

SOLAR SYSTEM GAME FOR CHILDREN'S LEARNING

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ABSTRAK

Satu permainan 2D yang menarik dengan fokus utama pada sistem solar, Aplikasi Permainan Solar System direka khas untuk kanak-kanak berusia antara 7 hingga 12 tahun. Permainan ini dibangunkan sebagai aplikasi untuk telefon pintar, memberikan kebebasan kepada pemain untuk berinteraksi dengan bahan pendidikan pada bila-bila masa dan di mana sahaja. Matlamat utama adalah untuk mempercepatkan proses pendidikan dan membantu pemain muda membina asas pengetahuan yang kukuh mengenai sistem solar. Permainan ini bertujuan untuk menyediakan pengalaman yang menarik yang membangkitkan minat dan menggalakkan kesedaran tentang objek-objek dalam sistem solar kita melalui permainan interaktif, bahan pendidikan, dan ciri-ciri mesra pengguna. Bagi memastikan keberkesanan pengajaran permainan ini, projek ini menggunakan metodologi “RAD (Rapid Application Development)” yang membolehkan penciptaan aplikasi yang berkesan dan penambahbaikan secara berulang. Hasil projek menunjukkan kejayaan dalam mencipta satu permainan kuiz 2D yang menyeronokkan dan memberi maklumat, membolehkan pemain muda memperoleh pengetahuan asas tentang sistem solar dengan cara yang menyeronokkan dan menarik.

ABSTRACT

An engaging 2D platformer game with a heavy focus on our solar system as its central theme, the Solar System Game Application is made for kids between the ages of 7 and 12. The game, which was created as an application for smartphones, gives players the freedom to interact with the educational material whenever and wherever they like. The main goal is to speed up the process of education and assist young players in building a strong knowledge base regarding the solar system. The game seeks to offer a deeply engaging experience that sparks interest and encourages an awareness of the celestial bodies in our solar system through interactive gameplay, educational material, and user-friendly features. In order to assure the game's instructional effectiveness, the project makes use of the RAD (Rapid Application Development) methodology, which enables effective creation and iterative changes. The project's outcomes show how an entertaining and informative 2D quiz game was successfully created, allowing young players to acquire a fundamental knowledge of our solar system in a fun and engaging manner.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Since the COVID-19 pandemic spread all over the world, the percentage of people playing games are increasing to fill time during the lockdown. According to Ofcom, 62 percent of UK adults will be playing video games in 2020. This was a rise over prior years, according to the media regulator, as adults sought other types of amusement because to the pandemic's restrictions. It is because during long periods of being cooped up at home, many individuals turned to video gaming for enjoyment. There are variety of games and differences genre of games that have been playing by game lovers. Persons in general from kids to the adult love to play games and some people use the game as an alternative to gain money. For an example, there are many people that start to stream games during lockdown to gain money even at home. An entertainment game is designed to give the user excitement while they are actively engaging in game activities. But, for this project, it will be related to the educational games which are those that are focused on teaching people about a particular topic or expertise. So, the player still can entertain themselves by playing the game while learning some specific things.

Every child has the right to an education, and it is a crucial aspect of nation-building. COVID-19 triggered a learning catastrophe, with school closures affecting the education of 91% of kids over the world. Since the beginning of the epidemic, 168 million children have been missing from school, with 5 million children in Malaysia alone. Therefore, by implementing some educational in a game can increase the children's learning rate rather than using the old styles learning such as using the books. It is not all awful when it comes to using books to learn but some children easily get bored when learning by using that alternative. The educational game give so much benefits such as increasing their thinking skills and children will not stress when learning something.

In this project, a solar system-themed educational game will be developed for youngsters aged 7 to 12 years old. This game will teach kids about the solar system and its various components. Everyone, especially your children, may develop a better understanding of the fragility of the earth by learning about the solar system. Knowing why your planet is unique and how you can protect it will help to keep the world safe and healthy for future generations. The game's genre is game-based learning and it is a single-player game. There are limited educational games in the Google Play Store or in the Apple App Store that related to the solar system and this is the reason why this game will be developed for mobile. Beside the game, there will be placed some Augmented Reality features to make the game application more interesting.

1.2 PROBLEM STATEMENTS

The main purpose for developing this project is to enable children in learning about solar system without affected by problems. The one problem that exist is the traditional method that already being developed from time to time may not still relevant for the new generation of children. There is a lack of exposure to the solar system among these young children, which will lead to a lack of awareness of natural laws and natural resources. In this era, there are so much technology that being construct by the IT company and we can see so many kids already master the technique on how to use the gadget in the early age. As a result, some youngsters are unable to adapt to the traditional educational system and employing a modern learning style through the development of the educational game is the greatest option for them.

Besides that, the problem that occur when it comes to educational games or app is there are too many advertisements because some games are filled with pop-up ads that interrupt play, and make the cancel button nearly impossible to find. We can see that the developer more focusing on making money rather than give education to the youngsters. Because many advertisements occur in the middle of the game, gamers get less interested in playing. It is quite inconvenient to have to close the ad every time it shows. Due to this issue, it is quite likely that the application will be withdrawn quickly after it is downloaded.

The last problem, it is difficult to find any of the educational games that related to solar system in the Play Store or the Apple App Store because most of the game does not contain any educational component. Moreover, almost every game just like the other normal game and does not have any additional contain to attract youngsters to play it. The existing game also lack of augmented reality features as an additional to make the game more fun.

1.3 OBJECTIVE

The objective for this project is:

- I. To study the existing solar system game for the young students from 7 to 12 years old.
- II. To design and develop a solar system game and AR features for children from 7 to 12 years old.
- III. To evaluate the functionality and effectiveness of the developed solar system game for children education.

1.4 SCOPE

The scope for this project is:

User Scope:

- I. The youngsters from 7 to 12 years old.
- II. Primary school students that interested in solar system.

System Scope:

- I. This is game-based learning.
- II. Consist of the solar system and spaces topic.

Development scope:

- I. Contains multimedia content such as 2D models graphic sound, text and animation.
- II. Contain simple AR features that can be tested by the player.
- III. Using Unity, Adobe Photoshop and Vuforia software.

1.5 SIGNIFICANCE OF PROJECT

I. Students/Children

-Youngsters can study in an interactive way, which will enhance their passion for the subject. They could learn about the solar system and space in an enjoyable way that would assist their knowledge of the subject.

