Virus Evasion: An Android 3D Game about Health Viruses

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Abstract: **Nowadays, there are many new health viruses that continue to exist anywhere that people can be affected. Knowing and familiarizing its symptoms, signs and effect can help elevate the health condition. As games can be a tool to educate the people, the researcher designed the application as 3D Educational Game using Unity, Adobe Photoshop CC, Blender for the 3D models, FL Studio for the in-game sounds, and C# as the programming language. As players progress through the game, there are levels to be unlocked along with health viruses such as: Diarrhea, Dengue, and COVID-19. The project was tested and improved using functionality and the compatibility test cases. Mobile Application Rating Scale (MARS) was adopted to evaluate the system. There are 37 end-users and 10 I.T experts participated in the testing procedure to measure the functionality of the game accordingly with a total average of 3.49 mean and standard deviation of 0.44 interpreted as the game provides enough information on the three health viruses presented in the game. The evaluation results of the applications proves that application is an effective tool, informative and enjoyable way to spread awareness about health viruses introduced in the game.**

Keywords: **Game, 3D game, Educational game, Health Viruses.**

I. INTRODUCTION

People nowadays are mindful about different health viruses especially when the pandemic started in the year 2020. Everyone should stay knowledgeable about its symptoms, signs, and house medication in any possible sickness that people may acquire outside the house by Suttie (2020). Being careful in the surroundings, specifically in the public helps aids in restricting the transmission of the virus. as well as knowing the symptoms of every sickness. Spears (2020). Highlighted by Weatherspoon (2018), being aware and knowledgeable of the possible cause of the virus may save lives and helps to rule out the proper medication of the diseases that may limit the severe reaction to the body of the human beings.

According to an article by Edubirdie (2022). As the era of digital technology evolved, the use of mobile phones and interactive games has become a crucial part of everyone's life. Mobile phones have become an important asset in our daily life whether its research, communication, using social media, or just by playing games using our mobile phone. Applying the advantage of using the mobile phone as the instrument of an educational game to spread awareness about the three commonly known viruses such as COVID-19, Dengue, and Diarrhea into an interactive three-dimensional environment of the application.

Developing "Virus Evasion: An Android 3D Game About Health Viruses" is an interactive 3D adventure game about three commonly known viruses such as COVID-19, Diarrhea and Dengue. This will give awareness to the user about the viruses while having fun in using the game. The game "Virus Evasion" is inspired by the pandemic as it will stand as a reminder of the pandemic that has occurred in the world. The content in this application was validated and evaluated by the licensed medical practitioner that made the information accurate. Through this, the user may understand the symptoms, possible cures, and the details of the three different viruses.

One of the goals of every human being is to become healthy and prevent getting any sickness from the viruses that can be contagious. Nowadays, interactive mobile games are one of the instruments to be use as a tool for spreading awareness about viruses that can lead the human to a great immune system, limit the spread of diseases, symptoms, and the possible and easiest cure. (Watson and Busch, 2021).

Simplicity of the designed game in a three-dimensional view, with a harder-to-master levels, with new rewards and challenges as well as the adventure game that will allow the user to be in a quarantine mode in finding some healthy boosts will allow entertainment. Health games have shown to be an effective method of remembering, teaching, and awareness. (Klein 2018).

Furthermore, the game will be developed using Unity Hub and the assets/sprites of the game will be created at Adobe Photoshop CC and Blender. The C# scripts will be coded at Visual Studio. The game will be an offline game and will be able to launch at mobile devices such as Android. The game will consist of two characters where the player can select their desired player through the character selection menu. The player can also pick up medicine to make their character immune to the virus for a certain amount of time. The goal of the player is to pick up the vaccine at every stage. The player gets to move up, roll down, slide right, and slide left.

Developing an entertaining and educational mobile game can promote spreading awareness to everyone. Endless runner game is easily accessible for most players. They're easy to learn, and addictive since the player always aims to set t the maximum achievable score. their fast gameplay, their easy controls, natural themes, and straightforward gameplay mechanics create a genre that is accessible to almost anyone.

People nowadays become health conscious and afraid of getting infected by any viruses, especially when COVID-19 hits us. Minamalism (2021) states that all the people in the world experienced the pandemic and brought a realization about the dangers of the pandemic and how it can affect lives. We have chosen the three health viruses Diarrhea, Dengue, and COVID-19 as these three are well known in the Philippines. The target user of the game is children 7 years old and above. This game will also serve as a simulation where the player will be quarantined in a house where the player must complete the objectives to go back to the main game.

The researchers chose Diarrhea, Dengue, and COVID-19 as the main viruses presented in the game for the reasons stated in the studies to be discussed. According to a study by Hartman et al., (2022). Diarrhea is prevalent to Low-and-Middle Income Country (LMIC) where the Philippines is a part of. It is also stated in this study that Diarrhea is a major contributor in childhood mortality and that there are 61% of deaths due to Diarrhea globally and 80% from children die during their first 2 years of life. Another study to support this is the study conducted by Sangalang et al., (2020) where it is stated that Diarrhea is frequent in Metro Manila, Philippines because schools lack enough facilities for safe drinking water, sanitation, and hygiene. The researchers chose Dengue because in a study conducted by De Los Reyes, A.A. and Escaner (2018), Philippines is one of the southeast Asian countries with the highest dengue incidence rates and that Dengue is common in the Philippines because, the country is naturally prone to the disease and there are many kinds of dengue viruses moving around, putting a significant amount of risks to individuals. Another study to support this statement is the study by Ong et al., (2022), where it is stated that Dengue fever is frequent in the Philippines because it has been an ongoing epidemic and the country's warm weather enables disease-carrying mosquitoes to multiply. Lastly, the researchers chose COVID-19 because in a study conducted by Espiritu et al., (2020), it is stated that COVID-19 is spreading further in the Philippines as a result of the large number of tourists who visit and travel here, taking the virus with them. The National Capital Region is highly populated, making it difficult to contain the virus's spread. To support this study, an article by Biopath (2020), stated that the Philippines is among the most vulnerable countries to COVID-19 due to the Philippines's weak provision of the healthcare system.

The game will be developed using Unity and Visual Studio for the coding. Assets used for the game will be acquired in the Unity asset store and the sounds for the game will be from free online sounds. The game will feature a running game and a house scene where the player will be simulated when being quarantined. The game will have a tutorial and a VIDEX (Virus Index) where players can read more about the viruses in the game. The game will also have a character selection and name input for the character.

The project will develop a "VIRUS EVASION: AN ANDROID 3D GAME ABOUT HEALTH VIRUSES" that will be used by everyone above 7 years old in the Philippines.

Specifically, the project aims to:

1. Design a 3D game that has the following features:

a. Enables user to restart a game level, restart the level and provide the navigation control of the game through the main menu by selecting Play, Options, Quit, and VIDEX (VIRUS INDEX);

b. It will include a tutorial on how to play the game;

c. Display a short story line to start the game and provides information about viruses of Diarrhea, COVID19, and Dengue;

d. Allows the user to control to mute the game and adjust the graphics;

e. Allows users to choose a character of a girl or a boy in the story mode and change the preferred name;

f. There will be only three health viruses included in the game;

g. Running part of the game where the user must avoid the virus;

h. Objective finding game where the user must find the different objectives;

2. create the project using Unity Hub, Adobe Photoshop CC, Blender, and Visual Studio as frontend and C# as backend. It will run on Android devices only.

3. The type of tests that will be used in the proposed system are: Functional Test and Compatibility Test. Functional test will be used to guarantee that the elements of the proposed framework are working appropriately. Compatibility test is used to determine if the game is working properly or not, considering the device's hardware and graphics.

4. evaluate the performance of the system and measure it based on the following criteria of MARS (Mobile App Rating Scale), to wit:

a. Engagement;

b. Functionality;

c. Aesthetics;

d. Information Quality;

The proposed project VIRUS EVASION: AN ANDROID 3D GAME ABOUT HEALTH VIRUSES will let the user gain new knowledge about the three health viruses and how they can affect our body.

The game includes several features such as a mute button, graphics options, tutorial, character selection, and name input for the player. There is also a Virus Index Menu (VIDEX) where players can find more information about the three health viruses featured in the game. The character can be controlled using swipe controls, with left and right swipes moving the player horizontally, up swipe making the character jump, and down swipe making the character slide. The main objective of the game is to avoid various types of viruses that appear, with the game getting faster over time, requiring quicker reflexes from the player. By collecting medicine during gameplay, the player can become immune to viruses. The VIDEX provides information about different virus variations, including prevention and cure methods. If the character encounters a virus, the player is taken to a separate gameplay section called the quarantine house, where they need to collect objectives to return to the running game. The player has three attempts in the quarantine house gameplay and failing results in losing the game and restarting the level. The minimum requirements required to run the game is 6GB of RAM, phone screen resolution of 720x1560, an octa-core chipset, and an Android Version of 9. For a smoother experience playing the game, the recommended requirements are 8GB of RAM, phone screen resolution of 1080x2400 for the best fit, an octa-core chipset, and an Android Version of 13.

