

AN EFFECTIVE LEARNING APPLICATION
FOR AUTISM SPECTRUM DISORDER (AELA)

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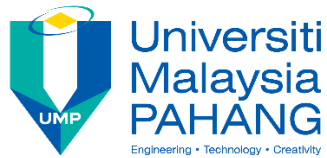
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AN EFFECTIVE LEARNING APPLICATION
FOR AUTISM SPECTRUM DISORDER [AELA]

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ABSTRAK

Pada masa ini, terdapat banyak aplikasi autisme yang telah dibangun untuk pengguna Android dan iOS yang boleh dipasang di gedung Play Store dan Apple. Permohonan itu adalah untuk membantu kanak-kanak autisme dan juga sebagai alternatif untuk ibu bapa bekerja sepenuh masa dan ibu bapa berpendapatan rendah. Walau bagaimanapun, aplikasi sedia ada yang telah dibangun sangat terhad dalam modul pembelajaran. Oleh itu, ibu bapa mereka perlu memuat turun lebih banyak aplikasi autisme untuk memberikan pendedahan pembelajaran lebih banyak tetapi pada masa yang sama ia akan menjejaskan storan telefon mereka. Selain itu, terdapat beberapa modul yang ibu bapa perlu membayar untuk kanak-kanak autisme mereka untuk meneruskan proses pembelajaran. Aplikasi yang sedia ada untuk pembelajaran tidak hanya dibangun dalam platform pendidikan tetapi juga sebahagiannya dibangun dalam platform permainan. Ini akan menjadikan kanak-kanak autisme bukan sahaja belajar tetapi pada masa yang sama bersenang-senang menggunakan aplikasi ini. Selain itu, aplikasi yang sedia ada tidak mempunyai aktiviti atau kuiz untuk mengukur pemahaman dan kemajuan kanak-kanak dan bukannya mempunyai markah. Oleh itu, projek ini akan direka untuk meningkatkan aplikasi sedia ada yang wujud di pasaran. Aplikasi Pembelajaran Berkesan untuk Autisme Spectrum Disorder (AELA) adalah salah satu aplikasi pembelajaran melalui platform permainan. Ia akan memberi tumpuan kepada membangunkan aplikasi mudah alih dalam pendidikan untuk kanak-kanak autisme yang mempunyai pelbagai modul untuk menjadikan anak-anak lebih memahami. Objektif projek ini adalah untuk mengkaji aplikasi autisme berkaitan dan mencari idea untuk memperbaikinya, untuk membangunkan aplikasi mudah alih modul pembelajaran melalui permainan untuk kanak-kanak autisme dan untuk menilai fungsi tujuan aplikasi mudah alih untuk pengguna android. Selain itu, metodologi yang digunakan dalam pembangunan AELA adalah Pembangunan Aplikasi Rapid yang memenuhi fasa keseluruhan secara keseluruhan untuk membina aplikasi yang boleh digunakan oleh kanak-kanak autisme. AELA dibangun dengan menggunakan platform Unity. Aplikasi ini membantu kanak-kanak autisme meningkatkan pengetahuan mereka dengan mempunyai pelbagai modul. Selain itu, mereka bukan sahaja belajar tetapi pada masa yang sama bersenang-senang menggunakan aplikasi itu. Permohonan AELA berjaya dilaksanakan dan hasil UAT dapat diterima.

ABSTRACT

For the time being, there are many autism applications had been developed for Android and iOS users which they can be installed in Play Store and Apple store. Those applications are to help the autism kids and also as an alternative for full time working parent and middle low-cost income parent. However, those existing applications that has been developed is very limited in learning module. So, their parent needs to download more autism application to give more learning exposure but at the same time it will affect their phone storage. Furthermore, there are some of the module that parents need to pay for their autism kids to continue the learning process. The existing application for learning does not only developed in education platform but also some of them are developed in gaming platform. This will make the autism kids not only learning but at the same time having fun using the application. Apart from that, the existing application does not have activity or quiz to measure the kids understanding and progression instead of they should have a scoring. Therefore, this project will be designed to improve the existing application that are existed in the market. An Effective Learning Application for Autism Spectrum Disorder (AELA) is one of the learning applications via gaming platform. It will be focus on developing a mobile application in education for autism kids which have variety of module to make the kids more understanding. The objective of this project is to study the related autism application and find the idea to improve it, to developed a learning module mobile application via game for autism kid and to evaluate the functionality of the purpose mobile application for android user. Besides that, the methodology that used in AELA development is Rapid Application Development which meet the overall fast phase to build the application that can be use by autism kids. AELA is developed by using Unity platform. This application helps autism kids increase their knowledges by having a variety of modules. Furthermore, they are not only learning but at the same time having fun using the application. AELA application is successfully implemented and result of UAT can be accepted.

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LIST OF ABBREVIATIONS

AELA	An Effective Learning Application
SRS	Software Requirement Specification
SDD	Software Design Document
RAD	Rapid Application Development
ASD	Autism Spectrum Disorder

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Autism is a continuous and permanent disorder of brain development. The name of the autism itself comes from the Greek word *autos* which mean ‘own’ and according to Bleuler, autism means ‘escape from reality’. According to The Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM 5), autism is also categorized as a psychiatric illness and is known as ‘Autism Spectrum Disorder’ (ASD). The term “spectrum” reflects the wide variation in challenges and strengths possessed by each person with autism. Kid who have this ASD disease will have problems from social media, verbal or nonverbal communication and behaviour issues and can be detected as early as two or three years old.

A child with ASD who is very sensitive may be greatly troubled and sometimes even pained by sounds, touches, smells or sights that seem normal to others. Kids who are autistic may have repetitive, stereotyped body movements such as rocking, pacing or hand flapping. They may have unusual responses to people, attachments to objects, resistance to change in their routines or aggressive or self-injurious behaviour. At times they may seem not to notice people, objects or activities in their surroundings. Some kids with autism may also develop seizures and in some cases, those seizures may not occur until adolescence. Autism is not an infectious disease, but still has no cure.

PERMATA Kurnia is an early intervention centre for autism children under the Permata Division, Prime Minister’s Department. PERMATA Kurnia was established aimed at raising public awareness of autism. Among the services provided are early

intervention services for children with autism. In addition, PERMATA Kurnia also helps empower parents and train also educate the community on evidence-based strategies to helps individuals with autism. Unfortunately, this intervention centre is only at certain places and very limited. This cause difficulties to the family who are living at rural area to get early intervention for their autism kids.