II. Teachers

-To increase student involvement, teachers can incorporate a new manner of teaching in the classroom.

III. Parents/family member

-Parents and family members can assist in the home schooling of their youngsters or siblings.

1.6 REPORT ORGANIZATION

This thesis consists of five chapters. Chapter 1 discussed the project's introduction, which included problem statements, objectives, scope, significance of the project and thesis organisation.

Chapter 2 provides a brief overview of three existing gaming applications, as well as descriptions and comparisons of educational games for learning about the solar system.

Chapter 3 will describe the project's methodology, from the System Development Life Cycle (SDLC) to the project's design.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Chapter 2 analyses existing game applications in education. Three existing solar system games were properly discussed and compared. The Graphical User Interface (GUI), Operating System (OS), game genre, type of connection, language delivered, target audiences, size of application, functionalities provided, advantages and disadvantages of the game application will be the focus of the comparisons. The weaknesses, advantages, and effectiveness of the existing game applications are identified through comparisons between the three existing game applications. The comparisons are made to ensure that the game application developed in this project is superior than the previous version.

2.2 REVIEW OF EXISTING SYSTEMS

Three existing game application about solar system will be reviewed in this section. These three applications are Solar System for kids-Learn Astronomy, Kids Solar System – Children’s learn planets and Star Walk Kids. The gameplay and animation in each of these game applications is unique.

2.2.1 Application 1- Solar System for kids-Learn Astronomy

Solar System for kids-Learn Astronomy is a game specifically for children and suitable for all ages. In this game, they will learn about solar system and study new information while playing. This game available on mobile platform and it can be download either in Google Play for Android or Apple App Store for iOS user. Figure 2.1 show the icon of Solar System for kids-Learn Astronomy. This game originally developed by Kokotots Inc. In this game player can learn about all 13 planets, dwarf planets, the moon

and the sun, faraway galaxies and more. There are many modes which is spelling and reading, puzzles and quizzes, bug's world, fun facts and video. In spelling and reading mode, player must arrange all the letter to form a specific word by dragging the letter into a square space. For puzzles and quizzes, player need to combine all the puzzle's pieces to form an image and there also have memory puzzles where player need to select two squares with the same picture. All puzzles in each mode must be solved one by one to make sure it proceeds to the next level. Figure 2.2 shows the interface of each mode in this game.



Figure 2.1 Logo of Solar System for kids-Learn Astronomy



Figure 2.2 Example of Solar System for kids-Learn Astronomy game space

2.2.2 Application 2 - Kids Solar System – Children's learn planets

Kids Solar System – Children's learn planets is an educational game for kids to learn about solar system and English effectively. The target user for this game is for the kids with ages up to 8 years old and it perfect for 2 to 4 years old children. This game application can be download at the Google Play for Android and Apple App Store for iOS user. The game is developed by RoyalTime Inc. Figure 2.3 shows the icon of this Kids

Solar System game application. In this game there are two modes which is the first one is spelling. Firstly, when player open the game, they would see a menu with several planets. Player is allowed to select any planet of his or her choosing. Playing the puzzle game will teach them how to recognise shapes and form planets. Puzzle piece must be dragged to its proper location and this will teach the kids to match. Once the puzzle game is completed, they will be able to interact with the planet by using space shuttles and other objects that appear at random. When they interact with these items and place them on the planet, it emits sound and giggles. Once the kids are satisfied, they can begin forming the planet's name by demonstrating letter-by-letter and reading out the letters. Figure 2.4 show the example of the game space for this application.



Figure 2.3 Logo of Kids Solar System – Children’s learn planets



Figure 2.4 Example of Kids Solar System – Children’s learn planets game space

2.2.3 Application 3 –Star Walk Kids

Star Walk Kids is a kid-friendly version of the popular astronomical app Star Walk. It is an excellent educational tool for young astronomy enthusiasts who want to explore space. Star Walk Kids promotes free exploration by providing a virtual planetarium where children can learn interesting facts by watching animations and listening to brief explanations. Figure 2.5 show the logo of Star Walk Kids. This game is suitable for the youngsters from the age of 5 to 12 years old. This application was developed by the Vito Technology company. There are many features in the game which is player can step by step explore the universe, unlock new levels and it will be challenged. Player can slide or rotate the phone 360 degree to search for the planets and when they click on it, it will show some information. Next, they can try to answer the quizzes to test their knowledge. They also can point their device to the sky and enjoy the stars, planets and constellations. Player also able to watch some funny cartoon movies about the space phenomena and celestial objects by clicking on the cinema. Figure 2.6 show the example of Star Walk Kids game space.



Figure 2.5 Logo of Star Walk Kids

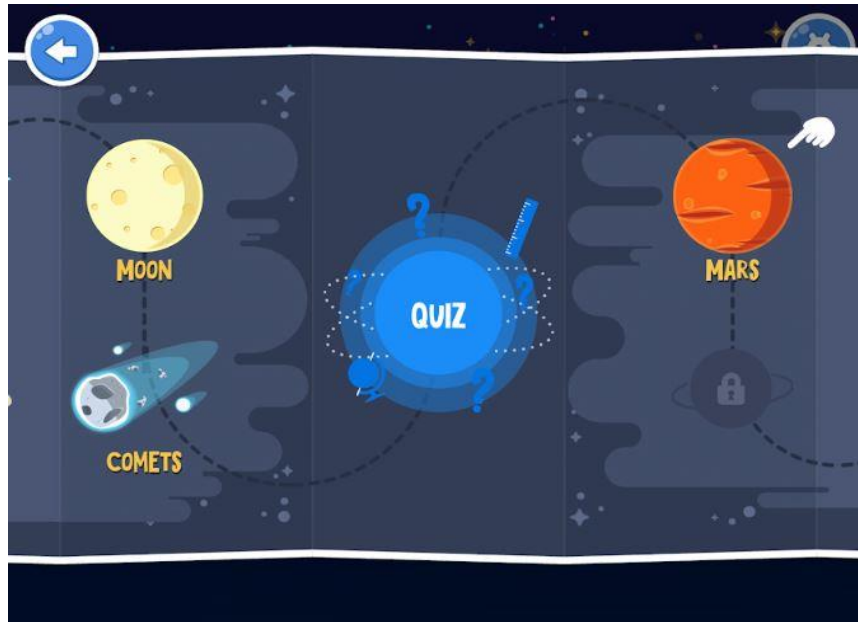


Figure 2.6 Example of Star Walk Kids game space

2.3 COMPARISONS OF THREE EXISTING SYSTEMS

Application Name	Solar System for kids- Learn Astronomy	Kids Solar System – Children’s learn planets	Star Walk Kids
Graphical User Interface (GUI)	The interface is well-organized, colourful and simple.	Simple and well-organized interface.	Dull interface but well-organized.
Operating System (OS)	Android, iOS	Android, iOS	Android, iOS
Game Genre	Puzzle	Puzzle	Puzzle
Type of Connection	Offline	Offline	Offline
Language Provided	English	English, French, German, Italian, Japanese, Spanish	English
Target	Ages up to 8 years old	Ages up to 8 years old	Ages up to 12