The game can only run on Android devices and therefore, the game will only be available on Play Store and will not be compatible with Android operating systems of 8 and lower. The game will only feature three health viruses in the game. These three viruses are Diarrhea, Dengue, and COVID-19. The game will not feature other health viruses and will only focus on the three health viruses mentioned. The quarantine house gameplay of the game will only focus on the house and no other settings.

The main goal of this project is to give information on the different variations of virus and how it can be prevented or cured. The following are the beneficiaries of the study:

Children. The proposed project will let children who are 7-12 years old would know the dangers of the different variations of viruses and help them know new information about the different variations of virus.

Parents. The proposed project will let the parents of the children to know how they can protect their loved ones from the different variations of virus.

Society. The proposed project will inform the users of the dangers on the three health viruses presented in the game.

Future Researchers. The proposed project will let the future researchers use this study for their future references for the project that they want to propose.

II. REVIEW OF RELATED LITERATURE AND SYSTEM

A. Related Literature

This chapter contains the studies conducted by the other researchers and topics related to "VIRUS EVASION: AN ANDROID 3D GAME ABOUT HEALTH VIRUSES".

The researchers reviewed similar literatures, particularly literature, books, and articles related to the development of the application, originated from different sources. It is more a compilation of resources and subjects that will be used in the process. Some of the subjects that have been listed as follows:

Virus. According to Mellisa Conrad Stoppler, MD (2021). A virus is a type of microorganism that is not able to reproduce itself. A virus needs a host so that it can reproduce itself. Once a virus successfully manages to infect a host, it will reproduce itself and it may reproduce with errors or mutations. Virus will be the main focus of the game and will revolve around it.

Vaccine. According to Lois Zopi, B.A., (2023). Vaccine are medicines that helps the individual to build immunity against specific diseases. Vaccines contains the actual bacteria or virus or specific elements that came from them that can cause sickness. Incorporating this into the game, vaccines are located at the end of each level where if the player collects the vaccine, the player will win the level.

Importance of being Vaccinated. Being vaccinated helps us counter highly infectious diseases that can spread all over the world fast. By being vaccinated, we can prevent the spread of these highly infectious diseases. Being vaccinated also protects ourselves and our loved ones and, we can contribute protecting our community by helping not spread the highly infectious diseases. (Norwegian Institute of Public Health, 2018). Being vaccinated is important for our health, with the vaccine mechanic of the game, the researchers would be able to spread information on the benefits of getting vaccinated.

Simple and Effective Protection. Dangerous infectious diseases can be stopped by people getting vaccinated. Some vaccines offer lifelong protection against specific kinds of diseases, but some vaccine only offers immunity for a period and requires booster shots to prolong the effects of the vaccine. (International Journal of Infectious Diseases 2018). As stated above, vaccine is a simple and effective protection against viruses. With the help of the proposed project, spreading awareness can be done through gaming as the players can enjoy playing the game and at the same time learning new information.

Different Variations of Virus. The different kind of viruses that are listed below will be featured in the game:

Diarrhea. Diarrhea occurs due to the infection of a virus the bowel and this virus is called viral gastroenteritis. The symptoms of diarrhea are bloating, nausea, and a strong urge to have bowel movement. Severe diarrhea can also occur. The symptoms for severe diarrhea are high body temperature, loss of weight, lack of fluids, intense discomfort, throwing up, and bleeding. (Christopher M. Pruitt, 2018). Diarrhea levels will be featured on stages 1 – 3 of the game. Symptoms of diarrhea can vary with some cases that are severe. These symptoms will be shown in the game through the objective finding part of the game.

COVID-19. According to Centers for Disease Control and Prevention people who have COVID-19 will experience from mild to serious symptoms. Examples of these some instances of these symptoms include heightened body temperature or experiencing chills, cough, breathing difficulties, exhaustion, muscle soreness, headache, sudden loss of taste or smell, scratchy throat, congestion or runny nose, queasiness, and loose bowels. (Gareth Lacobucci, 2021). COVID-19 is infamous for taking lives of many. COVID -19 levels will be from stages 7 – 10. COVID -19 symptoms can be seen on the objective finding part of the game and as the objective finding part of the game progresses, the symptoms of the player will worsen based on the symptoms stated in the study.

Dengue. Dengue is an infectious disease that can spread to people with the bite of an infected female mosquito. Dengue is prevalent in places where poor sanitation is observed. The signs of dengue include feelings of queasiness, rash, aches and pains. Severe dengue can also be contracted by a person if the symptoms are not prevented or ignored. Severe dengue can lead to shock, internal bleeding, and fatality. The indications of severe dengue encompass abdominal discomfort, vomiting, bleeding from the nose or gums, and vomiting of blood, and feeling tired, restless, or irritable. (Kamolwish Laoprasopwattana et al., 2021). Dengue will be featured on the stages 4 – 6 of the game, the symptoms that will be presented in the game will be based on the symptoms discussed in the study. Severe dengue symptoms will also be shown in the objective finding part of the game as the player progress through the objective game.

How the different variations of virus can be prevented. The three different variations of virus can be treated or prevented by:

Diarrhea Prevention. Treatment for diarrhea can be treated at home when it is not severe. Drinking plenty of water, changing your diet, reducing caffeine intake, and avoiding foods and drinks that give gas can be enough to treat diarrhea at home. Preventing diarrhea is an easy task. Having good hygiene is enough to prevent diarrhea. Vaccination is another treatment to prevent diarrhea to infants. The most important thing to prevent Diarrhea is proper hand washing and good hygiene. Avoiding eating food from street vendors, eating only vegetables and fruits that are cooked or can be peeled, eating foods that are properly cooked, checking expiration dates of pre-packaged foods, not eating of raw or undercooked food will also help in the prevention of Diarrhea according to the article. (Sabrina Felson, MD, 2021). As stated in this study, the treatment for diarrhea can be treated at home. In the objective finding part of the game, the player is being simulated that the player is infected with Diarrhea, in order to complete the objective part of the game, the player must collect objectives based on the preventing methods mentioned in this study.

COVID-19 Prevention. The most effective measures to stop the spread of COVID19. from one person to another are by: following social distancing by maintaining 6 feet from other precautions include remaining indoors, refraining from touching your face, practicing regular hand hygiene, and donning a face covering. Being vaccinated also gives a person a way to build immunity against COVID-19. Treatment for COVID-19 must be addressed quickly as soon as the symptoms show. Treatment must be given immediately to a person showing signs of COVID-19 for the treatment to be effective. (yalemedicine.org, 2022) Practice of social distancing, washing of hands, wearing of face mask, restricting travel, and watching for symptoms are the key to prevent COVID-19. Maintaining approximately 6 feet from others is a good way of social distancing. Washing of hands especially when outside is recommended to be a part of routine to prevent the spread of COVID-19. Wearing a face mask is also a must because it is stated in this article that face masks are created to establish a protective barrier between the respiratory system and the external environment.. Restricting travel is also another step to prevent COVID-19 as by restricting travel, contracting of COVID-19 is unlikely. Watching for symptoms is the most important part as you may not know if you have COVID-19 as symptoms of COVID-19 is like other respiratory viruses. (Health Matters, 2020). As stated in this study, the best way to prevent the transmission of COVID -19 is by staying at home. This prevention method gave the developers the idea to make the objective finding game where the player is being simulated that the player is quarantined. Worsening of the symptoms can also be seen in the game to simulate that the player's health is being affected.

Dengue Prevention. No medication exists for the treatment of dengue. Treating dengue is by treating the symptoms of it. Drinking plenty of fluids, taking paracetamol, and resting are things that can be done to treat dengue. By treating the symptoms, dengue will usually go away once the infection is out of your body. (Center for Disease Control and Prevention 2020), According to an article by the World Health Organization (2023) to prevent getting Dengue, you must wear clothes that cover your body as much as possible, window screens to prevent mosquitoes from coming in, mosquito nets, and insect repellents. However, if you get Dengue, it is important to recover, get sufficient rest, stay hydrated, and use paracetamol for pain relief, and watch for severe symptoms is a must to recover from Dengue. In the study conducted by the Center for Disease Control and Prevention, there is no specific medicine to treat dengue and the only way to treat it is by treating the symptoms of it. This statement fits into our objective finding game as the player must find medicines as objectives in the game to treat the symptoms of the player.

Type of Games. There are several types of games which depend on the needs of the user.

Video Games. any of a wide variety of games in which the player manipulates onscreen graphics using a computer, mobile device, or dedicated gaming console connected to a television or other display screen. (internetmatter.org, 2021). As stated in this study, a video game is where the player manipulates on-screen graphics. In our case, the video game will be able to run on mobile devices.

Educational Games. Games that are designed with educational value as the design of the main game. (Kupeli, 2019). In this study, it is stated that educational games are games that are designed with educational values. In the proposed project, the educational value that the player can get is through the three health viruses presented in the game.

