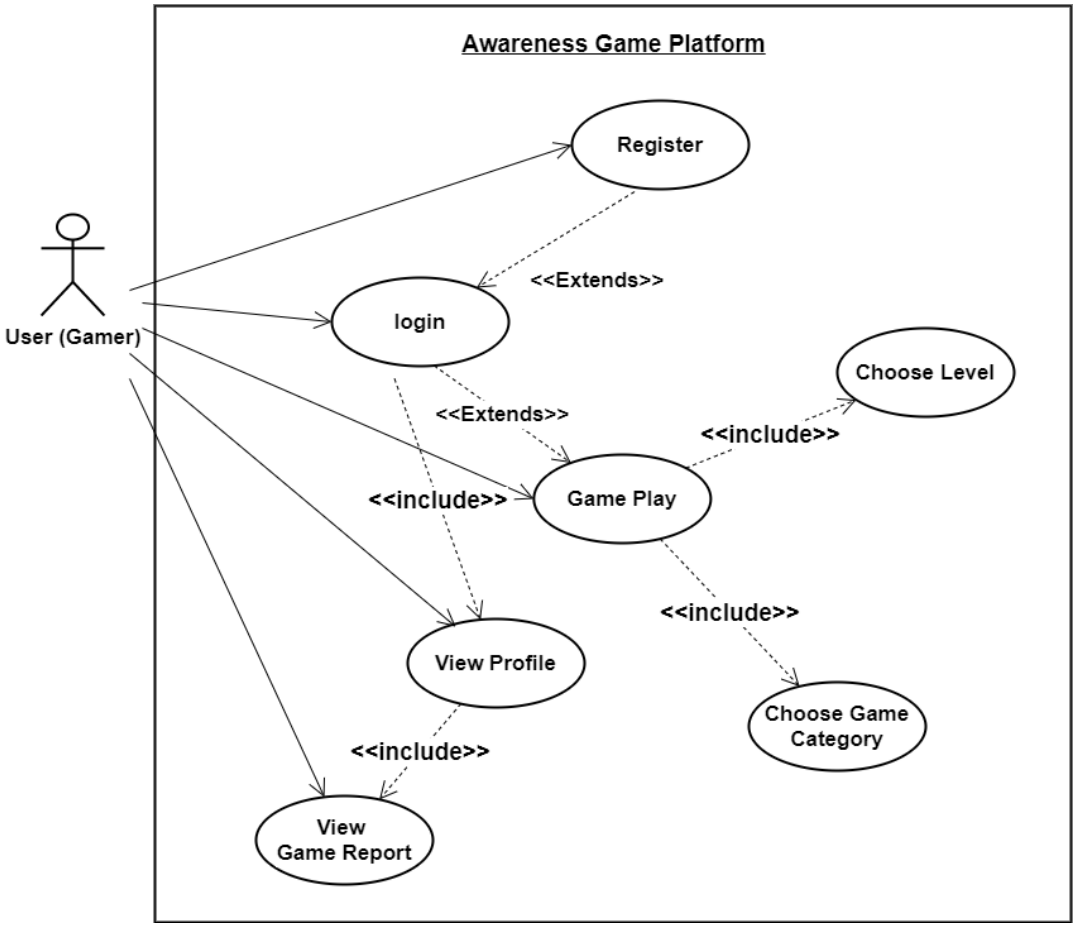

Figure 3 4: Usecase Diagram

3.4 Tools and Technologies

3.4.1 Tools

Unity - Unity is the best platform for game play development. Unity use to create and deploy high quality 3D and 2D games across the console, via smartphone, VR / AR. It's a cross platform game engine.

Android studio - Android Studio is Android's official IDE. It offers Android developers personalized applications including tools for rich code editing, debugging, reviewing, and profiling.

Adobe Photoshop - Adobe Photoshop is a basic apparatus for designers, visual specialists, and inventive experts. It is broadly utilized for picture altering, modifying, making picture arrangements, and adding effects. Computerized or scanned pictures can be altered.

SQLite - SQLite is an open-source relational database for example used to perform database procedure on android gadgets.

Adobe illustrates - Adobe Illustrator is utilized to make an assortment of advanced and printed pictures, including cartoons, outlines, charts, diagrams, logos, and illustrations. Illustrator permits a client to import a photo and use it as a manual for follow an item in the photo.

Blender - Blender is a program used for 3D modeling, animation and rendering. Using Blender, you can create a 3d model from scratch, sculpt, rig, texture, animate and render it to still or movie formats. Blender also features its own game engine, and can be extended to support third party render engines.

3.4.2 Technologies

Virtual reality - The main technology that implements our game is virtual reality. Virtual reality technology is a three-dimensional (3-D) artificial environment that is applied to computer games. Virtual reality experiences are developed with VR software and presented to the user in such a way as to simulate the real-world environment, create illusion suspension and help the user experience the VR environment as real.