There are some applications has been developed for Android and iOS users which they can be installed in Play Store and Apple store. Those applications are to help the autism kids and also as an alternative for full time working parent and middle low-cost income parent. However, those existing applications that has been developed is very limited in learning module. So, their parent needs to download more autism application to give more learning exposure but at the same time it will affect their phone storage. Furthermore, there are some of the module that parents need to pay for their autism kids to continue the learning process.

The existing application for learning does not only developed in education platform but also some of them are developed in gaming platform. This will make the autism kids not only learning but at the same time having fun using the application. Apart from that, the existing application does not have activity or quiz to measure the kids understanding and progression instead of they should have a scoring. Therefore, this project will be designed to improve the existing application that are existed in the market.

An Effective learning Application for Autism Spectrum Disorder (AELA) is one of the learning applications via gaming platform. As early learning exposure about shape, color and number which developed for autism kids. It will be focus on to developing a mobile application on education for autism kids which have variety of module to make the kids more understanding. This application is also aimed to helps users especially autism kids to understand some term in English language.

1.2 PROBLEM STATEMENT

An existing autism application for learning are been developed in education platform and gaming platform. Currently, those existing applications has limited learning module which the autism kids will have their limitation in learning same thing repeatedly. The limitation of the existing application will make the autism kids not to expose many things. In additional, some of the application were developed not focus to the autism learning syllabus.

1.3 OBJECTIVES

Based on the problem statement, the objectives of the proposed application are: -

- i. To study the related autism application and find the idea to improve it.
- ii. To develop a mobile application via game based on module learning for autism kids.
- iii. To evaluate the functionality of learning application for autism kids.

1.4 SCOPE

The main scopes of the project are:

- i. System User: Autism kids two to six years old.
- ii. System Functionality:
 - a) Shape Module
 - b) Color Module
 - c) Number Module
- iii. Hardware and software
 - a) Hardware: Using a laptop with specification windows 7 and above as hardware to develop and design the application.
 - b) Software: Unity Platform.

1.5 REPORT ORGANIZATION

This report consists of five (5) chapters which the parts are chapter1 introduction, chapter 2 literature review, chapter 3 methodology, chapter 4 implementation, testing and result discussion and last but not least chapter 5 conclusion.

Chapter 1 describes briefly about of An Effective Learning Application for Autism Spectrum Disorder. It includes problem statement, objective, scope and report organization for this application.

Chapter 2 will discuss about the literature review of the application. This chapter discusses about the detail of autism apps that going to develop and comparing with the three (3) existing application in the market.

Chapter 3 will discuss about the methodology used during development of autism apps by android application. This chapter also will explain about the implementation process of the method used in the application.

Chapter 4 will discuss about result and discussion of the application that will develop, designing the testing and result discussion. This chapter will also discuss about how the process been implemented.

Finally, Chapter 5 will explain the conclusion of overall project with constraint development and future work that can be implement to improve AELA.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter will describe comparison of the application that already existing. There are three existing application that will make comparison which are Count It Easy, Autism iHelp-Shape and Color In-Autism Series. All this application is developed for the autism kids. This chapter will explain and carried out the application which wanted to developed. After describe comparison, this chapter will come out advantages and this advantages that I can make enhance An Effective Learning Application for Autism Spectrum Disorder.

2.2 EXISTING APPLICATION REVIEW

At this moment, there are many mobile applications that have developed for autism kids to help their learning process. So literally there are a few existing applications that can be differentiate learning application for autism kids. The following are some of the common application applied for autism kids learning.

2.2.1 Count It Easy

Count It Easy is learning game that developed by WebTeam Corporation to assist parent and special educators in teaching basic counting skills to the autism kids. The colourful, animated apps is built of principles of applied behaviour analysis. Behaviour analysis focuses on the principles that explain how learning takes place. Applied behaviour analysis (ABA) is the use of these techniques and principles to bring about meaningful and positive change in behaviour.



Figure 2.1 Interface of Count It Easy

Figure 2.1 shows the interface for Count It Easy. The kids can choose whether to play or want to do training mode which need to set in app settings. In the apps setting, the user also can set time and specify question order as shown in Figure 2.2



Figure 2.2 Count It Easy apps setting

There is an option called ‘Question Intro’ enabling which activates the sounds animals make. The basic purpose of these feature is to familiarize kids with various animal sounds and offer them some fun as they learn. In the gameplay session, the child is shown different animals and is asked to count the number of animals being shown. Each screen appears with numbers of single animal, together with three answers one of which is correct. If the user chooses the wrong answer, the apps will give the hint for the right answer by the activated box with green color as shown in Figure 2.3



Figure 2.3 Question with hint answer

The ABA method of intervention necessitates positive reinforcements on correct responses. Whenever the kid makes correct responses an animation is played as a reward of his performance shown on Figure 2.4



Figure 2.4 Reward performance

Total score for a particular session is displayed at the end of an activity. The user can like or share the score on Facebook or Twitter and may also rate the apps on a scale of one to five stars. Figure 2.5 shows the total score for Count It Easy.



Figure 2.5 Total score for Count It Easy

Table 2.1 shown the advantages and disadvantages of Count It Easy.

Table 2.1 Advantages and disadvantages of Count It Easy.

Application	Advantages	Disadvantages
Count It Easy	<ul style="list-style-type: none"> <li data-bbox="683 474 1018 618">i- This application is a free version for Android user. <li data-bbox="683 779 1018 1034">ii- This application provides a training mode before use the apps. <li data-bbox="683 1088 1018 1232">iii- This application has a scoring for the quiz. <li data-bbox="683 1397 1018 1541">v- The autism kids can know about animal. 	<ul style="list-style-type: none"> <li data-bbox="1083 474 1394 730">i- The activity that provides is too simple for learning application. <li data-bbox="1083 779 1394 981">ii- There are only five questions in the application. <li data-bbox="1083 1088 1394 1339">iv- The question is very difficult for kids below than six years old.

In conclusion, there are a few features that can be include in AELA. First feature is we can use the multiple answer in the activity. Then, we include the tutorial for each module as a guideline. Count It Easy also have disadvantages which is the module is very difficult to understand, even though it is too simple learning application but not suitable for autism kids below than six years old. This application suitable and suggest for any primary school student.