Single-Player Game. Tailored for a solo player or games intended for single-player mode, this implies that the game accommodates only one active player. A game suitable for playing on a single device, regardless of whether it is a high-performance desktop or a compact, resource-constrained handheld gadget. (IGIGlobal, 2018). The project concept entails a game designed for a solo player, emphasizing that it cannot be played online in conjunction with other players.

Endless Running Game. Endless Running Game is a type of game where there is no finish line. It is a type of game where the players compete for high scores. The game starts easily and gets harder and harder as time goes by requiring faster reactions from the player. Endless running game controls can be swiping controls or tilt controls. (jerrymomoda.com, 2019). Endless running game is a part of the proposed project. The player will have to play through the endless running part of the game in order to progress through the different levels of the game.

Types of Hardware. These are hardware being used to develop and test the software:

Mobile Devices. The foremost gaming platform today is mobile, with mobile devices progressing from simple time-killing games to those that offer intricate graphics and immersive narratives. Mobile devices in the past did not give enough power to support high graphics games like in console or personal computers. Mobile devices now can support high quality graphics as mobile devices have evolved over time. Gamers choose mobile devices as their platform or gaming as we carry our smartphones with us every day. According to medium.com, the mobile gaming market is expected to hit 218 billion dollars by 2030. This is due to mobile games being more accessible because we carry our mobile devices with us everywhere. (Zen Estacio, 2018). In this study, it is stated that mobile is now the number one platform for gamers. With the help of this study, the researchers decided that the game will run on mobile devices as most of us carry smartphone devices with us every day.

Adobe Photoshop. It is a software tool that enables the modification and improvement of graphics and images. It has a variety of editing tools that are necessary for various types of photographs. (TechTarget, 2019). The developers used the tool Adobe Photoshop to make the front end of the game. As stated in this study, Adobe Photoshop has a variety of editing tools. With the help of this tool, the developers will be able to make original assets for the proposed project.

Blender. Is a 3D creation toolkit that is open source and free. It supports the complete 3D workflow, encompassing tasks such as modeling, rigging, animation, simulation, rendering, compositing, motion tracking, and even video editing and game creation. (Upwork Team, 2023). As stated in this study, Blender is free and open source. The developers will be using this tool to make the 3D models for the game which supports the animation for the 3D models.

Unity. Is a versatile game engine developed by Unity Technologies, serving as a foundation for the development of video games and simulations across various platforms, including computers, consoles, and mobile devices. (freeCodeCamp, 2020). As stated in this study, Unity is used to create video games. In our case, the proposed project is a video game and Unity will be able to provide the developers with the means to develop the proposed project.

Visual Studio. It is a software application used for building websites, web apps, computer programs, web services, and mobile applications. It offers support for many widely used revision control systems and includes features such as a code editor, debugger, GUI design tool, and database schema designer. (Computer Hope, 2019). Visual Studio will be used for the backend of the proposed project. With the help of Visual Studio, the developers will be able to code the backend of the proposed project.

FL Studio. According to, is an audio maker that a user can use to make beats for his/her projects. FL Studio is popular because it is simple to grasp, cost-effective, attractive interface, various file export options, and available on multiple platforms. FL studio is easy to learn because users with no knowledge on music system can jump straight into FL studio and make music. FL studio is budget friendly because by purchasing FL studio, the user will get lifetime updates. FL studio is interface aesthetics because users will not be overwhelmed with the user interface when first using FL studio. FL studio is exporting file possibilities because the projects that you created using FL studio can be exported into .aiff, .wav, and .mp3 files. FL Studio is cross platform accessible because a user can use FL studio from Windows, Mac, Android, and IOS. (Soundsm, 2021). With the help of this tool, the developers will be able to make the sounds for the game even with no background knowledge of audio making.

C#. Anders Hejlsberg developed C#, an object-oriented programming language, in the year 2000. It was developed to compete with the programming language Java. C# can be used for game development. Unity supports the use of C# to develop games in the Unity engine. (Cybrnetics Informatics, 2020). As stated, C# supports Unity in developing games. C# will be used by the developers in order to avoid errors in developing the proposed project.

Test. Test is conducted to see if the project has some errors. This is the procedure to check the project's quality, performance, and reliability before it is published to the public. Is a set of conditions where it tests the software to see if it satisfies the requirements and if it functions well. This test is used after developing the software.

Functional Test. This test is carried out as part of the software development process to determine whether the software is functional. This kind of software testing determines whether the program satisfies all requirements for operation. (techopedia, 2020). In this study, it is stated that functional test is used to determine if the program satisfies all the requirements of operation. With the help of functional test, the developers will be able to test if the functionalities of the proposed project are working correctly.

Compatibility Test. It is a test to see if the software can function across various platforms, operating systems, and networks. Before it is published, this test makes sure everything will function as it should. (Software Testing Help, 2022). Compatibility testing will be used by the developers to ensure that the proposed project will run on different Android versions.

Evaluation Instrument. This is used to measure if the software is in the standard.

MARS (Mobile App Rating Scale). It is designed to evaluate the program or application using the engagement, functionality, aesthetics, and information quality standards. It is a reliable tool for describing and assessing the software.

Engagement. Application engagement is a metric that is used to measure and describe the interaction of the user to the application. Engagement is important because developers can study the application performance to improve the application depending on the needs of the user. (Deniz Taşyürek, 2022). In this criteria, the developers will measure if the proposed project interacts well with the end user. This criteria is critical as it will determine if the engagement of the player with the proposed project is satisfied.

Functionality. There are six key functionalities for the application to succeed and the following are: Focus, Onboarding procedure, Streamlined navigation, Personalization, Search filters and sorting, and Feedback mechanism. These functionalities are used for the application to have users using them. (Nanoscale Multifunctional Materials, 2019). In this study, simple navigation is discussed and it is crucial for the functionality of the game. If the users will be able to distinguish buttons from one another and what the buttons can do.

Aesthetics. Is a methodology that investigates a set of principles and practices that allude to a certain essence of beauty. (jstor.org, 2019). Aesthetics as defined in this study is the appeal of the game to the end users. This criteria will be used to determine if the visuals of the game is enjoyable to the user.

Information Quality. There are six stages of mobile application development to ensure that an application will be good on launch and these are: Ensure mobile application quality during product conceptualization, Ensure mobile application quality during the design stage, Ensure mobile application during the development stage, Ensure mobile application quality while testing, Mobile application QA checklist, Ensure mobile application quality during the deployment stage, and Ensure mobile application quality in the post-deployment stage. (Alignminds Technologies, 2020). Information quality is the main focus of the proposed project, as the main focus of the project is to spread awareness on the health viruses in the game.

B. Related Studies

These are the studies which the developers relate the development of the project.

Game-Based Learning

An article by Alyssa Froehling (2022). Titled Game-Based Leaning Theory and Evidence. Games consistently surpass other teaching methods in terms of enhancing cognitive outcomes for learning and communication abilities, based on research. Games also help with information retention and significantly improve students who perform poorly by increasing their interest and motivation. Furthermore, when educational research is included into game design, outcomes for learning improve. The utilization of educational games in competitive robotics courses and academic esports has significant benefits,

encouraging students' interest in STEM subjects, creating crucial 21st-century skills, and developing positive relationships. In conclusion, game-based learning improves learning, knowledge retention, and student engagement while also allowing meaningful educational experiences.

An article by Daily Pioneer (2018) titled Learn through Gaming. The use of games has been shown to be helpful in learning. It makes learning more enjoyable and interactive, helps in resolving issues, gives immediate feedback, and it helps with retention of information. Learners can gain knowledge while having fun by using games. To improve understanding, game-based learning utilizes methods such as divided learning and topic blending. It also promotes hands-on learning and shows critical thinking. Games provide instant feedback to assist players in learning from their errors. Although it does not replace regular schooling, Game-based learning improves and makes education more interesting. It can promote learning if balanced correctly.

A study conducted by Hu et al. (2021) titled the Effectives of a Serious Game Versus Online Lecturers for Improving Medical Students. The designed serious game for medical education about COVID-19 is a good option or alternative for knowledge retention of the information compared to the traditional way of teaching. A test was conducted for serious games and online lectures to explore and prove which is more likely to have the potential for an effective approach to disseminating information to improve one's knowledge about COVID-19. It was truly a sudden shift in education to learn from traditional to online lectures. Thus, implementing serious games will be a useful and new method to have effective learning.

According to this study by Suppa et al. (2021) titled Effect of a Serious Game (ESCAPE COVID-19) on the inclination to alter COVID-19 control protocols among longterm care facility staff. This study sets out to see if playing "Escape COVID-19" would cause Long-Term Care Facilities (LTFC) employees to adjust their infection prevention and control (IPC) protocols. Thus, the influence of this serious game among staff members was more effective than typical infection prevention and control measures in persuading LTCF staff members to implement COVID-19. As they are playing a critical role in the fight against the disease, the employees are willing to alter their behavior with the aid of this serious game

In a study by Tan et al. (2022) titled Influence of a serious game on understanding, mindset, and implementation in vector control and dengue prevention among adults in primary healthcare. Dengue awareness and prevention measures are equally effective among adults using a game and are recommended to use as it is considered also a good alternative to raise awareness among people. The study aims to Assess the efficiency of a serious game designed for community awareness outreach.