3D Modeling - 3D modeling is the process of creating, using specific software, a mathematical representation of any surface of an object in three dimensions. The 3D modeling process creates a digital object which can be fully animated, making it an important technique for an animation of characters and special effects.

Full Motion video - Full Motion Video (FMV) games are video games that rely on pre-recorded TV or film quality recordings and animations instead of characters, vectors or 3D models to represent game action.

Game Audio - We can make, hear and tweak sound effects and behaviors while playing the game. It features an audio authoring tool, and a cross-platform sound engine that allows audio on - the-fly.

3.5 Benefits of the System

Divisional Secretariat - This mobile application is mainly targeting on the divisional secretariat. So Divisional secretariat can recommend this application for the people. So, it can get the details of people on these if categories of environmental, health, safety and cyber security by using this mobile application in conducting several programs for the people.

Awareness Sessions - There are many awareness sessions are conducted by different sectors for different people. Such as for disabled people. So, this mobile application can be used to measure the Quality of their life.

Hospital - There are many different programs conducted by the hospitals such as awareness programs on the accidents, on dengue. So, this mobile application can be given to the hospital words for knowing the reasons why the people become accident. Why people suffering from dengue? And what are the other factors influence for this.

NGO - Now Non-governmental Organizations mostly conduct many programs for people. So, this mobile application can be used by NGO for getting for more details on people.