2.2.2 Autism iHelp-Shape

Autism iHelp is a vocabulary teaching aid developed by parent for a kid with autism and speech language pathologist. Autism iHelp was inspired by the need for specific language intervention tools for kids with Autism Spectrum Disorder focusing on their unique strengths and difficulty with expressive vocabulary.

Autism iHelp-Shape is extremely unique when compared to any other first words learning application. This application includes group of pictures categorized by specific shape. This apps help distinguishes and identify common item by shapes allows increased environmental generalization. This help the autism kids to recognized that boundaries in regard to categorized are not exclusive.

This application includes 64 real world photos and it has been proven that autism kids respond best to photo as opposed to illustrations and very visual leaner. This learning activity are presented in game-like format. This game check retention of the learned vocabulary and integrate auditory and visual memory. Figure 2.1 shows the main menu for the application.

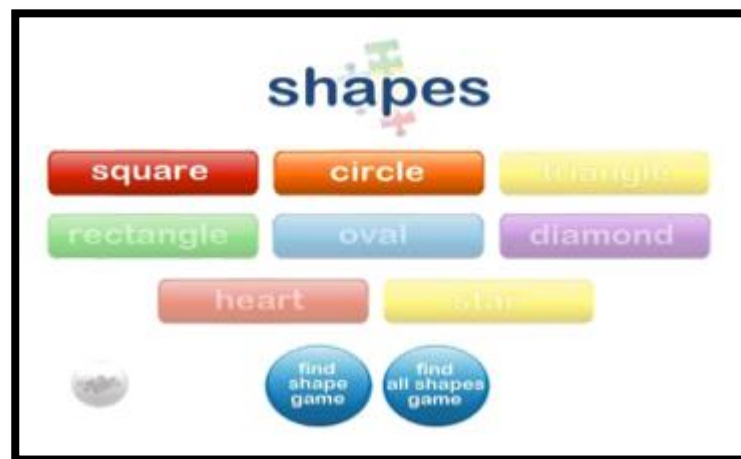


Figure 2.6 Main menu for Autism iHelp-Shape

There are eight categories of shape in this application which is Square, Circle, Triangle, Rectangle, Oval, Diamond, Heart and Star. All of these shapes have the same content which is teach the kids about the shape with real-world photo. Figure 2.7 shows the content of the module.

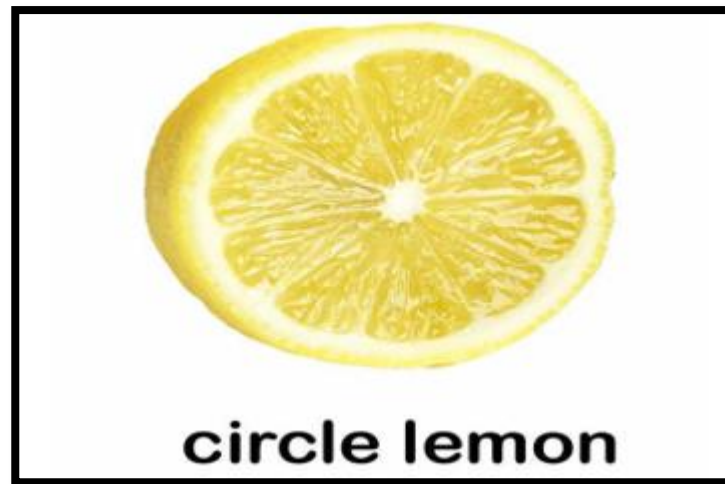


Figure 2.7 Content of the module

In this module it has text and sound so that kids can understand the shape about. Then the kids need to touch the screen to make a move to another part. After finish this application will ask whether want to repeat the learning process or not. Figure 2.8 shows the interface to continue learning.



Figure 2.8 Interface continue the learning

If user click button yes, then it will repeat to the learning process. If the user click button no, it will go to home interface for user to choose another shape to learn. User also can go to the game session if they click button but need to pay it.

Table 2.2 shown the advantages and disadvantages of Autism iHelp-Shape.

Table 2.2 Advantages and Disadvantages of Autism iHelp-Shape

Application	Advantages	Disadvantages
Autism iHelp-Shape	i- Autism kids can know the shape in real-world.	i- Lack of animation and sound. ii- There are only two from eight activities that can be used for free. iii- The interface is not interesting for the autism kids.

In conclusion, there are many disadvantages than advantages from the application. For the autism kids Autism iHelp-Shape is not attractive to them because the application is lack of animation and music. This application is limited for only two activities that can be used for free while for another six activities user need to buy first.

2.2.3 Color In-Autism Series

Color In is a fun apps developed for kids with special needs to help them engage in expressive behaviour and also understand the synchrony of natural color. Bright color leaves a healthy impression on plaint mind of young children, inspiring positive thinking and constructive activities. These apps have two part which is training mode and play.

This application with the aid of assistive technology for autism spectrum disorders, ask the user to apply colours to image animals such as cat, dog, elephant and lion. Built on the discrete trial part of Applied Behaviour Analysis (ABA), it includes colourful audio-visual prompts and highly interactive gameplay environment.

In training part, the kids are shown how to fill colours before he or she is asked to do it their selves. The number of colour inputs required to fill each image varies according to the intricacy of the sketch (the animal and background). At any point during an activity, the kids can undo an input without losing on the count of steps remaining to complete filling all required colour and proceed next image as in Figure 2.9.



Figure 2.9 Interface for the activity

Each screen features a Help icon that tells the kid built-in color scheme for the corresponding image. However, the kids are free to pick any color from the list of colors given with each image. An animation is played on successful completion of each step. This technique is based on the rule of positive reinforcement. Parent, teacher or caregiver

can set the time and sequences of activities from the ‘Setting’ part of the apps. The default time to complete applying colour to an image is one minute as shown in Figure 2.10.