In a study by Pratama and Setyaningrum (2018) titled Exploring the impact of gamebased learning on students' cognitive and emotional development, the research delves into how educational games can enhance and reinforce learning outcomes.

In a study conducted by Serrano (2019) titled analyzing the impact of digital gamebased learning on student education, the literature review assesses the influence of gamebased learning on student engagement, motivation, and academic performance, highlighting its beneficial effects.

In a study conducted by Chung and Chang (2020) The study "Influence of problembased learning games on effective computer programming learning in higher education" investigates the impact of a game called "Programmer Adventure Land" on college students' computer programming knowledge. The results suggest that game-based learning serves as an effective alternative method for educators to enhance student satisfaction in challenging subjects.

A study conducted by Kazu and Kuvvetli (2023) titled A study employing triangulation to assess the effectiveness of digital game-based language learning in acquiring vocabulary. The study is about a digital game-based learning tool named "Quizziz". The tool was used to test vocabulary acquisition skills. In this study, students are divided into two groups. An experimental group that uses Quizziz for vocabulary practice and a control group that practiced vocabulary traditionally in the native language. The results of this study found out that the experimental group which uses Quizziz outperforms the control group. Demonstrating the efficacy of learning through games.

In a study conducted by Hartt et al., (2020) titled Game On: Exploring the Effectiveness of Game-based learning. This research aims to assess the efficiency of gamebased learning in urban planning education. The study utilized two approaches, game-based learning, and conventional lecture-style teaching. The outcomes indicated that game-based learning is an effective method for engaging students, fostering motivation, and enhancing emotional involvement.

A study conducted by Wang and Zheng (2020) Entitled "Utilizing Game-Based Learning for Science Education: A Middle School Study," this research aims to evaluate the impact of game-based learning on middle school students. Through an experiment comparing digital and non-digital game-based learning, the study revealed that the performance of students in the game-based learning groups surpassed that of the non-digital game-based groups. Additionally, students from the game-based learning groups demonstrated higher levels of self-reliance compared to the other group.

In a study conducted by Rajan (2022) The study titled "Enhancing Student Learning through Game-Based Learning: An Evaluation" primarily investigates the effectiveness of game-based learning in improving student learning outcomes. The research findings suggest that game-based learning is an effective method for enhancing students' knowledge, particularly in specific subject areas.

Virus Awareness

A study conducted by Wolka et al., (2020) titled Understanding of the Coronavirus Disease (COVID-19) and Its Preventive Measures in Chosen Areas in Wolaita Zone, Southern Ethiopia. The study was to figure out how much people living in Wolaita Zone, Southern Ethiopia, were aware of COVID-19 and how they attempted to prevent it. Most survey participants were knowledgeable about COVID-19, including its symptoms and transmission. Some thought it was God's punishment. People suggested several techniques to avoid it, but some were unproven, such as drinking hot water or applying ginger and garlic. Lack of clean water and accessible hygiene equipment were among the difficulties. The study suggests ongoing education as well as the involvement of local leaders and healthcare professionals in order to provide correct knowledge to individuals who are vulnerable.

A study conducted by Li et al., (2022) The study investigated Chinese university students' awareness of and willingness to accept the COVID-19 vaccine. Most of them were willing to be vaccinated, but not every one of them were knowledgeable about the vaccination. Age, gender, and where they lived all had an impact on how much they knew and whether or not they wanted to be vaccinated. Some students struggled to sleep and were nervous, which may have made them unaware of the immunization. According to the report, the government and schools need to offer more vaccine knowledge and assistance for children's mental health in order for them to make informed vaccination decisions.

A study conducted by Jaber et al., (2021) titled Awareness and perception of COVID19 among the general population. According to the study, people in Jordan and Iraq have a good awareness of COVID-19, but they are unaware of how the virus spreads and its possible treatments. Both countries had similar reactions to the pandemic. Authorities should communicate accurate information on official locations and online platforms to help people manage with the problems of COVID-19.

A study conducted by Kumar et al., (2020) titled Dengue Awareness and its determinants among urban adults. According to the study, many individuals are unaware about dengue and how they can avoid it, particularly women who remain at home, persons with lower incomes, and those who did not attend school regularly. As a result, it is critical to target these populations and educate them on dengue prevention. Healthcare personnel, through Anganwadi centers and medical clinics, can play an important role in sharing this knowledge. This allows us to better manage and decrease cases of dengue in the area.

A study conducted by Hossain et al., (2021) titled Knowledge, awareness and preventive practices of dengue outbreak. The study discovered that while a lot of individuals in Bangladesh had heard of dengue, their awareness of the disease is limited. They are unsure about the way dengue spreads and how to avoid it. While they are aware that dengue may be treated, they are unaware of the most effective methods of treatment. According to the study, better education and awareness campaigns are needed to improve people's awareness of dengue as well as how to protect themselves against it. This will aid in the management of the disease's spread throughout the country.

A study conducted by Radhika et al., (2019) The research examined the awareness level of dengue disease among school children in the Gampaha District, Sri Lanka, as well as the impact of school-based health education programs in enhancing knowledge and practices. As its conclusion, the study discovered that previous to the awareness campaign, students had little understanding about dengue symptoms, how to care for patients, and how to prevent dengue. However, their understanding improved significantly following the program. The study suggests implementing educational initiatives in schools and involving the community in order to raise awareness and aid in the prevention of dengue. This will limit the amount of dengue cases and keep the disease from spreading throughout the neighborhood.

A study conducted by Mohmend and Abdalla (2021) the study focused on the awareness and knowledge of mothers concerning the home management of diarrheal disease for children under the age of five. Their study evaluated what moms knew about diarrhea among young kids. They discovered that while most moms were aware of the symptoms and how to manage diarrhea, many were unaware of how it spreads or which foods to avoid. To keep children healthy, mothers must learn more about diarrhea prevention.

A study conducted by Ranjan (2020) The study aimed to evaluate mothers' awareness regarding the prevention of diarrhea among children under the age of five. The study found that moms of children under the age of five have a general lack of knowledge about diarrhea prevention. Diarrhea is still a major source of sickness and death in children under the age of five, and mothers play an important role in avoiding it. Health education programs are required to teach and educate mothers on effective diarrhea prevention methods for their children.

C. Synthesis

The articles and studies discussed in the related literature and related studies gives the developer more knowledge about the viruses, vaccine, and educational games that can be used to further improve the project. The researches searched factual information about the three health viruses that will be presented in the game. The nature and the prevention of these health viruses that is included in the related literature gave the researchers idea on how to implement these viruses in the game. Types of hardware is also discussed in the related literature. These types of hardware that is included in the related literature will help the researchers in developing the project. The functionality test is also included in the related literature to ensure that the functionalities of the game will be tested before being deployed to the end users. Compatibility testing is also included in related literature to make sure that the game is compatible to Android devices with a version of 9 – 13. Evaluation instruments is also included in the related literature. The evaluation instrument that will be used by the researchers is the Mobile Application Rating Scale (MARS). This is used to evaluate the game based on the criteria of Engagement, Functionality, Aesthetics, and Information Quality.

Game-Based learning based from the studies that have been mentioned above is an effective and an alternative way of teaching students and the people about different topics or subjects. All of the studies about game-based learning have come to one conclusion and that is game-based learning is an enjoyable and an entertaining way to teach the people about certain topics. Virus awareness studies that have been mentioned all states that people are aware of the virus but lacks information on how it spreads and its symptoms. Further education is needed in order for the people to be aware of the virus symptoms and its transmission.

The related literature and related studies included in this chapter helped the developers to gain new ideas and inspirations on how the developers can implement these themes into the proposed project Virus Evasion: An Android 3D Game About Health Viruses.

D. Conceptual Framework

In this section, the project's phases, requirements, and process are detailed and discussed.

Figure 1 shows the conceptual model of the study shows the three phases of input, process, and output in the development of the application. The first phase of input introduces the knowledge requirement in data gathering of the information about the viruses, vaccines, mobile application development, C# programming language, Blender animating and creating 3D models, and FL studio for audio. The software requirements needed to develop the project are Unity, Blender, Adobe Photoshop CC, Visual Studio, and FL Studio. Hardware requirements are the needed materials or technology to use the application. During the development of the application, a laptop/computer with at least a minimum requirement of processor of I5 or Ryzen 3, GTX 750ti graphics card and 8GB ram is also needed to develop the project. To test the project that is being developed, the hardware requirements are an Android phone with an android version of 9.0 or higher, at least 300MB memory space, at least 2GB ram, and an Android phone with an API level of 28.