Audience			years old
Size of Application	59 MB	26 MB	39 MB
Function	<p>-Provide a button to start the game.</p> <p>- Provide home icon to going back to the main menu.</p> <p>-Provide a play button to play the short video.</p> <p>-Provide the “Buy Now” button to go premium.</p>	<p>-Provide icon to start the game.</p> <p>-Provide a settings button to select the language and either want to on or off the hint, speed, caps, narration and sounds</p> <p>-Provide a home button to going back to the previous menu.</p> <p>-Provide a plus sign button to view extra content.</p> <p>-Provide a tick sign button to proceed the level.</p> <p>-Provide a parent sign button to buy the premium version of the game.</p>	<p>-Provide a button to play sound and going back to the previous page.</p> <p>-Provide a settings button to change the volume level, rate the game and contact the developer.</p> <p>-Provide a button to pay and remove all the ads</p> <p>-Provide the buttons to play, pause, rewind and forward the video.</p>
Advantages	-Kid's educational apps that are simple and easy to use UI/UX	-Good animation when player tap the object or clear a puzzle.	-A simple math question will appear when

	<ul style="list-style-type: none"> -Several interactive learning games, puzzles, spelling tests, and other activities are available. -There is instruction in every level as guide. -Nice animation is shown when player click some of the planets or object in it. 	<ul style="list-style-type: none"> -Relaxing audio and easy gameplay. -Each planet has realistic sound effects. 	<ul style="list-style-type: none"> player tap the settings button. -Contains interesting cartoon animation video -When player rotate the device 350 degree, the view on the screen also rotating.
Disadvantages	<ul style="list-style-type: none"> -Too many advertisements appear while playing the game. -Player must buy the premium version to unlock all function. 	<ul style="list-style-type: none"> -Player must buy the premium version to unlock all function. -The home button sometimes not working. -Too simple and less puzzles and modes. -No instructional guides. 	<ul style="list-style-type: none"> -Too many advertisements appear while playing the game. -Player must pay to remove all the ads. -No instruction to guide how to play this game. -Player cannot pause the narration audio.

Based on the comparison above, we want to make some improvement in the project by develop a solar system and space for children's learning. The improvement that we will make is the game will free from any advertisement and player does not need to pay for the full version. It will be a free to play game and it will have some AR features to make the game more interesting and also it will have an instructional to guide the player on how to play the game. The button will work properly to avoid any problem during playing the game.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter will summarize the development process of the project. The methodological method is recognized as one of the most used in the field of research. The method is relevant and deemed sufficient in the administration and the organization of an application development process. Rapid Application Development (RAD) is chosen for this project. The context diagram, activity diagram, use case diagram, data design, project requirements and prototype are included in this chapter

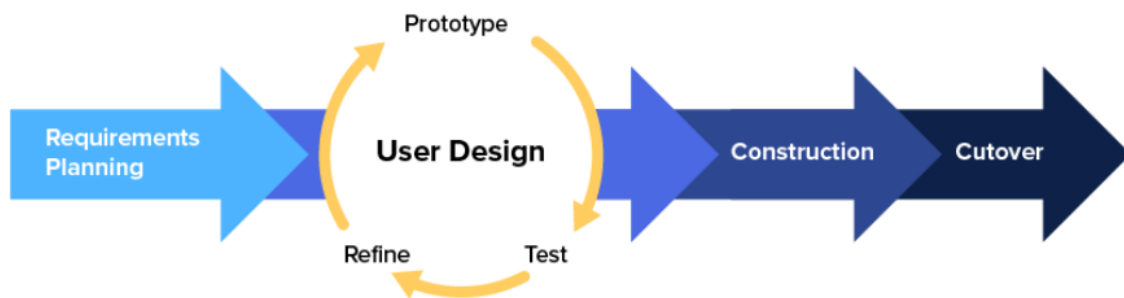


Figure 3.1 Rapid Application Development (RAD) model

3.2 PROJECT MANAGEMENT FRAMEWORK

The RAD model is used in the project's SDLC. Due to this small-scale project, it is suitable to use the RAD model because this model is typically used by small projects to achieve their goals in the shortest amount of time possible by working on prototypes and improving the system with the prototypes at the same time. This model is divided into four phases: requirements planning, user design, rapid construction, and cutover.

i. Requirements Planning

The project will interact between users during the requirements planning phase to determine the precise objectives and expectations for the 2D Solar System Quiz Game. Next, determine the project requirements through in-depth research and analysis, taking into consideration the current difficulties and possible problems that need to be resolved in order to produce a successful game.

ii. User Design

The game will be designed with users' needs in consideration at every step of the way thanks to close client-developer communication during the user design phase. Each game prototype, which will have additional augmented reality (AR) capabilities as well as tools for spelling, guessing, drag-and-drop, and feedback, will be available for testing by users. Based on user feedback, the game can be continuously improved via this iterative process.

iii. Rapid Construction

Include the 2D quiz game's lone developer in the coding, system testing, and integration processes. Along with the introduction of the extra AR function, the game will be built with a variety of game modes, like spelling, guessing, and drag and drop.

iv. Cutover

After completion, the game will be put into use. This requires performing operations including data conversion, testing, and user support. In order to produce a perfect final product of the game application, the developer will carefully check the game for any flaws or issues.