Figure 2.10 Setting part

Table 2.3 shown the advantages and disadvantages of Color In-Autism Series

Table 2.3 Advantages and disadvantages of Color In-Autism Series

Application	Advantages	Disadvantages
Color In-Autism Series	<ul style="list-style-type: none"> i- This application is very interesting for autism kids. ii- This application includes sound and music for attract the autism kids. iv- This application applied an 	<ul style="list-style-type: none"> i- Autism cannot learn the color name. iii- This application does not have the instruction.

	attractive graphic for attract the autism intention.	
--	--	--

In conclusion, Color In-Autism Series has more advantages than disadvantages. This application has more attractive graphical user interface that can attract the autism kids' attention. Furthermore, this application contain sound, music interesting picture and animation. This is the concept that we will use to develop our application to attract the autism kids. While, there also have a few disadvantages for the application which are autism kids cannot learn the color name and know how to spell it. Then, there is no instruction on how to use the application.

2.3 COMPARISON OF THE EXISTING APPLICATION AND PROPOSED APPLICATION

Table 2.4 shows the summaries of the existing systems and the proposed system. The comparison against the proposed project can help us to know a deficiency of the existing system so that we can avoid it and become more competitive. This comparison also helps to improve quality of the An Effective Learning Application for Autism Spectrum Disorder.

Table 2.4 Comparison of Three Existing System with AELA

Application	Count It Easy	Autism iHelp-Shape	Color In-Autism Series	AELA
Features	<ul style="list-style-type: none"> i- Have training mode to give the user guideline. ii- Can share the score on Facebook or Twitter iii- Can give the rate for the application. 		<ul style="list-style-type: none"> i- Have training mode before play the activity. ii- Can set the time for the activity. 	<ul style="list-style-type: none"> i- Contain of three song videos in each of the module.
Platform	Android version 4.1	iOS version 6.0 and above	iOS version 8.2 and above	Android 4.4 and above

Continued

Table 2.4 Continued

<p>Advantages</p>	<ul style="list-style-type: none"> i- This application is a free version for android. ii- This application provides a training before use the apps. iii- This application has a scoring for the quiz. iv- The autism kids can know about the animal. 	<ul style="list-style-type: none"> i- Autism kids can know the shape in real-world 	<ul style="list-style-type: none"> i- This application is very interesting for autism kids. ii- This application includes sound and music for attract the autism kids to use the application. iii- This application applied an attractive graphic for attract the kid attention. 	<ul style="list-style-type: none"> i- This application has three combination of module which are shape, color and number. ii- This application has interactive design interface iii- This application has a scoring mark in each of the level in every module.
<p>Disadvantages</p>	<ul style="list-style-type: none"> i- The activity that provides is too simple for learning application. ii- There are only five question in the application. iii- The question is very difficult to 	<ul style="list-style-type: none"> i- Lack of animation and music. ii- There are two from eight activities that can be used for free. iii- The interface is not interesting 	<ul style="list-style-type: none"> i- Autism kids cannot learn the color name. ii- This application does not have the instruction 	<ul style="list-style-type: none"> i- This application only can use for android user.

Continued

Table 2.4 Continued

	understand for kids below than six years old	for the autism kids.		
--	--	----------------------	--	--

Based on the comparison table above, it can be concluded that all the existing application has their own pro and contras. For Count It Easy, it has many features apart from other application. Besides, it also has many advantages like have a scoring mark which is good for parent to know and monitor their children performance. While, Autism iHelp-Shape have many disadvantages compared to other application. For this application parent need to buy certain module to continue the learning module. Meanwhile, for Color In -Autism Series is such a proper application compared to Autism iHelp-Shape because it consists a graphic element to attract the autism kids.

2.4 EXISTING TECHNOLOGY

Research have been done to identify and analyse type of operating system will used for this mobile application, software had been chosen, size resolution and briefly explain on sound recorder for this mobile application.

There are many types of mobile operating system such as Android, Microsoft, Symbian and iOS. However, Android and iOS are dominant in mobile operating system. This will briefly explain on why Android been chosen as operating system for AELA.

2.4.1 Android

Android is an operating system that act as middleware and key application. The founder for Android is Andy Rubin, Rich Miner, Nick Sears and Chris White at Palo Alto of California in 2003. In 2005, Android was acquired by Google. Coding language for android is Java developer who use Android as their operating system. Can gain a profit by selling their application on android market. Android market is an online store and developed by Google. Android user can search and choose an application and widgets on android market. Features of Android is it enable reuse and replacement of components. Next, Android is optimized for mobile device and it is based on open source Web kit engine. The feature of Android is it support Near Field Communication (NFC) which is enable payment option that is easy and simpler than cash or credit cards. Secondly, Integrated Development Environment (IDE) that can be use by developer to develop an application is Android Studio since Android Studio is free for IDE. Next, Developer can use Linux, Mac or Windows operating system to build an application since Android support those Operating System. Lastly, the developer can get fast review for their application since distribution platform for Android within few hours.

2.4.2 iOS

iOS is also known as iPhone OS had been recognized at Macworld event on 2007. Application on iOS will be stored in App Store. App Store was released in 2008 and it enable iPhone user to browse and download application directly to their device. The feature if iOS is it have zoom in and zoom out when we playing the videos. The others are iOS support folder screen of 4x4 application for 240 application in a folder. Next, programming language used to develop iOS is Swift. Developer also can used XCode as platform to build an application since iOS support XCode as their Integrated Development Environment (IDE). However, developer only can used MAC as operating system of development since iOS does not support others operating system. Lastly, developer will get slow review since distribution platform for iOS takes several weeks.

2.4.3 Comparison of Mobile Operating System

Table 2.5 Comparison of Mobile Operating System

Operating System	Android	iOS
Operating system for Development	Windows, Linux and Mac	Mac
Programming Language	Swift	Java
Integrated Development Environment (IDE)	Android Studio	XCode
Distribution platform	Fast	Slow

Based on table above android had chosen as mobile operating system for AELA because it is easy to be implement. The programming language for Android is Java while iOS is Swift. Based on Pierre Carbonello (2016), Ranking for Java is first with 23.4% while ranking for Swift is ten with 3.2% for Popularity of Programming Language Index.

The purpose of the statistic is to determine the most popular programming language tutorial searched in Google. Hence, it easier to implement application using Java language that iOS. Secondly, population of Android user worldwide is higher than others operating system. According to International Data Corporation (2016), the percentage of android user and iOS user in second quarter 2016 are 87.6% and 11.7% consecutively. Thus, more user can access AELA if it builds in Android and iOS. Lastly, Android can develop by using various operating system such as Windows, Linux and Mac while OS only support Mac as their operating system. Since operating system used to build AELA is Windows thus Android is chosen.