In the process phase, the developer undergoes the following steps such as requirement gathering and analysis, Designing, Coding and Building, Testing and maintenance of the application. In the requirement gather and analysis phase, the developers will collect information if the information that will be presented in the game is factual and timely. In the designing phase the developers will design the flow of the game and the storyboard of the game. In the coding and building phase, the developers will start coding the frontend and the backend of the game. In the testing and the maintenance phase of the game the developers will look for bugs and perform updates on the game so that the end users will have an enjoyable experience. An output of Virus Evasion: An Android 3D Game About Health Viruses is the result of the development.

The development team will use the criteria of Mobile Application Rating Scale (MARS) to evaluate the system. The MARS criteria will consist of Engagement, Functionality, Aesthetics, and Information Quality.
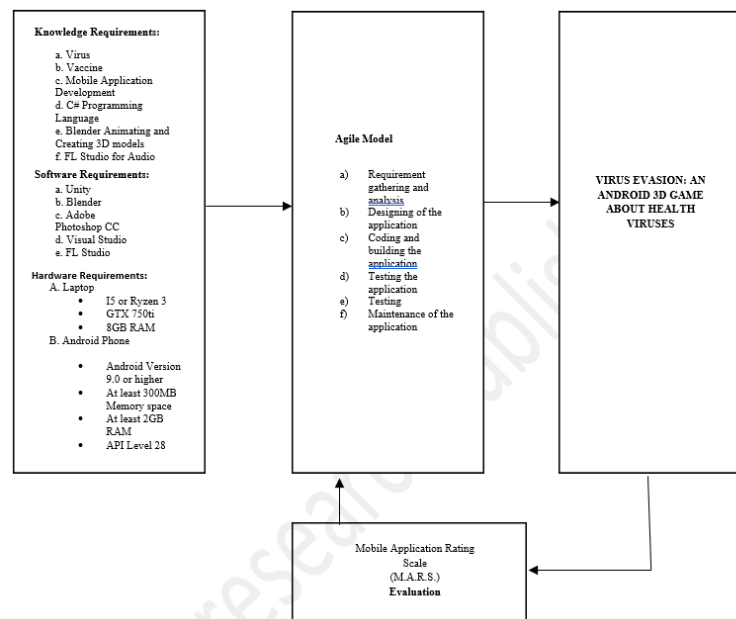

Figure 1. Conceptual Model of the Virus Evasion: An Android 3D Game About Health Viruses

E. Technical Definition of Terms

These are the terms defined within a specific field of expertise.

Virus. The main subject of the proposed capstone project. The virus are the elements in the game that the player will encounter. The virus that the player will encounter in the game are Diarrhea, Dengue, and COVID-19..

Video Game. The proposed project Virus Evasion: An Android 3D Game About Health Viruses It is a mobile game that is compatible with Android devices.

Mobile Device. Specifically Android mobile devices are the mobile device that will be used in order to play the proposed project.

Personal Computer. Personal computer will be the tool used to develop the proposed project. It will be used to develop the front-end and the back-end of the proposed project.

Android Android is the operating system needed in a mobile device to run the proposed project.

Adobe Photoshop Adobe Photoshop will be used to develop the front end of the proposed project. Specifically, the cutscene images for the project will be created using Adobe Photoshop.

Blender Blender will be used to develop the 3D models of the proposed project. 3D models such as the model for the character, environment, and the interactable objects in the game.

Unity. Unity is the engine that will be used by the developers of the game to make the proposed project. The researchers will use Unity to connect the front end of the proposed project to the back end of the project.

Visual Studio. Visual studio is the IDE that will be used by the developers to program the back end of the system. Specifically, Visual Studio will be the compiler for the code developed by the developers to make the proposed project function.

III. METHODOLOGY

The project development technique was covered in this chapter. There are numerous illustrations and representations of the internal workings of the application in this. Future readers and researchers will be able to evaluate the system's flow and comprehend this project's goals by using the concepts and techniques used throughout.

Design. The system flows are portrayed through design. The flowchart serves as the application's working demonstration in this process model. The storyboard, which depicts how the application's flow will be seen from the perspective of the end user.

Process Model. The process modeling presents the workflow of the system in graphical representation or in an illustration.

Object Model. Object modeling presents the functions and processes that can be done in the system through an illustration.

Storyboard. A storyboard is used to convey ideas into short scenes so that the flow of the game will be easily understood. It is like a roadmap where the storyboard will be a visual guide on how the flow of the game. A storyboard is useful when the flow of the game has a lot of steps so with the guide of the storyboard, it can be visualized easily and will not be confusing. (Luke Leighfield, 2022)

The game's storyboard begins with the developer logo, setting the game's identity. Tapping the title screen leads to the main menu, offering access to various features. Pressing play triggers, a captivating cutscene, immersing players in the storyline. Character selection follows, allowing personalization.

A tutorial ensures familiarity, after which players choose levels matching their skill, seamlessly transitioning to running gameplay. Colliding with a health virus redirects to quarantine gameplay, completing objectives lets players return to running with reduced health. A congratulatory message near the endpoint is followed by the choice to return to the menu or proceed, offering flexibility and progression.
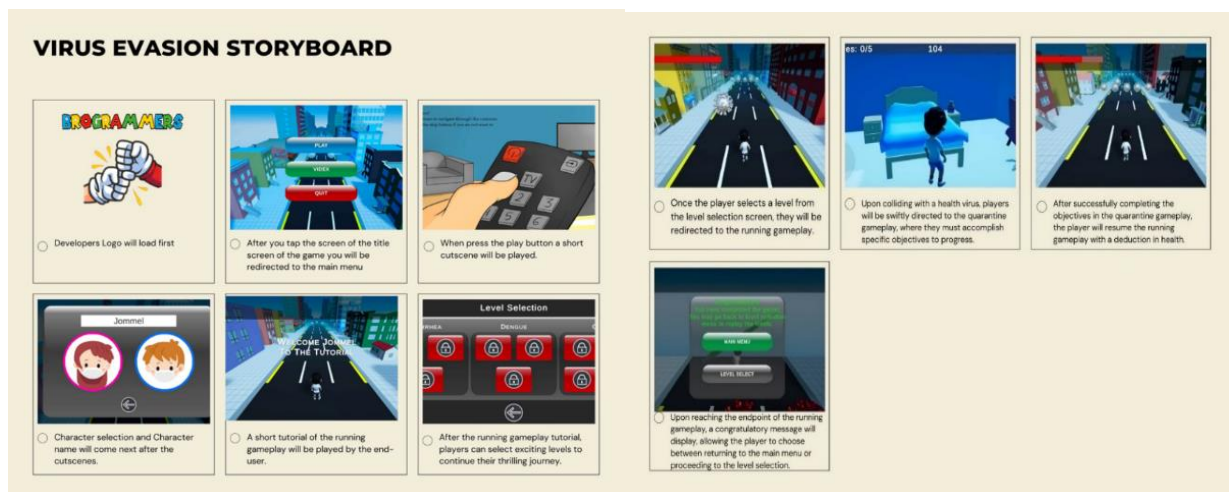

Figure 2. Storyboard of Virus Evasion

Activity Diagram.

Shows a system's actions or control flow graphically, much like a flowchart or data flow diagram. Utilized a lot while modeling business.

Figure 3 The game's activity diagram is as follows: Users login with Google Play Account; wrong input prompts retries, while successful login allows game download and launch. Upon launch, the splash screen appears, leading to the main menu upon tap. The main menu features How to play, mute sound, VIDEX, Graphics, Quit, and Play options. How to play explains with a back button. Quit closes the app. VIDEX shows viruses; selecting one reveals info, back button, and hyperlink. Play initiates a cutscene with navigation and skip buttons. After the cutscene, a character selection menu appears, prompting user input. The tutorial follows character selection.