3.3 PROJECT REQUIREMENT

Functional Requirement:

- a. Player will be able to use all the button without any problem.
- b. Player able to use the quit button to quit the application.
- c. The player able to mute or control the in-game volume.
- d. The AR features can be tested and it must work properly.

Non-Functional Requirement:

- a. The interface and the button size must be well-designed.
- b. The game's hard disc space must be less than one gigabyte.
- c. The game must operate smoothly as it was programming.
- d. The game's programming must be able to be updated.
- e. The game should be able to run on mobile (Android platform).

Constraints and Limitation:

- a. The game development process must finish within the provided time.
- b. The software that will be used may cause a lagging during development process.

Software Requirement:

Purpose	Software
Operating System	Windows 11
Game Engine	Unity
Scripting Code	Visual Studio Code
Image Editing	Adobe Photoshop CS6 Adobe Illustrator CS6 Snipping Tool
Diagram Sketching	Draw.io

Documentation	Microsoft Office
AR Development	Vuforia

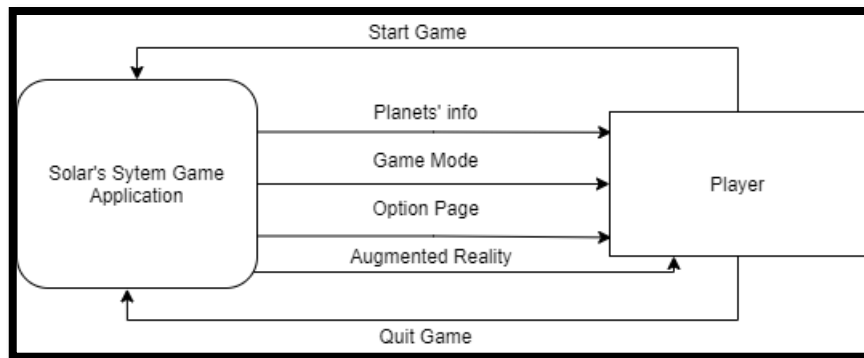
Hardware Requirements

Purpose	Hardware
<p>A portable computer is used for documentation and development of the project.</p> <p>Specifications:</p> <ul style="list-style-type: none"> -Processor: AMD Ryzen 5 5600H with Radeon Graphics 3.30 GHz -RAM: 8.00 GB (7.35 GB usable) -Type of system: 64-bit operating system, x64-based processor. 	Laptop
<p>A smartphone is used to test the mobile game application during the development to make sure it can run smoothly.</p> <p>Specifications:</p> <ul style="list-style-type: none"> -Operating System: Android 11, upgradable to Android 12, MIUI 13 for POCO -Internal Memory: 256GB/8GB RAM -Resolution: 1080 x 2400 pixels, 20:9 ratio (~395 ppi density) 	Smartphone

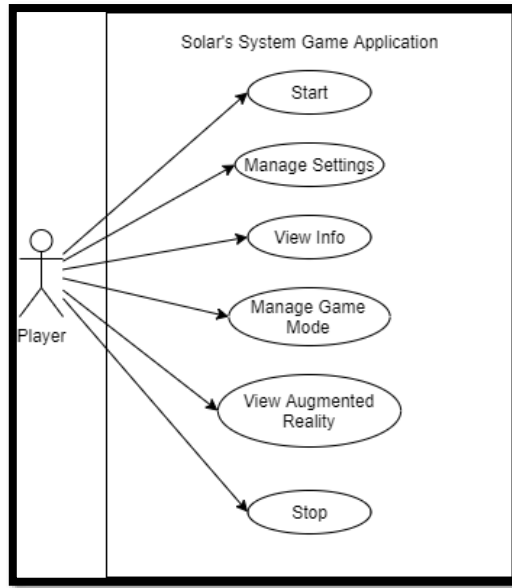
<p>The external hard disk is used for storing the file and documents that related to this project and it can be used as a backup storage to avoid missing file.</p> <p>The hard disk can store files up to 2TB and it enough to store the game application as it needs small storage.</p>	<p>External Hard Disk</p>

3.4 PROPOSED DESIGN

Context Diagram:

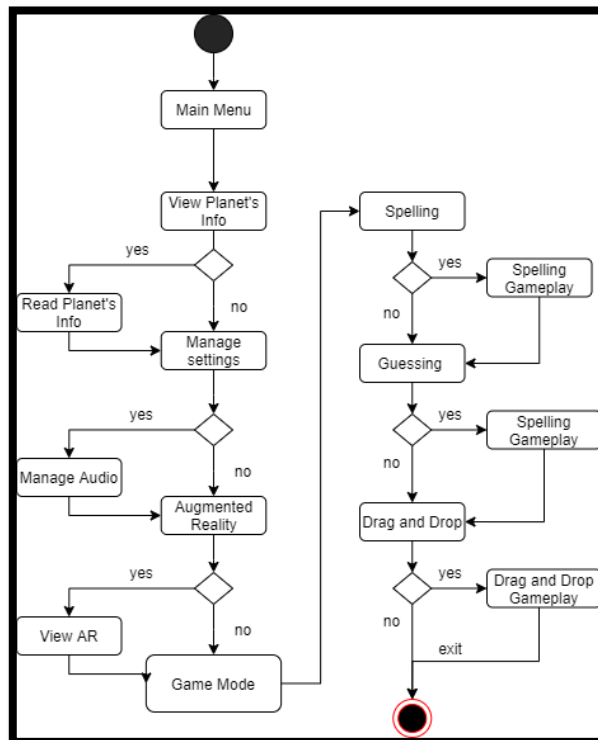


Use Case Diagram:







This use case initiates by player. It provides the player the capability to play the solar system's game by login the game and choose the 3 game modes available. Player also can change the audio settings and view the augmented reality features and read planet's info.