2.5 SUMMARY

For the conclusion, this chapter are written to get the overview of the proposed application. By analysing and differentiating the three existing applications, it derived us to create a better application for autism kids.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter discuss overall approach and framework of An Effective Learning Application for Autism Spectrum Disorder. In All software development process, methodology is part of the development process. Software development methodology refer to the structure, plan and control the process of developing an information system. It is important part in programming development since it controls the stream of the system. It is also to ensure the proposed system can be done base on the timeline given for the system.

There are variety of software development methodologies that a developer can use. Every Methodology accessible are most suited to specific sorts of project, based on various technical authoritative, project and group consideration. In this venture, Rapid Application Development (RAD) will be used as a software development method.

3.2 SOFTWARE DEVELOPMENT METHODOLOGY

3.2.1 Rapid Application Development

After making a detail in a several methodologies, Rapid Application Methodology (RAD) is chosen for this project. This methodology is chosen because it concentrates on building a system quickly. This system does not backtrack the arranging if anything occurs since planning. It just backtracks the one phase before that is investigation phase. RAD is based on incremental model. This model aimed results and higher quality which mean to give

excellent development processes with the help of other development approaches. Once the prototype ready, then it will go to the testing phase and lastly to the implementation phase. (LucidChart Content Team, 2018).

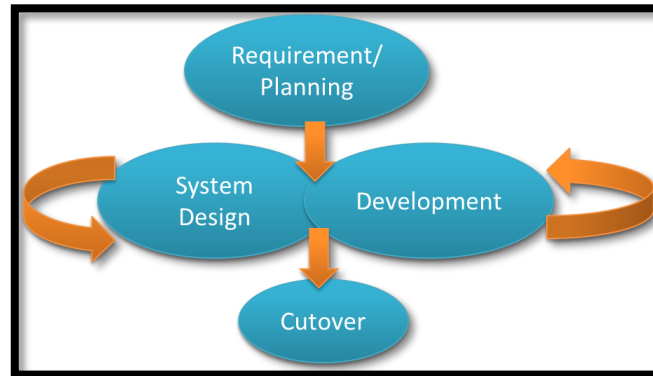


Figure 3.1 RAD Phase

3.2.1.1 Requirement Planning Phase

In this phase, we need to meet up with client which is PERMATA Kurnia to gather all the requirements. It will end when the team agrees on the key issues and gets management approval to proceed. The aims of requirement planning phase to know about the diagnosed issues or problems of the current application. The requirement planning phase commence with a number of comparing exists applications. I have a summary from my comparison with the existing apps. By this comparing I can come across the requirements that they overlooked or not utilized in the application. All these requirements have to meet to be able to attain their expectation for the application. The list of the requirement is in Appendix A.

3.2.1.2 System Design Phase

In this phase, client need to cooperate with developer to develop models and prototypes that represent related application process, input and output. Then, all the application's data and processes figured out. In this phase also will create a prototype of the proposed application. There will be a user interface diagram, dialogue diagram and a data flow diagram. All these diagrams are for user to know more about the flows of the application. By modelling all these diagrams, the user can easily learn more details regarding the application. This will minimize the probability of user make changes in the requirements at the time of the development phase. There will prototype type of user interface in this document to demonstrate clients on appearance the interface of this application.

3.2.1.3 Development Phase

In this phase, we start to construct the application. Task that involve in this phase are application development, programming and coding, unit integration and system testing. In this stage, changes on the requirement are welcome. This phase will be explained in details in Chapter 4.

3.2.1.4 Cutover Phase

In this phase, client will test the An Effective Learning Application for Autism Spectrum Disorder to make sure all requirements are following as well. The User Acceptance Testing (UAT) is documented for ease to review after do the testing. If have any error, the developer will do the improvement. Furthermore, the verification and validation data will do, to make sure the application does not have any error during its use. After carrying out all the testing and find minimum number of errors, then application can be delivered to the user.

3.2.2 Product Perspective

The context diagram involves the interaction between An Effective Learning Application for Autism Spectrum Disorder with two user which are parent and autism kids. Figure 3.2 has shown the context diagram An Effective Learning Application for Autism Spectrum Disorder (AELA).

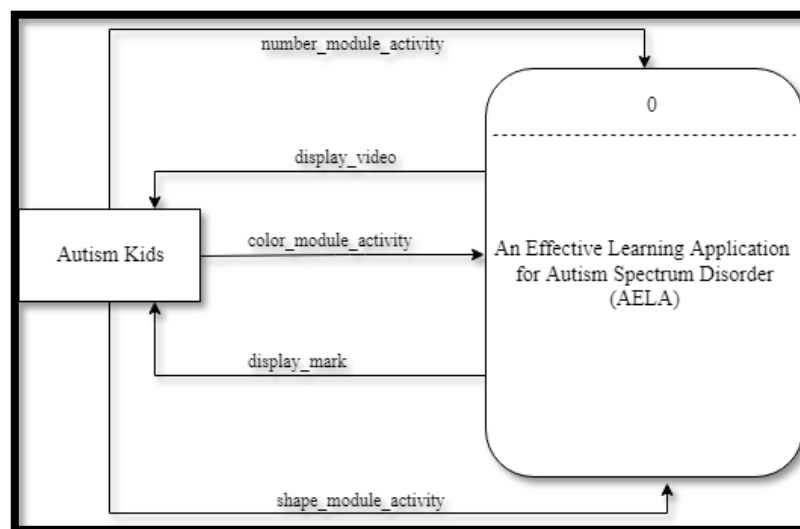


Figure 3.2 Context Diagram of AELA

3.2.3 Use Case Diagram

Use Case diagram involves a user which is autism kids. There are only three use case which are Manage Shape Module, Manage Colour Module and Manage Number Module. Figure 3.3 has shown the use case diagram of An Effective Learning Application for Autism Spectrum Disorder (AELA).