Upon tutorial completion, level selection emerges, where players choose levels. Clicking a level trigger running gameplay, initiated by screen tap. In the running gameplay, the pause menu offers level select, main menu, and resume options. Virus impact leads to quarantine house gameplay. For failed quarantine attempts, users choose extended time or more objectives. Three quarantine failures lead back to level selection. Completed quarantine objectives enable return to running gameplay. Successful running gameplay completion allows return to level selection or main menu.
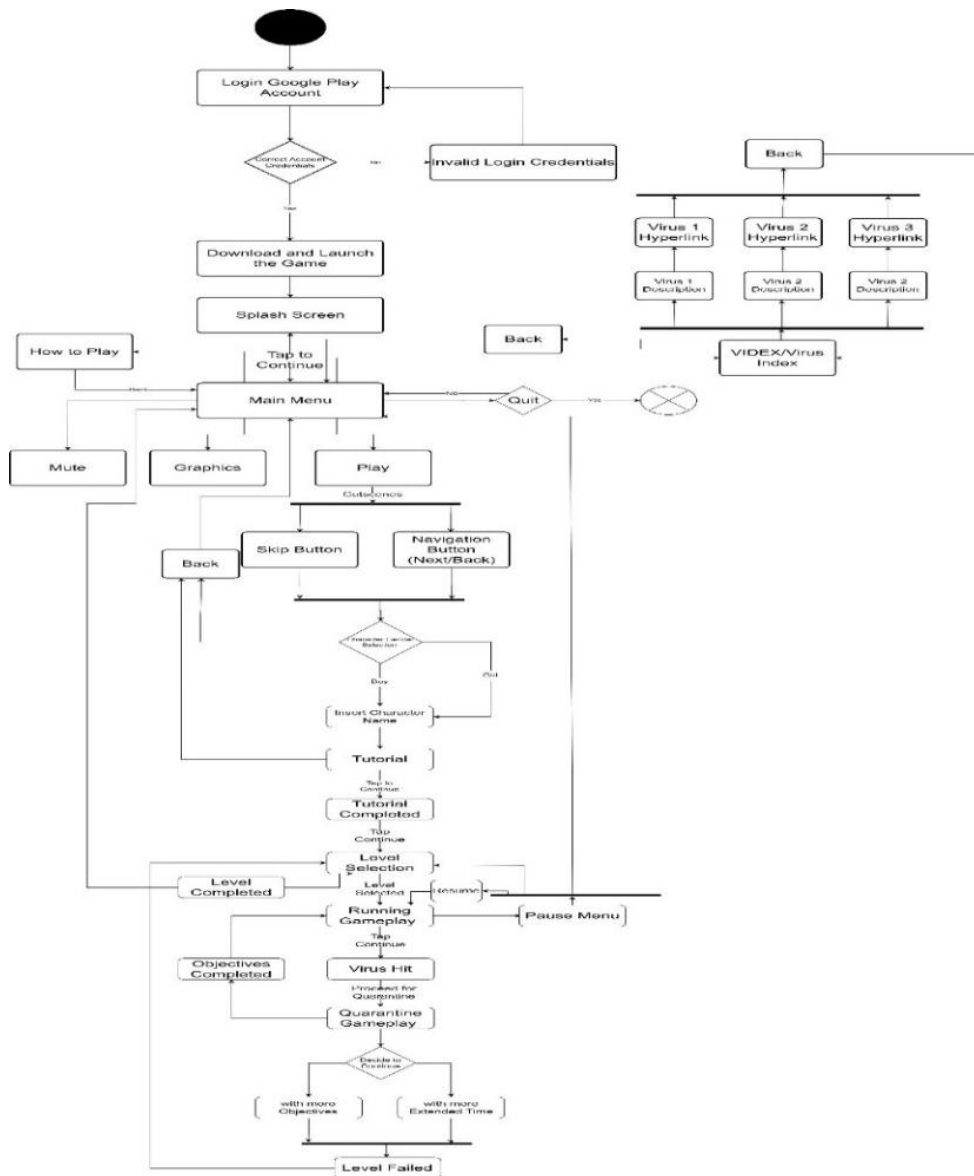
Figure 3. Activity Diagram of Virus Evasion

Development

This stage included a discussion of the project's development process as well as the hardware and software used.

Software Development Life Cycle.

The software development life cycle involves following established business practices to create software applications. This typically includes steps such as planning, requirements gathering, design, building, documentation, testing, deployment, and maintenance. Depending on the project's scope and complexity, some managers may modify or streamline these steps. It is recommended that these fundamental components be incorporated in any software development project.

Agile Method.

is a methodology that involves breaking down work into smaller, iterative components, rather than focusing on long-term planning. This approach typically begins with establishing the project's requirements and scope at the outset of the development phase. zenkit.com (2018).

During our research project, we adopted the Agile methodology to manage our development process effectively. We divided our work into several sprints, each with specific goals and tasks. Here's an overview of our four agile sprints and the progress we made during each phase.

Figure 4. Agile Sprint model in SDLC

Figure 5 shows the first agile sprint. During the first agile sprint, the researchers developed the foundations for the game. The main menu was developed along with the buttons located in it. The running scene and house scene is developed in this sprint. Along with the 3D models that will be used for the game. The first agile sprint started on September 9, 2022 and ended on November 8, 2022.
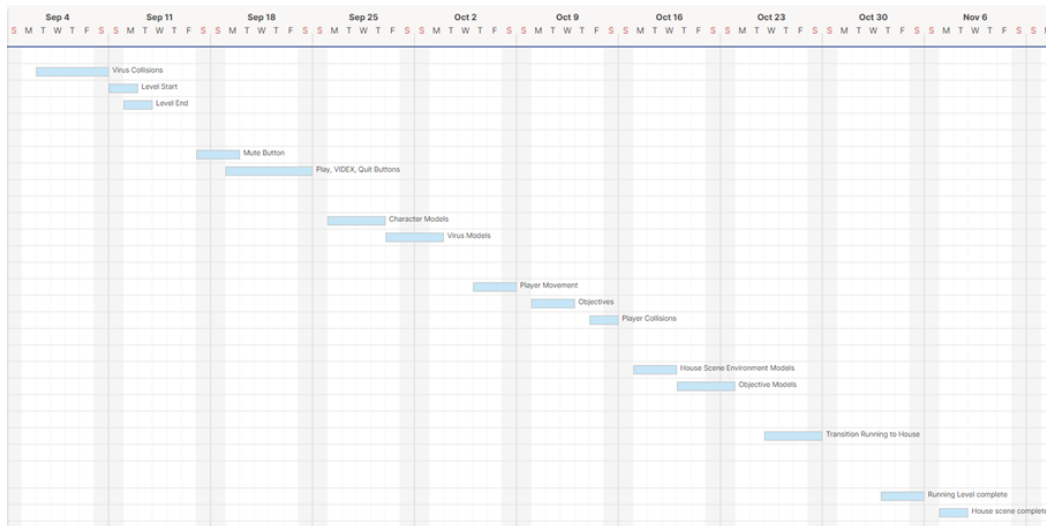

Figure 5. First Agile Sprint

Figure 6 displays the second agile sprint. In the second agile sprint, the researchers developed the running scene and house scene tutorial. Running scene levels 1 – 10 is also developed in this sprint. VIDEX contents and graphics button is also added to the main menu and a short storyline was developed for the game. The second agile sprint started on November 9, 2022, and ended on November 28, 2022.
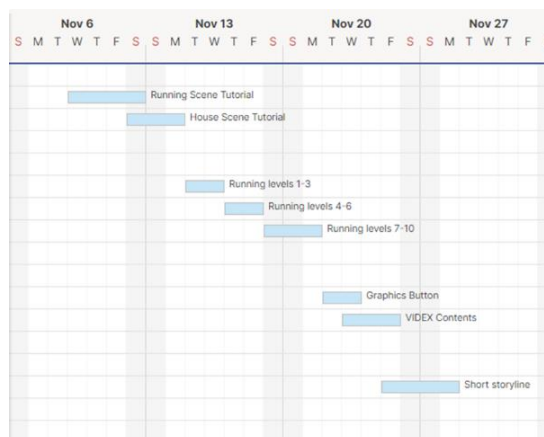

Figure 6. Second Agile Sprint

Figure 7 shows the third agile sprint. In the third agile sprint. The developers fixed 3D models for the running scene, house scene, and house scene objectives. The developers also fixed user interface bugs in the main menu, running scene, and the house scene. The third agile sprint started on November 30, 2022 and ended on December 16, 2022.
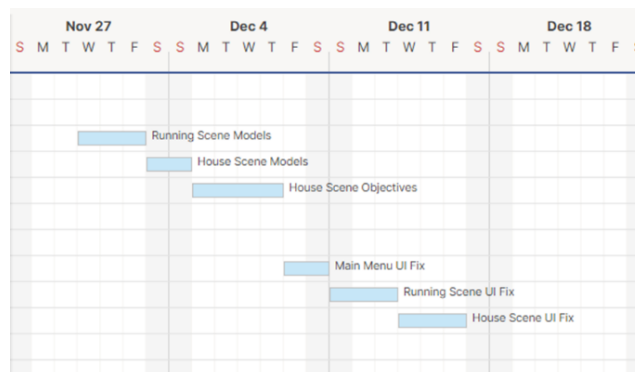

Figure 7. Third Agile Sprint

Figure 8 shows the fourth agile sprint. In the fourth and last agile sprint. The researchers tested the game if the game still has bugs. While testing the game, the researchers encountered minor bugs and fixed it immediately. The fourth sprint started on December 17, 2022 and ended on January 19, 2023.
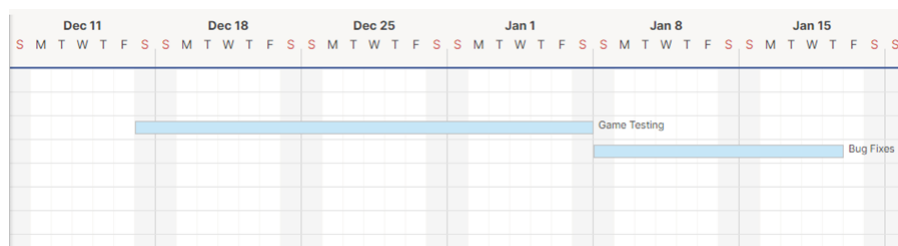

Figure 8. Fourth Agile Sprint

Software Requirements.