Activity Diagram:



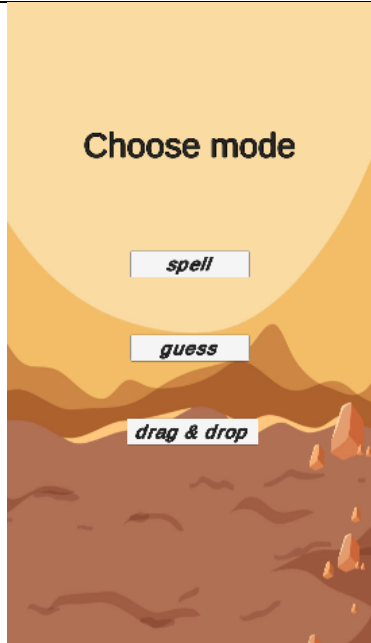
3.5 PROOF OF INITIAL CONCEPT

Prototype

	
<p>This is the interface after the game application is open. Player can click the “start game” to play.</p>	<p>This is the main menu for the Solar System Game application. Player can choose either proceed to the planet’s info, game mode, augmented reality (extras), option or exit by touched the buttons.</p>
	

In the Planet's Info section, there will be basic for each planet and there are 8 planets in this section. Player can click next to read the next planet's info.


For the option, player can tap on the audio logo to on or off the audio.



For the Game Mode, player can choose either spell, guess or drag and drop mode.

First is the Spell mode, in this mode, player can touch the alphabets in order to form the correct name of the planet. Player need to answer all the question until the last planet.



<p>Next, for the Guess mode, player need to guess what the name of the planet based on the statement that appear on the screen,</p>	<p>Last mode is Drag and Drop which player can drag the planet by hold it and drop it on the specific number according to the planets position in the solar system.</p>
	
<p>There will be Augmented Reality features in this application where player can try it by tap the button. The AR will contain some simple interface that show some planet and can be test during leisure time.</p>	

3.6 TESTING PLAN

No.	Module	Activities	Status
1.	Main menu	-Player can tap “Start game” to start the game.	
2.	Augmented Reality	-Player can tap the button and proceed to smartphone camera.	
		-The 3D model of planet appears after player place the camera towards a plane surface.	
		-Player can go back to the application by tap the back button.	
3.	Settings	-Player can on and off the audio by tapping the audio button.	
		-The audio is functioning well.	

4.	Planet's Info	-The planet's information appears after player click the "Planet's Info" button.	
		- Player can view all the planet's info by tap the next button to change the scene.	
		-Player can go back to main menu by tapping the back button.	
5.	Exit	-Player can quit the application by tap the quit button.	
6.	Game mode	-Player can choose the 3 games mode by touch the button.	
		-Player can go back to main menu by tapping the back button.	
7.	Guess mode	-The question statement appears very well and well-done message is shown when they clear the mode.	
		-The answer option button works properly.	
8.	Spelling mode	-The alphabet button works properly.	
		-The image of planets appears on the screen well done message is shown when they clear the mode.	
9.	Drag and Drop mode	-Player can drag and drop the planets into its position well done message is shown when they clear the mode.	
		-The planets going into the correct position.	

3.7 POTENTIAL USE OF PROPOSED SOLUTION

- If we compared this game application with the related ones, this game is easier to be played because it doesn't have advertisement and free to play. Moreover, this game provides the direction on how to play to give understanding for the kids.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 INTRODUCTION

In this chapter, the development process of the SSGA will be extensively discussed, including implementation, testing, and outcome analysis. The GUI and each function will be thoroughly examined. The results of system testing will be presented to align with the project objectives. The system generates test data to ensure that all requirements are met and that there are no system faults.

4.2 IMPLEMENTATION

There are two main components covered in this section, implementation requirements, and methods. The development process for the project has been thoroughly documented. The first component discussed is the development environment, followed by a detailed discussion of the system's functionality.

4.2.1 DEVELOPMENT ENVIRONMENT

SSGA is an Android game application created using Unity game engine and Blender for the Augmented Reality (AR) features. The application is programmed in C# language and utilizes the Unity game development platform. Unity allows for creating reusable components and customizable properties.

4.2.2 SYSTEM FUNCTIONALITY

In this section, we will explore how the system operates and interacts with the user, including its graphical user interface (GUI). An effective GUI should present important information clearly and facilitate learning and usage. We will carefully analyze all of the system's interfaces and features.

a. Start Page

Figure 4.1, display the SSGA start page. To access the game menu, users just need to tap on the 'start game' button and it will proceed to the main menu and users does not need to make any account or login into some pages.



Figure 4.1 Start menu for SSGA

b. Game Main Menu

Figure 4.2 depicts the SSGA main page. Users may choose 4 different features there either to access the planet's info, game mode, extras (AR) or option. Users can tap on the button to access any of them.



Figure 4.2 Main menu of SSGA

c. View Planet's Info

Figure 4.3 depicts the info section of earth among the 8 planets available. Users can read thoroughly all the planets and to change to another planet's info panel, they can tap the 'next' button and it will bring the users to next planet's information page.

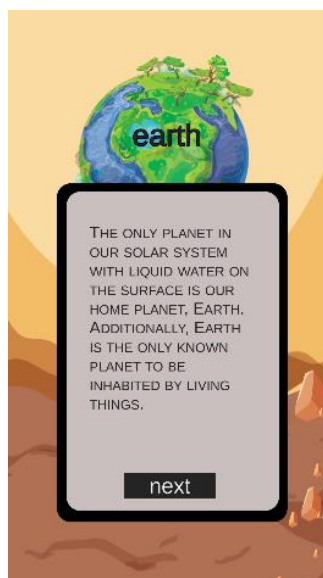


Figure 4.3 Earth's information in SSGA

d. Option

Figure 4.4 depicts the interface of the option pages when users accessed the option. This page will show how to on and off the audio by giving short instruction in the speech balloon.



Figure 4.4 Option pages of SSGA

e. Select game mode

Figure 4.5 depicts the SSGA select mode page. Users may choose either they want to access spell, guess or drag & drop mode by tap the button. Each mode will bring the different gameplay.



Figure 4.5 Choose mode page in SSGA

Figure 4.6 depicts one of the spell mode gameplays in the SSGA. In this mode, users must spell the right word for the planets that will appear. Users must tap on the word block one by one in order to form the planet's name and if success they will proceed to the next planet.



Figure 4.6 Spell Mode Page in SSGA

Figure 4.7 depicts one of the guess mode gameplays in the SSGA. In this mode, users must guess the right name for the planet according to the statement on the screen. There will be one right answer between the four answers choice. Users need to tap on the name block to answer and it will proceed to next planet page if success.