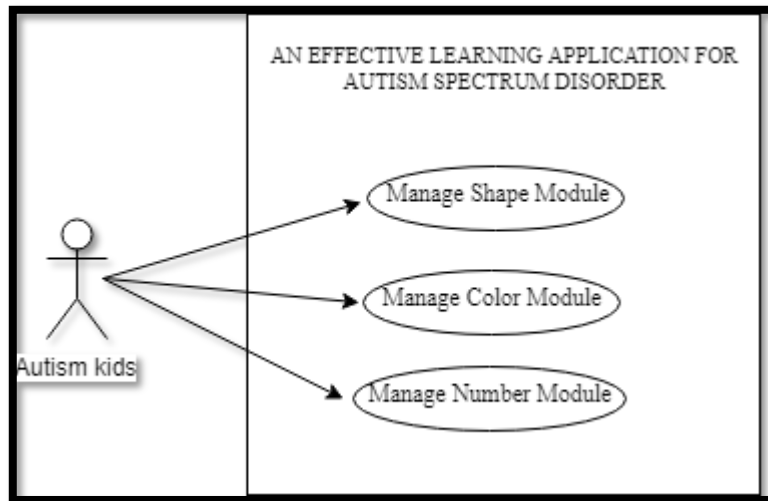


Figure 3.3 Use Case Diagram of AELA

3.2.4 Overall System Activity Diagram

Activity diagrams show the workflow from a start point to the finish point detailing the many decision paths that exist in the progression of events contained in the activity. This flow can be sequential, branches or concurrent. The following diagram is an activity diagram of overall system for An Effective Learning Application for Autism Spectrum Disorder (AELA) as shown in Figure 3.4.

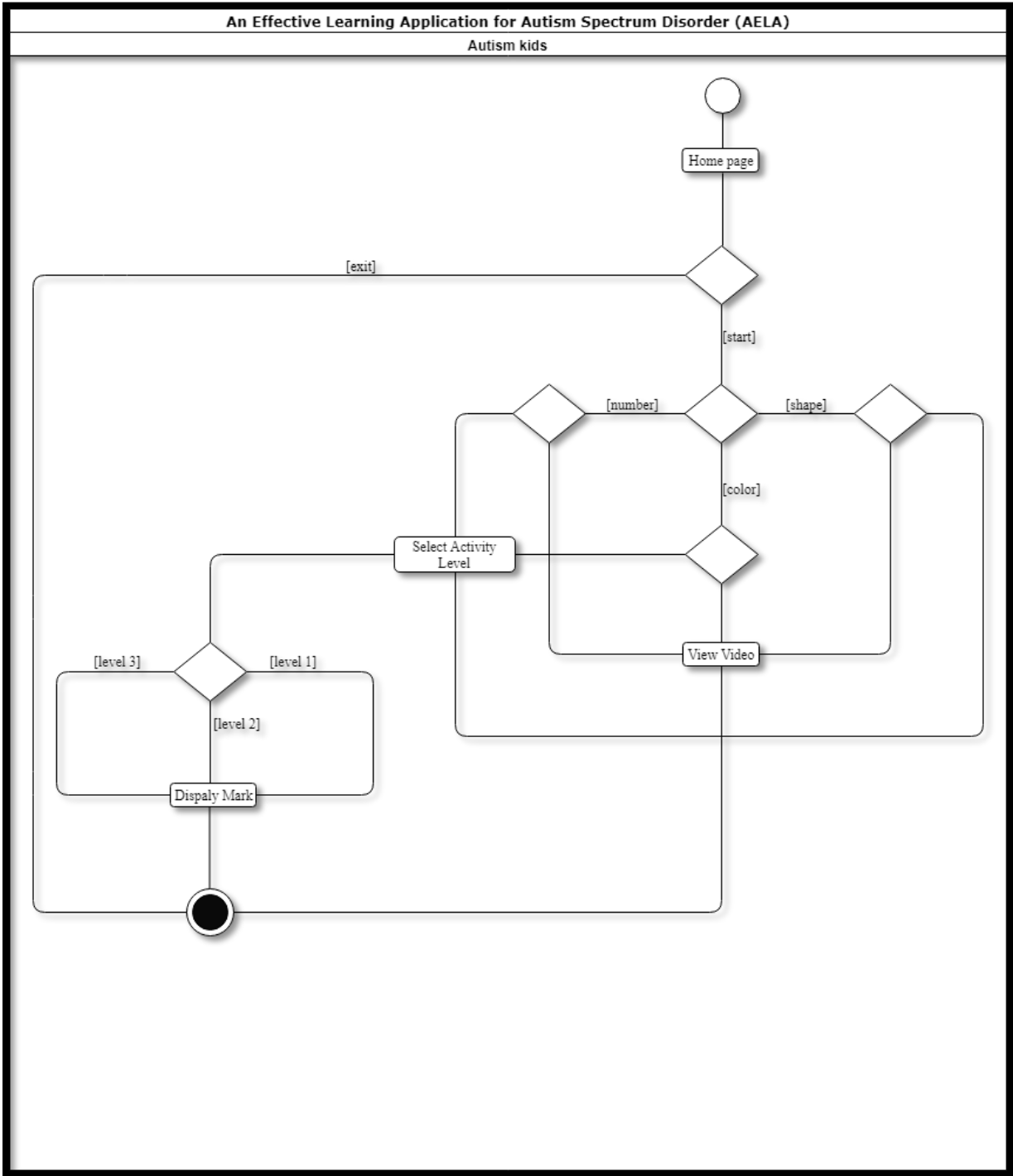


Figure 3.4 Activity Diagram of AELA

3.2.5 Propose System Interface

Figure 3.5 show AELA dialogue diagram. This dialogue diagram will be reference for An Effective Learning Application for Autism Spectrum Disorder user interface.