The development of the proposed system will be created using Unity. Visual Studio will be used, and C# programming language will be used for the scripting of the game. The assets will be developed using Blender and Adobe Photoshop CC. The development of the in-game sounds will be developed using FL Studio.

Hardware Requirements.

The device that is used to develop the proposed project is a laptop or a computer that has an Intel I5 or an AMD Ryzen 3. It also needs a video card of GTX 750ti. It also needs 8GB RAM. The android phone that will be used to test the application will require an Android phone with a version of 9.0 or higher. It also needs at least 300MB memory space and at least 2GB RAM. The Android phone also requires an API level of 28.

Test Plan

The researchers will be using test plans to test the application if the application contains bugs or errors in the application. Test plan will ensure that the application's function is functioning correctly. Test plans will help the developers in further improvement of the application when the application is in the implementation phase.

Test Procedure. The following steps are done to test the system.

1. Test cases were made for the checking and evaluation of the application.

2. Setting up of the test instruments that will be given to the end-users.

3. Showing the application to the end-users.

4. Building the APK of the application that can be downloaded by the end-users.

5. Explaining the application to the evaluators and the purpose of the application.

6. Test sheets will be distributed via Microsoft Word.

7. The responses from Microsoft Word will be collected and tallied for interpretation.

8. Recommendations and suggestions will be documented for further improvement of the application

Test Instrument.

The test instruments that will be used are the Functionality Testing and the Compatibility Testing. The Compatibility test was used to check if the application would work consistently using different versions of the Android platform from 9.0 Pie, 10.0 Q, 11.0 Red Velvet Cake, 12.0 Snow cone, and to the latest 13.0 Tiramisu. Furthermore, a functionality test was used to know if each module and sub-part of the mobile application is performing as expected.

Evaluation Plan

The evaluation step is for the verification of the acceptability of the users. This was performed to prove that the project is positive and serves its purpose. The evaluation tool used was based on the Mobile Application Rating Scale or MARS. Thirty (30) end-users and ten (10) IT experts were invited to perform this activity. The device used is mobile phones running Android platform versions 9.0, 10.0,11.0, 12.0 and 13.0.

Evaluation Tool.

The evaluation instrument used in the project was based on MARS. This instrument gives an easy-to-use, objective, reliable and simple tool that is for assessing the mobile application quality for the practitioners and researchers. MARS Criteria that have "Engagement" for the appeal of the project. "Functionality" for the performance and easy navigation. "Aesthetics" the overall visual design of the mobile application. And "Information" for the quality of data that is presented in the mobile app.

The table portrays the scoring system of the evaluation. Four (4) the highest for "Highly Acceptable". Three (3) for the "Acceptable". Two (2) getting "Fairly Acceptable". One (1) the lowest for "Unacceptable".

Table 1: Scoring System for Mobile Application Rating System (MARS)

Numerical Rating	Equivalent
4	Highly Acceptable
3	Acceptable
2	Fairly Acceptable
1	Unacceptable

Evaluation procedure. The evaluation phase was successfully done with the following steps.

1. Evaluators will be scheduled for a meeting. Evaluators will be contacted through Messenger and Gmail.

2. Once the evaluators are available, the evaluation will start.

3. The researchers will be explaining the application and its relevance.

4. Evaluators will be given time to test the application.

5. Evaluation forms will be sent through the evaluators email.

6. The results of the evaluation forms will be tallied.

7. Comments and recommendations will be documented for the further improvement of the application.

8. Average mean and standard deviation of the results will be tallied.

https://docs.google.com/forms/d/e/1FAIpQLSeijxGAAu7GxRyiiU3kbwih19DUc-k4Q7KoT_EAff6jneRQ7A/viewform?usp=sf_link

Statistical Treatment of Data.

The researchers collected information from 10 IT Experts and 30 end user's respondents. The data that has been gathered will be calculated, interpreted, and validated based on the weighted mean and standard deviation. The formulas that will be used by the researchers is as follows:

Weighted Mean.

The outcomes of the test takers are averaged mathematically to produce the mean, with each data point contributing equally to the final mean. The total number of responses is N, and the total score is x.

Equation 1 displays the weighted mean's mathematical formula. The weighted mean will be computed for each survey response and appended. The total number of participants was then divided.

$$\overline{x} = \frac{\sum x}{N} \qquad \text{Equation 1}$$

Where:

$\overline{x}$ = Mean

$\sum$ = "Summation of"

x = Score of Proper Weight

N = Total Number of Participants

Equation 1. Weighted Mean Formula

Standard Deviation.

A useful measure of data variability. It can help the proponents to understand how a batch of data is different from the average. The algorithm for calculating the standard deviation is shown in Equation 2. The weighted mean of the responses was calculated first, then the standard deviation was determined. After the results have been totaled up and squared, which is less than the total number of respondents, the response scores were subtracted from the mean using the standard deviation.

Likert Scale. The researchers used the Likert Scale to assess the acceptance level of the respondents from the questionnaires based on the criteria that was stated in the preferred evaluation tool.

Numerical Scale. The respondent's feedback demonstrates how the rating scale relates to the application's acceptability level.

$$SD = \sqrt{\frac{\sum(x - \bar{x})^2}{N - 1}} \qquad \text{Equation 2}$$

Where:

$\overline{x}$ = Mean

$\sum$ = "Summation of"

x = Score of Proper Weight

N = Total Number of Participants

Equation 2. Standard Deviation Formula

The table 2 shows the level of interpretation of the acceptability of the application that is being evaluated. The rating "1.00" – "1.75" means that the application is unacceptable. The application has failed to achieve its primary functions. The rating "1.76" – "2.50" means that the application is fairly acceptable. The application is functioning but lacks consistency. The rating "2.51" – "3.25" is acceptable. It means that the application is consistent and primary functions are running smoothly. The rating "3.26" – "4.00" is highly acceptable. It means that the application's functions and objectives are met, and the application is running smoothly.

Table 2: Likert Scale of Mobile Application Rating System (MARS)

3.26 – 4.00	Highly Acceptable
2.51 – 3.25	Acceptable
1.76 – 2.50	Fairly Acceptable
1.00 – 1.75	Unacceptable

IV. RESULTS AND DISCUSSION

A. User Interface Design

In this chapter, the project's performance is covered. It will show the design of the user interface, project capabilities, constraints, test findings, and results of the evaluation that attest to the goals being achieved in this project.

User Interface Design

The user interface refers to the parts of the project that users interact with. This integrates the system's appeal, simplicity, and ease of use.
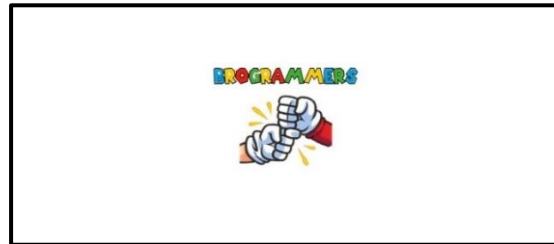

Figure 9. Splash screen of "Virus Evasion".

Figure 9 presents the splash screen of the game; the user will need to tap his/her phone screen to continue to the main menu of the game.

B. Project Capabilities and Limitations

This shows the project capabilities and limitations of the game Virus Evasion: An Android 3D Game About Health Viruses.

Capabilities

1. The application uses English language.

2. The application can be used without internet connection.

3. The application features three viruses. These viruses are Diarrhea, Dengue, and COVID-19.

4. The application has a cutscene at the beginning of the game.

5. The application allows the user to input his/her desired name.

6. The application has a character selection menu.

7. The application contains a VIDEX or Virus Index where players can check for more information about the three viruses presented in the game.

8. The application has a graphics options menu to adjust the graphics of the game.

9. The application has a mute option if the player does not want to hear the in-game sounds.

10. The application provides user with instructions and a tutorial on how to play the game.

11. The application has a running game and an objective finding game.

12. The application has Story board.

13. The application is an offline game.

Limitations

1. The application only features three viruses.

2. If the user fails to complete the objective finding game, the user must restart the whole level.

3. The user is only capable of playing in the house scene and cannot go out.

4. The game does not fall under the category of an open-world game.

5. The game is only playable on Android devices with an Android version of 9 or higher.

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C. Test Results

To ensure that the application is running smoothly, the testing phase was done. The tests used are Functionality Testing and Compatibility Testing. Functionality testing has been used to evaluate the application's performance and features in the application in relation to the design requirements. Compatibility testing has been used to test if the application can run on Android versions 9, 10, 11, 12, and 13.

In table 3, 10 IT experts participated in conducting the compatibility test of the system. Based on the test criteria that was provided, all 6 test criteria passed the test with 100 percent passing.