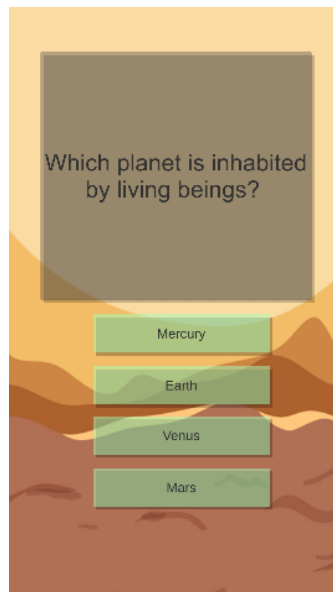


Figure 4.7 Guess Mode Page in SSGA

Figure 4.8 show one of the drag and drop mode gameplays in the SSGA. In this mode, users must drag and drop each planet to their own position according to the arrangements. If success, they will proceed to the next planet pages.



Figure 4.8 Drag and Drop Mode Page in SSGA

f. View Augmented Reality

Figure 4.9 show the simple 3D model for some chosen planets including moon and sun. Player just click the button and hold their smartphone's camera direct to any plane surface and the model will appear on it.

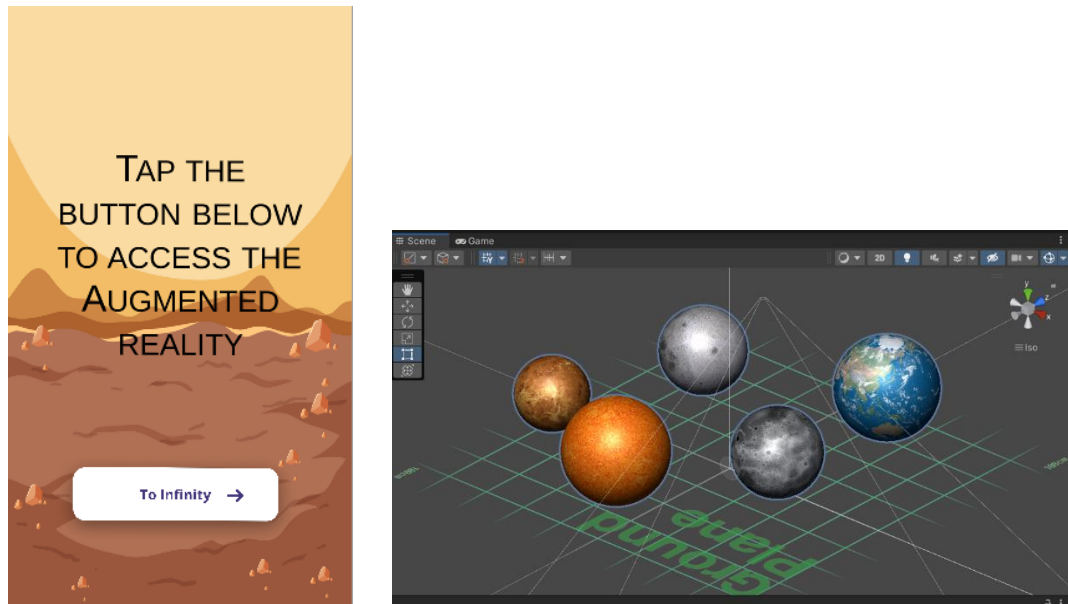


Figure 4.9 Augmented Reality in SSGA

4.3 TESTING AND RESULT DISCUSSION

The SSGA is developed using Unity, C# language, and Blender for the Augmented Reality model. Testing is a vital aspect of the development process as it ensures that all functionalities are error-free and meet the required criteria. Testing will be carried out throughout the development cycle to ensure that the final product is of high quality and meets the expectations of the users.

4.3.1 FUNCTIONAL TESTING

To evaluate the SSGA, four methods of functional testing will be utilized: unit testing, integration testing, system testing, and user acceptability testing. Each of these testing methods will be explained in more detail later on in the development process to ensure that the SSGA is fully functional, integrated, and meets the requirements of the end-users.

I. Unit Testing

This testing method will be used to test each individual component of the SSGA, such as the game logic, user interface, and audio. By performing unit testing, any bugs or errors in the code can be detected and fixed early in the development process.

II. Integration Testing

This testing method will be used to ensure that all the different components of the SSGA work together seamlessly. For example, the integration between the game logic and the user interface will be tested to ensure that they communicate properly and that there are no integration issues.

III. System Testing

This testing method will be used to test the SSGA as a whole, to ensure that it meets all functional and non-functional requirements. This will involve testing the application in different environments and scenarios, such as on different devices and with different user inputs.

IV. User Acceptance Testing

This testing method will be used to gather feedback from end-users on the usability and functionality of the SSGA. This feedback will be used to improve the SSGA, by making it more intuitive and user-friendly. The goal is to ensure that the SSGA meets the end-users' requirements and expectations, and that it provides an enjoyable and educational experience. The UAT can be view at the *Appendix C*.

CHAPTER 5

CONCLUSION

5.1 INTRODUCTION

In order to accomplish the objectives and address the challenges mentioned earlier, a summary of the Solar System Game Application's implementation for children ages 7-12 will be provided in Chapter 5. The foundations of conventional education for both teaching and learning are trustworthy materials like books. Children of today may struggle to concentrate and rapidly become bored or disinterested when studying from textbooks and giving more attention to a teacher's guidance. Because it contains multimedia elements like audio, visual graphics, and augmented reality, this newly developed game application can aid in focusing and motivating children.

Additionally, it facilitates engaging and enjoyable learning for children. Adobe Illustrator, Adobe Photoshop, Microsoft Visual Studio Code, Unity, and Vuforia were used to construct this gaming application. Furthermore, this gaming application was developed using the RAD method because it is appropriate for small-scale projects like this one. This gaming application is used and tested by kids between the ages of 4 and 6 as well as by parents, teachers, and other adults. The evaluation process's outcomes demonstrate that they give this gaming application generated positive comments.

Overall, the Solar System Game Application's deployment was successful in giving young children an engaging and enjoyable learning experience that helped them gain a better grasp of the solar system.

5.2 DISCUSSION ON USER ACCEPTANCE

Following the development phase, the usability, effectiveness, and functionality of the gaming application are assessed using the implementation and assessment processes. Users have to decide whether all of the gaming application's

features are operational during User Acceptance Tests (UAT), which are used to evaluate an application's functionality. For the UAT findings, check the APPENDIX C. Overall findings show that every component of the gaming application is operational and working as intended. Once the game is completed, users are given a survey using a Google form to evaluate the usability and efficiency of the. The majority of respondents to the Likert scale item analysis rated strongly agree and agree. It is safe to infer that this resulted in positive user feedback for the gaming application.