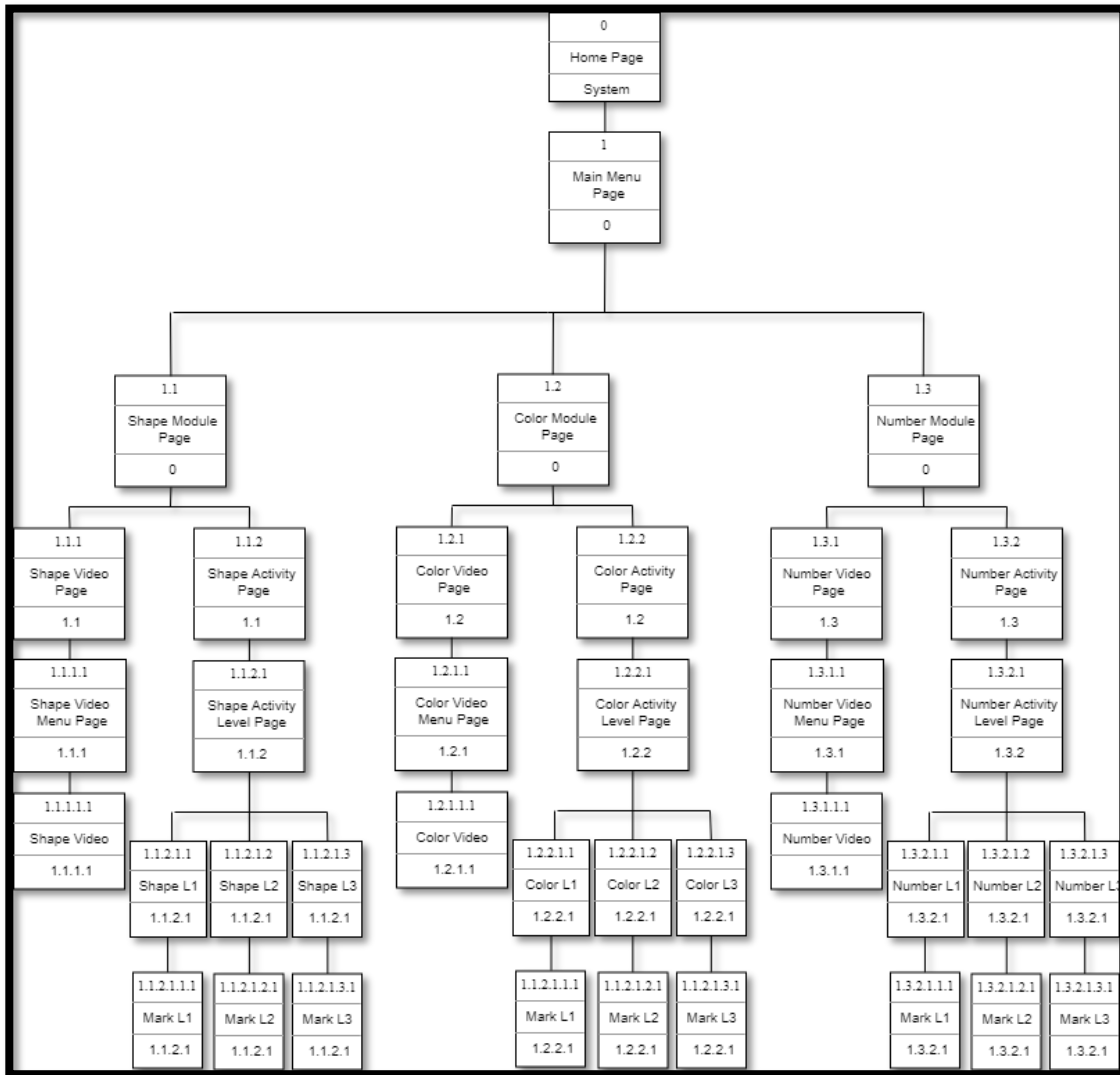


Figure 3.5 Dialogue Diagram of AELA

3.2.6 General Architecture

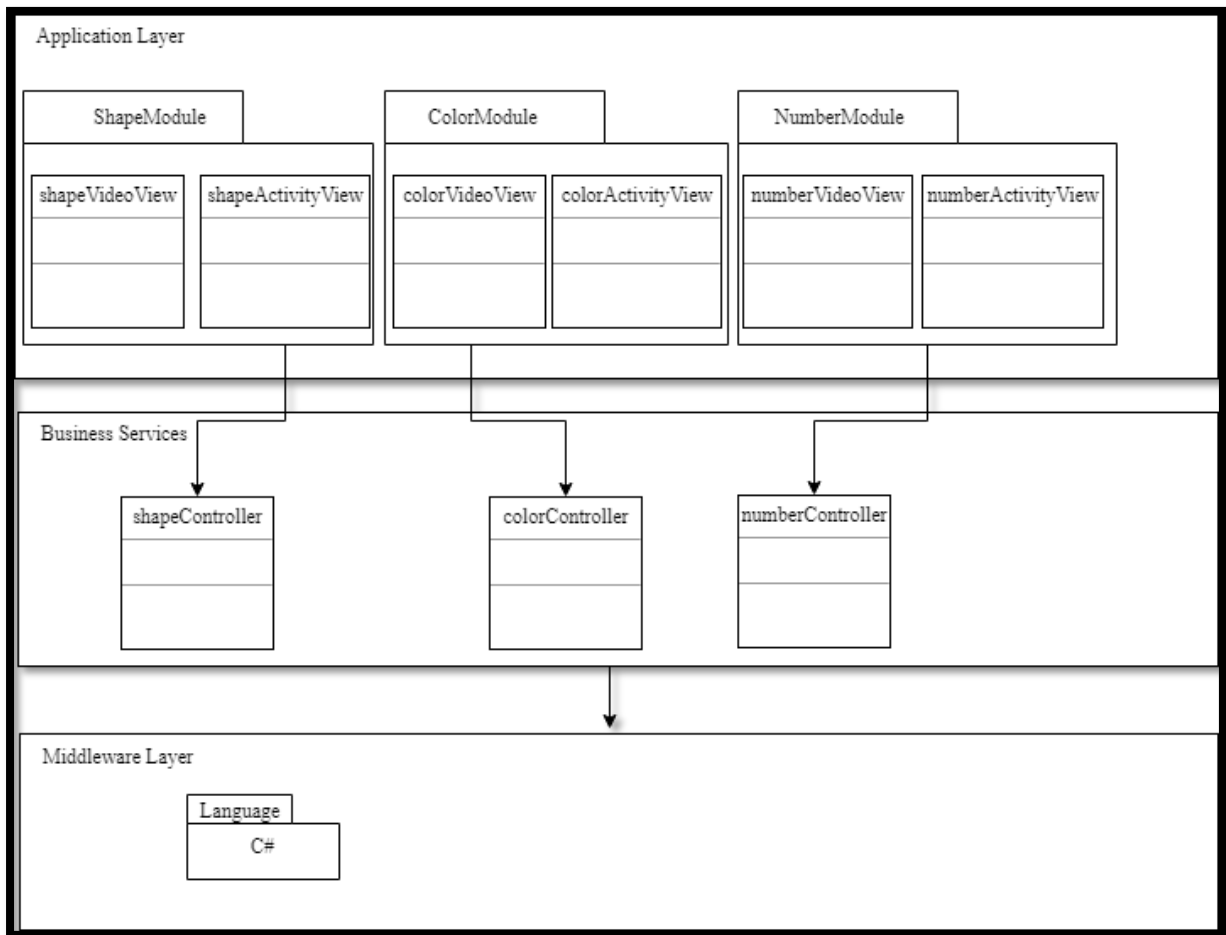


Figure 3.6 General Architecture of AELA

3.2.6.1 Application Layer

The application layer contains application-specific design elements.