Table 3: Test Results Using the Compatibility Test of 10 IT Experts

Test Respondents	Pass	Fail	Test Criteria	Percentage
Consultant	6	0	6	100%
IT Expert 1	6	0	6	100%
IT Expert 2	6	0	6	100%
IT Expert 3	6	0	6	100%
IT Expert 4	6	0	6	100%
IT Expert 5	6	0	6	100%
IT Expert 6	6	0	6	100%
IT Expert 7	6	0	6	100%
IT Expert 8	6	0	6	100%
IT Expert 9	6	0	6	100%
IT Expert 10	6	0	6	100%

In table 4, 10 IT Experts and 1 consultant participated in conducting the functionality test of the system. Based on the test criteria that was proved. all 47 test criteria passed the test with 100 percent of passing.

Table 4: Test Results Using the Functionality Test.

Test Respondents	Pass	Fail	Test Criteria	Percentage
Consultant	47	0	47	100%
IT Expert	47	0	47	100%
IT Expert	47	0	47	100%
IT Expert	47	0	47	100%
IT Expert	47	0	47	100%
IT Expert	47	0	47	100%
IT Expert	47	0	47	100%
IT Expert	47	0	47	100%
IT Expert	47	0	47	100%
IT Expert	47	0	47	100%
IT Expert	47	0	47	100%
IT Expert	47	0	47	100%
IT Expert	47	0	47	100%

D. Evaluation Results

The evaluation phase evaluates the software's performance if it is acceptable among users and IT experts. The evaluation instrument that was used is the Mobile Application Rating Scale (MARS). 10 IT experts and 37 end-users participated in evaluating the application. The 10 IT experts who participated in evaluating this application are all experts in their own field such as game development. While the 37 end users ranges from the ages of 7-22.

Table 5 displays the evaluation results from ten (37) end-user. In table 5, 37 end users participated in evaluating the system. The highest rating in this table is the information criteria. The information criteria have the highest rating of 3.47 Mean and an SD of 0.39 for the 37 end users because for the end users, the game provides enough information on the three different health viruses presented in the game. The functionality criteria have the lowest rating with a Mean of 3.32 and an SD of 0.43. This has the lowest criteria for the end users because the end users feel that the user interface of the game is confusing to them.

Table 5: MARS Evaluation Result from thirty (30) end-users

Criteria	Mean	SD	Interception	Rank
Engagement	3.41	0.38	Highly Acceptable	4
Functionality	3.32	0.43	Highly Acceptable	3
Aesthetics	3.33	0.45	Highly Acceptable	2
Information	3.47	0.39	Highly Acceptable	1
Average Mean and Standard Deviation	3.38	0.41	Highly Acceptable	

Table 6 highlights the results of the evaluation from ten (10) IT Experts.

In table 6, 10 IT experts participated in evaluating the system. The highest rating in this table is the information criteria. Information criteria have a mean of 3.53 and an SD of 0.65. Information criteria has the highest rating because for the 10 IT experts, the information quality of the game provides enough information for the end user. The lowest criterion in this table is the functionality criteria with a Mean of 3.45 and an SD of 0.56. Functionality criteria has the lowest rating for the 10 IT experts because the IT experts feels that the end users that will play the game will have a hard time navigating the user interface of the game.

Table 6: Evaluation Result from ten (10) IT Experts

Criteria	Mean	SD	Interception	Rank
Engagement	3.50	0.62	Highly Acceptable	3
Functionality	3.45	0.56	Highly Acceptable	4
Aesthetics	3.50	0.67	Highly Acceptable	2
Information	3.53	0.65	Highly Acceptable	1
Average Mean and Standard Deviation	3.50	0.62	Highly Acceptable	

In table 7, 38 end-users, 10 IT experts, and 1 technical adviser participated in evaluating the system. The highest criterion in this table is the information criteria with a Mean of 3.56 and an SD of 0.45. For the 38 end users, 10 IT experts, and 1 technical adviser, the information quality of the game is timely and will give new knowledge for the future end users of the game. The lowest criterion in this table is the aesthetics criteria with a Mean of 3.44 and an SD of 0.49. This criterion is ranked the lowest because the 38 end users, 10 IT experts, and 1 technical adviser feels that the game lacks more design.

Table 7: Overall Evaluation Result from thirty-seven (37) end- users and ten (10) IT Experts and one (1) technical adviser

Criteria	Mean	SD	Interception	Rank
Engagement	3.52	0.43	Highly Acceptable	2
Functionality	3.45	0.39	Highly Acceptable	4
Aesthetics	3.44	0.49	Highly Acceptable	3
Information	3.56	0.45	Highly Acceptable	1
Average Mean and Standard Deviation	3.49	0.44	Highly Acceptable	

V. CONCLUSION

A. Summary of Findings

This chapter summarizes the findings and considers the project's purpose and scope in relation to the finished product, as well as the results of testing and evaluations. The description of the main objectives of the project, the requirements that were satisfied, and the suggestions for the project's expansion.

After finding enough information on the three viruses presented in the game, we have proceeded with the development of the game. The developed game is an Android 3D game with a running game and an objective finding game. The game has options like a mute button for the in-game sounds and a graphics option button to adjust the graphics of the game. The developed game has a tutorial and a short story line. The developed game has character selection where the player can choose the character that the player will use in the game. The developed game also has a name customization so that the developed game will know what to call the player. The developed game was developed using Unity and Visual studio for the backend. After developing the game, we proceeded to the functionality and compatibility testing of the game. In functionality testing of the game where 10 IT experts participated in, all the functions of the game are working properly. In compatibility testing where 10 IT experts participated in, the developed game runs on Android versions 9 – 13. In evaluating the performance of the game based on the criteria by MARS, where 37 end-users, 10 IT experts, and 1 technical adviser participated in, the information quality of the game is the highest rated criteria with a Mean of 3.56 and an SD of 0.45. While the lowest rated criteria are the functionality criteria where it has a Mean of 3.45 and an SD of 0.39.

The tools and software that are used in developing the application are Unity, Visual Studio, Adobe Photoshop to create (png, jpeg, 3D) images, Blender to create 3D assets and FL Studio to create audios.

B. Conclusions

After developing the proposed project, the developers managed to complete all the objectives that are listed. These objectives are the main menu where the play, options, quit, and VIDEX (Virus Index) are located. A tutorial where the player will be introduced on how to play the game. A short storyline where the player can know information about the viruses presented in the game. A mute button and graphics option button located at the game's main menu allows players to silence the game and customize its graphics settings. A character selection wherein the player can choose the character that the player prefers, and an objective finding game where the player must complete the objectives to get back to the main running game. The tools that helped the developers develop the game are Unity as the engine for coding the front end and the back end of the game, Adobe Photoshop to make the short storyline of the game, Blender for the 3D models that will be used in the game, Visual Studio as the IDE of the game where the coding part of the development will take place, and C# as the programming language that will be used for developing the game. The developers used the functional and compatibility testing to evaluate the game, after using these testing methods, the developer found out that the functionalities of the game such as buttons are all functioning correctly according to their use and the proposed project is compatible to Android mobile devices with an Android version of 9 – 13.

The developers used the Mobile Application Rating Scale to evaluate the game based on the criteria of Engagement, Functionality, Aesthetics, and Information Quality. After evaluating the game with the help of 37 end users, 10 IT experts, and 1 technical adviser, the evaluation results showed that the highest criterion in the game is information quality which means that the information about the viruses presented in the game are helpful in spreading awareness. Incorporating the suggestions offered by the end user serves as a key method for enhancing the game's quality. By enhancing the game's visual appeal and integrating new features, we can elevate its overall experience. Additionally, introducing new viruses to the game expands the content available to players, offering them more engaging gameplay options. These improvements contribute to creating a more immersive and enjoyable gaming experience for our end users. In summary, the game was developed with the intention of educating players about three health viruses. The developers relied on research in game-based learning and virus awareness to guide their design choices. The inclusion of a house scene game mode enhances the learning experience by allowing players to simulate symptoms related to the health viruses, which addresses concerns raised in virus awareness studies. The game aims to spread knowledge and raise awareness about these health issues in an interactive and engaging way.

C. Recommendations

The recommendations listed below are based on the results and conclusions already presented.

1. According to the survey results, VIDEX description should be short as possible so because some users will not read the whole description of the virus.

2. In the cutscene part of the game, there should be an auto play so that the user can watch the cutscene instead of clicking next.

3. Making the level customized according to the virus level is another recommendation by the end users so that the game will be more enjoyable.

4. Limiting the size of the virus whenever the character is passing through it so that the game will be smoother for the end user.

5. More instructions at the quarantine house gameplay is another recommendation of the end user so that they will not feel lost while playing the quarantine house scene of the game.

6. Character customization is another recommendation by the end user so that their characters will be more customized according to the likes of the end user.

7. Game should be more optimized according to the end user so that it can run on different versions of Android devices.

8. Adding more time at the quarantine house gameplay is another recommendation by the end user so that they can complete the quarantine house gameplay and not be pressured by the time.

9. Adding more audio to the game is another recommendation by the end user so that the game will be more engaging to the end user.

10. Adding more visual graphics in the game is another recommendation so that the game will look more appealing to the eyes of the end user.

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