5.3 LIMITATION AND CONSTRAINT

There are limitations on effortlessly integrating Augmented Reality (AR) components during the game's development. Technical challenges included ensuring exact alignment of virtual items with the real world and delivering an intuitive user interface. The obstacles were successfully overcome to provide kids with an engaging augmented reality experience that enhanced their solar system exploration through careful calibration and optimization.

Code mistakes that occurred when all of the game's scenes were compiled into a single Unity project led to another constraint. Because the game had numerous sceneries and functionalities, integrating them occasionally caused code bugs that necessitated extensive debugging and troubleshooting. Next, some action is made by carefully fixing code issues, variable mistakes, and integration problems to make sure the gameplay is smooth. This allowed kids to move through the game's various stages without any difficulty.

The determination to overcome these obstacles made it possible for kids to interact with the game's interface and explore its exciting features without interruptions or technical problems.

5.4 FUTURE WORK

There are a number of features and improvements that could be added to the educational game with a solar system theme in the future:

Content Expansion: The game's content can be expanded to incorporate more details about space exploration, well-known astronauts, and noteworthy space missions, providing a more thorough understanding of the topic.

Gamified Assessment: By including evaluation features in the game, such as challenges or quizzes, kids may test their understanding and get feedback, further solidifying their learning objectives.

Cross-platform Compatibility: Investigating the prospect of creating the game for many platforms, including web-based variations, would improve accessibility and reach a larger audience.

Scoring System: The scoring system can be improved to a better version such as create a scoring record to observe the children's learning improvement from time to time.

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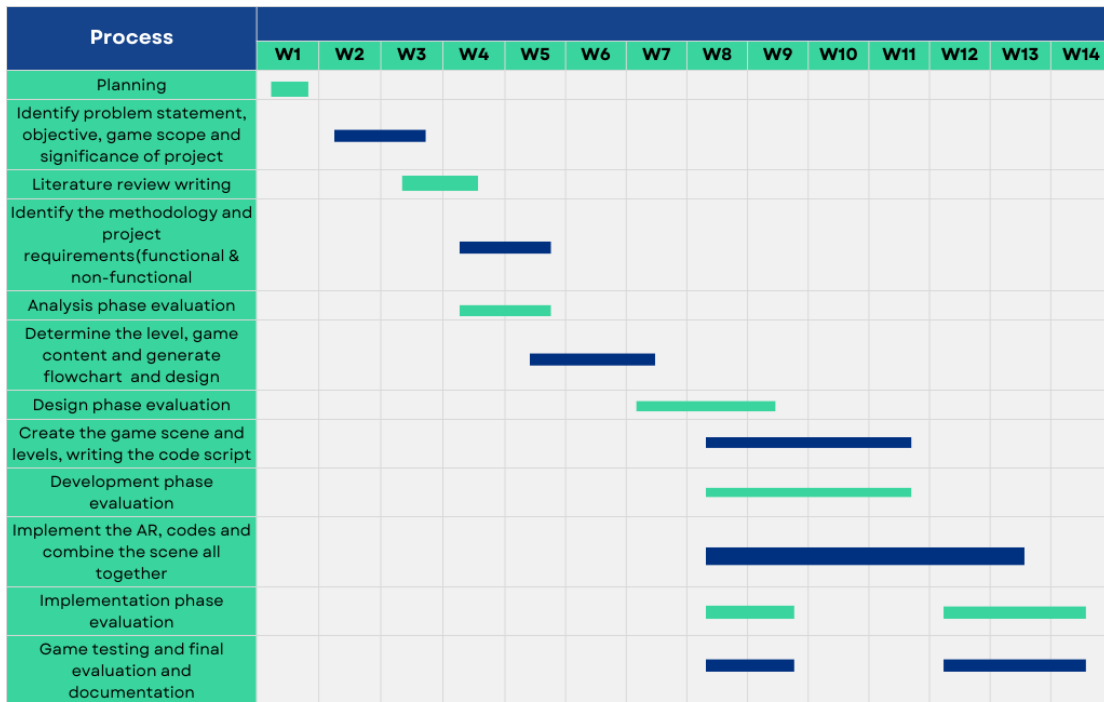
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Appendix A (Gantt Chart)



Appendix B (Usability Test (GOOGLE FORM))

2D Education Game Evaluation Form

Greetings and good day, I'm Muhammad Zarith Aidid bin Che Zakaria (CD19032), a student enrolled in an undergraduate program in the Faculty of Computing at University Malaysia Pahang. Regarding my game application project (SOLAR SYSTEM GAME AND AUGMENTED REALITY FOR CHILDREN'S LEARNING), which you may have already played, I would appreciate your honest feedback.

I sincerely appreciate you taking the time to cooperate and answer the questions on the surveys below. I really appreciate your response.

Rating Scale From 1-5



A horizontal rating scale with five categories, each in a dark blue box with a white arrow pointing down to a white circle containing a number. The categories and their corresponding numbers are: Poor (1), Unsatisfactory (2), Satisfactory (3), Very Satisfactory (4), and Outstanding (5).

How would you evaluate the solar system game's overall gameplay experience?

1 2 3 4 5

Did the game succeed in educating you about the various planets in the solar system?

1 2 3 4 5

Did you learn more as a result of the Augmented Reality (AR) elements included?

- 1 2 3 4 5
-

How entertaining were the game's visual visuals and animations?

- 1 2 3 4 5
-

How effectively did the game keep your interest and hold your attention throughout ?

- 1 2 3 4 5
-

What would you say is the game's level of challenge for children between the ages of 4-6?