4 DESCRIPTION OF PERSONAL AND FACILITIES

4.1 Work Breakdown Chart

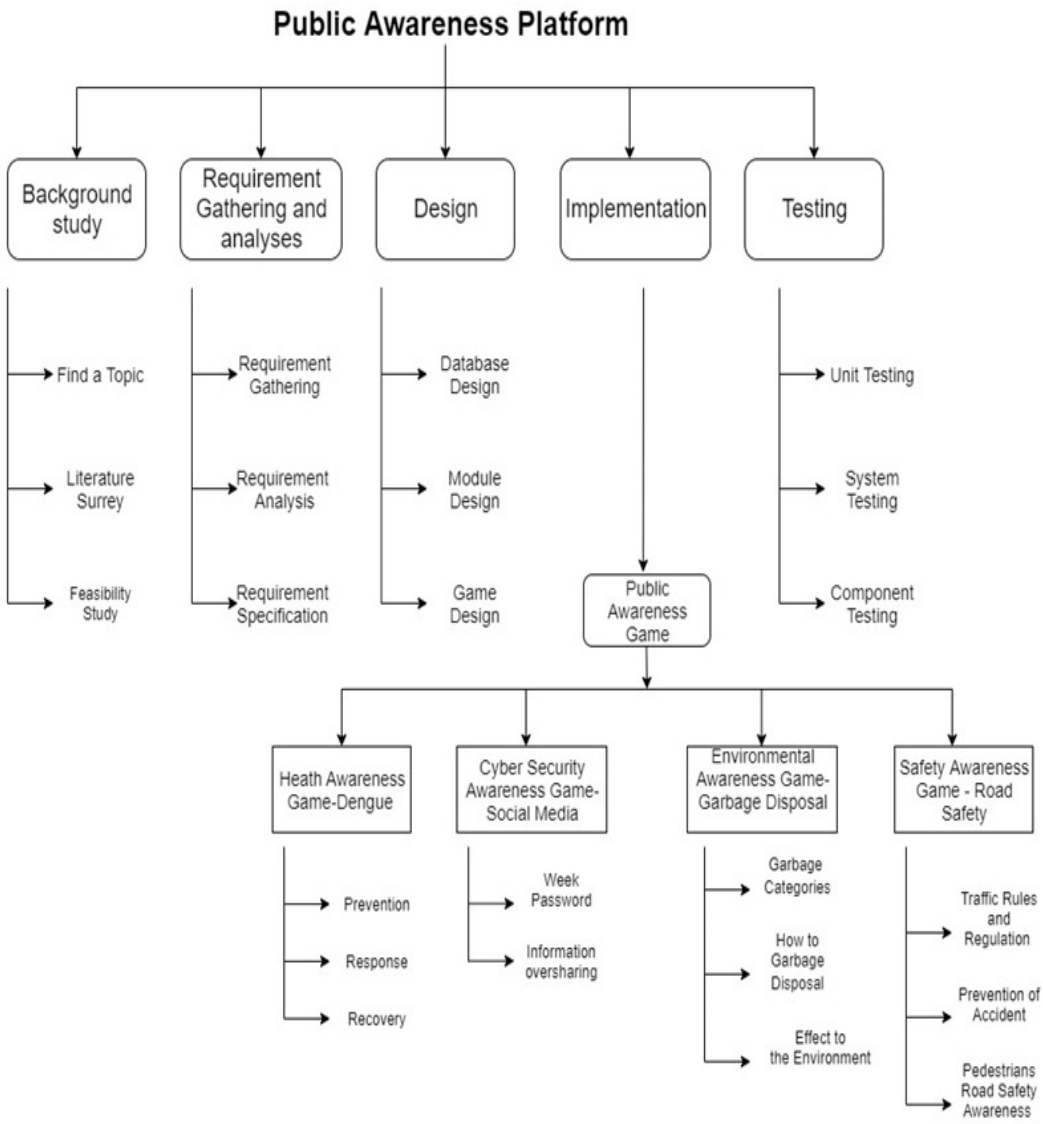

Figure 4. 1: Work Breakdown Chart

4.2 Gantt Chart

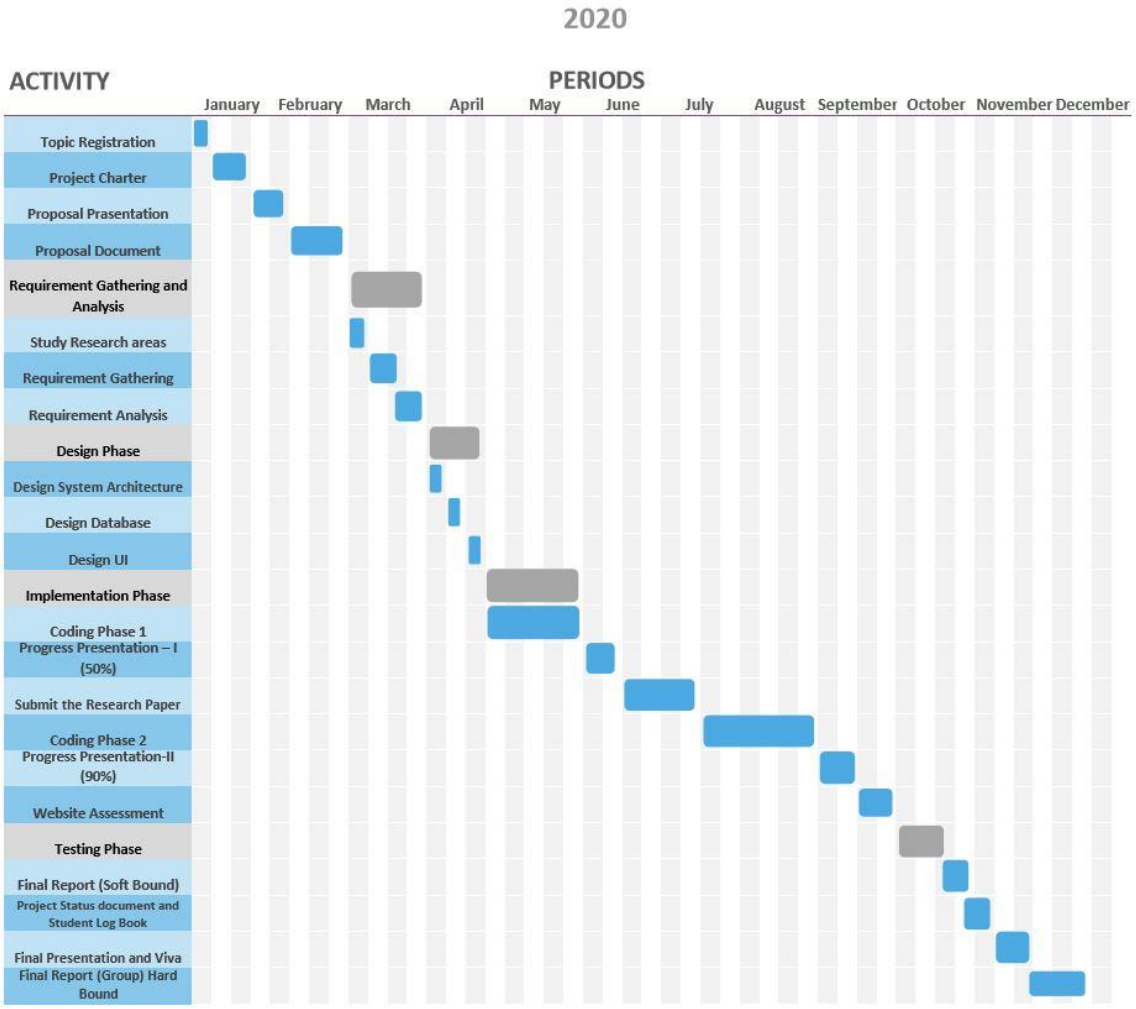

Figure 4. 2: Gantt chart

5 BUDGET AND BUDGET JUSTIFICATION

Table 5. 1: Budget Table

Requirement	Description	Price per unit (Rs.)	Quantity	Total(Rs.)
Special Software and Hardware	VR Box and Joystick	15000.00	1	15000.00
Documenting and Binding	Document hard copy printings			3500.00
	Binding cost			1500.00
Total Cost				**20000.00**

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