- 1 2 3 4 5
-

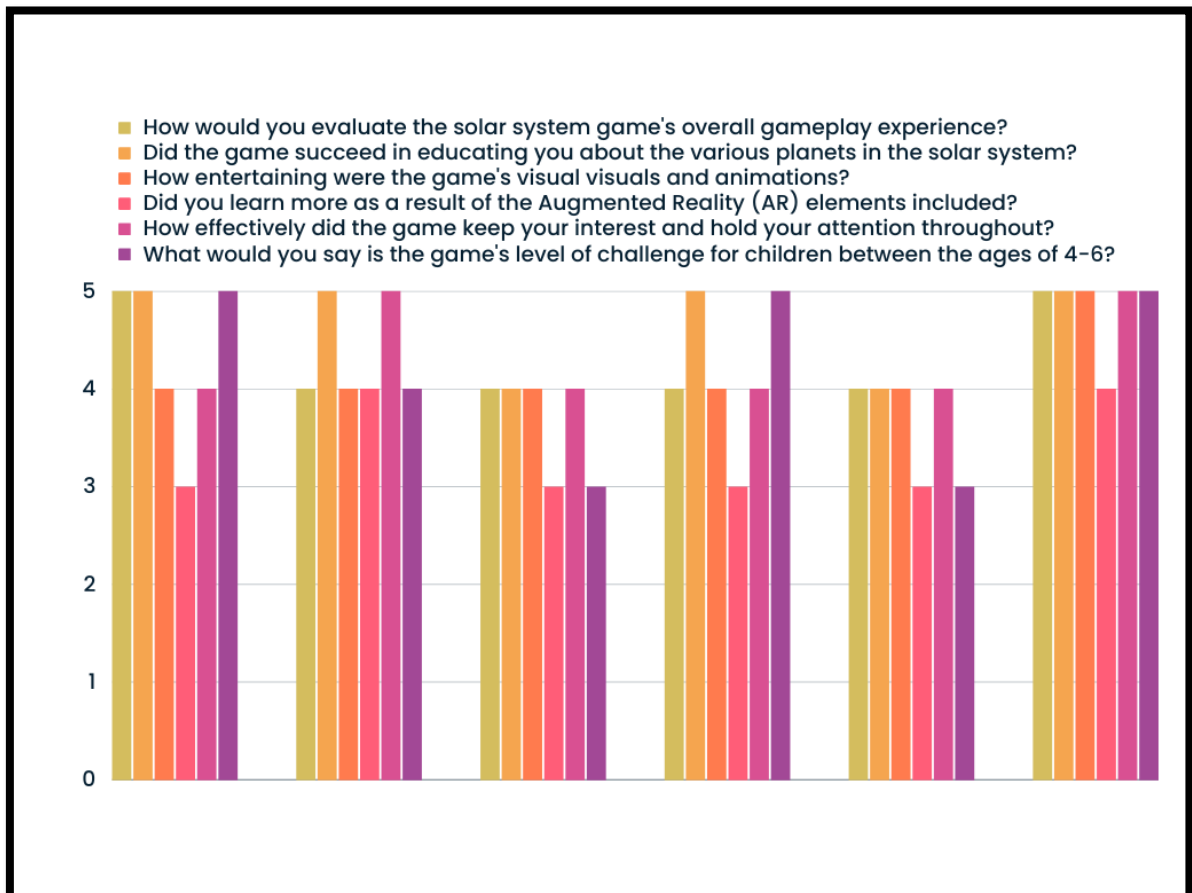
Would you encourage others to play this solar system game?

- Yes
- No

Can you provide comments after experiencing the game?

Your answer _____

Submit Clear form



Can you provide comments after experiencing the game?				
The game was awesome.				
The image and AR very nice.				
This game made my kids understand more about the planets and maybe u can add other component of solar system to make it more challenging.				
The game was educative and easy to understand. Kids will enjoy playing this game.				
Game is good and should add more planet model in the ar.				
The game is suitable for children because it is easy and simple to play.				

Appendix C (User Acceptance Test)

User name: Muhammad Rafiq Farhan bin Mohd Ridzuan

No.	Module	Activities	Status
1.	Main menu	-Player can tap “Start game” to start the game.	Pass
2.	Augmented Reality	-Player can tap the button and proceed to smartphone camera.	Pass
		-The 3D model of planet appears after player place the camera towards a plane surface.	Pass
		-Player can go back to the application by tap the back button.	Pass
3.	Settings	-Player can on and off the audio by tapping the audio button.	Pass
		-The audio is functioning well.	Pass
4.	Planet’s Info	-The planet’s information appears after player click the “Planet’s Info” button.	Pass
		- Player can view all the planet’s info by tap the next button to change the scene.	Pass
		-Player can go back to main menu by tapping the back button.	Pass
5.	Exit	-Player can quit the application by tap the quit button.	Pass
6.	Game mode	-Player can choose the 3 games mode by touch the button.	Pass
		-Player can go back to main menu by tapping the back button.	Pass
7.	Guess mode	-The question statement appears very well and well-done message is shown when they clear the mode.	Pass
		-The answer option button works properly.	Pass
8.	Spelling mode	-The alphabet button works properly.	Pass
		-The image of planets appears on the screen well done message is shown when they clear the mode.	Pass
9.	Drag and Drop mode	-Player can drag and drop the planets into its position well done message is shown when they clear the mode.	Pass
		-The planets going into the correct position.	Pass

User name: Muhammad Umar Fayyadh bin Hamdan

No.	Module	Activities	Status
1.	Main menu	-Player can tap “Start game” to start the game.	Pass
2.	Augmented Reality	-Player can tap the button and proceed to smartphone camera.	Pass
		-The 3D model of planet appears after player place the camera towards a plane surface.	Pass
		-Player can go back to the application by tap the back button.	Pass
3.	Settings	-Player can on and off the audio by tapping the audio button.	Pass
		-The audio is functioning well.	Pass
4.	Planet’s Info	-The planet’s information appears after player click the “Planet’s Info” button.	Pass
		- Player can view all the planet’s info by tap the next button to change the scene.	Pass
		-Player can go back to main menu by tapping the back button.	Pass
5.	Exit	-Player can quit the application by tap the quit button.	Pass
6.	Game mode	-Player can choose the 3 games mode by touch the button.	Pass
		-Player can go back to main menu by tapping the back button.	Pass
7.	Guess mode	-The question statement appears very well and well-done message is shown when they clear the mode.	Pass
		-The answer option button works properly.	Pass
8.	Spelling mode	-The alphabet button works properly.	Pass
		-The image of planets appears on the screen well done message is shown when they clear the mode.	Pass
9.	Drag and Drop mode	-Player can drag and drop the planets into its position well done message is shown when they clear the mode.	Pass
		-The planets going into the correct position.	Pass