3.2.6.2 Business Services Layer

The Business layer contains business-specific elements that are used in several application.

3.2.6.3 Middleware Layer

Provides utilities and platform-independent services.

3.2.7 Package Module

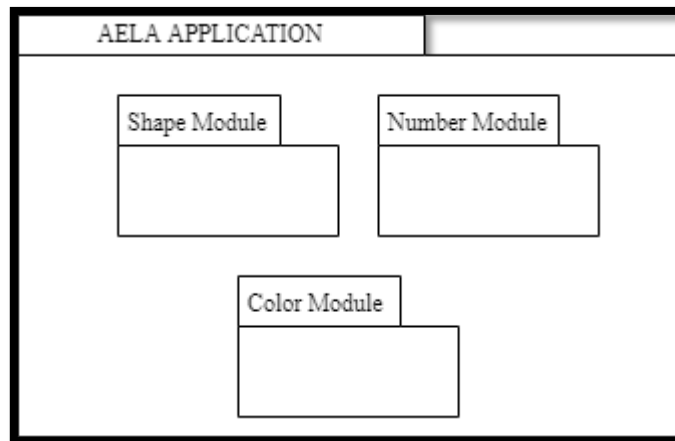


Figure 3.7 Package Module of AELA

3.2.7.1 Shape Module

This package is used to manage the shape module. Autism kids can select the ‘LET’S SING’ button or ‘LET’S PLAY’ button to choose. In ‘LET’S SING’ menu, they can view all the shape video while in the ‘LET’S PLAY’ menu, the kids can play a game which consist of three level and will display a mark at the end of each level.

3.2.7.2 Color Module

This package is used to manage the color module. Autism kids can select the ‘LET’S SING’ button or ‘LET’S PLAY’ button to choose. In ‘LET’S SING’ menu, they can view all the color video while in the ‘LET’S PLAY’ menu, the kids can play a game which consist of three level will display a mark at the end of each level.

3.2.7.3 Number Module

This package is used to manage the number module. Autism kids can select the ‘LET’S SING’ button or ‘LET’S PLAY’ button to choose. In ‘LET’S SING’ menu, they can view all the number video while in the ‘LET’S PLAY’ menu, the kids can play a game which consist of three level will display a mark at the end of each level.

3.2.8 Software Requirement Specification (SRS)

The Software Requirement Specification (SRS) is a documentation which describe the requirement of An Effective Learning Application for Autism Spectrum Disorder and ensuring that each requirement is completely satisfied. This documentation highlights the requirements needed of this system. This documentation also contains product description, interface requirements, software product features and requirement traceability. Refer Appendix B.

3.2.9 Software Design Document (SDD)

Software Design Documentation (SDD) describe the design aspect that is develop in An Effective Learning Application for Autism Spectrum Disorder. This documentation contains the data dictionary, preliminary design and detailed design. The detail will be on next document which is SDD. The SDD document can be referring in Appendix C.

3.3 HARDWARE AND SOFTWARE

This section will show about the hardware and software specifications, that were used during the development of the mobile application and the documentation for the proposed project. All the hardware and software involve will be explained in the following subsection.

3.3.1 Hardware Requirements and Specifications

Table 3.1 show the hardware item used throughout the documentation phase of the proposed project.

Table 3.1 Hardware Requirement of AELA

Hardware	Specification	Purpose
Laptop	Acer Aspire E 14 Intel Core I5-7200U	To write documentation, create and developed the application.
Tablet	Huawei Media Pad T3 7 with android marshmallow operating system.	To run the application.
Hard Disk	Toshiba 1TB	To back up the documentation files and source codes of the application.

3.3.2 Software Requirements and Specifications

Table 3.2 shows the software list used throughout the documentation and development phase of the proposed project.

Table 3.2 Software Requirement of AELA

Software	Specification	Purpose
Microsoft Word 2016	Version 2016	To write documentation.
Microsoft Project 2016	Version 2016	To test the develop application.
Unity software	Version 2018	To do the development for the application.
Adobe Photoshop & Adobe illustrator CS6	Version 2013	To edit and create graphic image.
Draw.io	Online website	To create the context diagram, dialogue diagram, use case diagram, package module and mvc of the application

3.4 GANTT CHART

Refer to Appendix D for the Gantt Charts. The Gantt chart for AELA indicates the progress and activities that have done within time given.

3.5 TESTING PLAN

In every project, an implementation of a testing is a must. As the details of the project objectives and also the specific beta test of the application could be seen in the testing plan. Furthermore, there are a few types of testing that could be conduct for the project, which are unit testing, integration testing, user acceptance of system testing and usability testing.

Usually, for testing an individual software module of an application, unit testing will be used. Thus, this test commonly carried out by the developer. So, to test the functionality for each function in An Effective Learning application for Autism Spectrum Disorder, this project will use unit testing to find out an error. If there are any error, the developer will do the correction and run the test again. Otherwise, integration testing will be run in the application. This is to ensure that there is no error between the function when the function integrate with each other after unit testing was done.

After that, system testing will be carried out for the whole application to test if the functionality, interdependency and communications works properly. Then the user acceptance testing will be conduct. This is where the client will test the function and comment about system functionality of the application.

Lastly, usability testing will be run for the application. The testing could be conduct in a few methods like an interview, survey or an observation. All of this method has the same goals which are to find out if the user found the application easy to be access or not.

CHAPTER 4

IMPLEMENTATION, TESTING AND RESULT DISCUSSION

4.1 INTRODUCTION

This chapter will discuss about the process of implementation, testing and result of the project. In order to relate with the implemented methodology, this process occurs during the implementation and testing phase. This chapter will include the explanation of the discussion that show the objectives of this project is fulfilled. During the implementation process, all function code is using Unity platform. Then the testing phase is performed to make sure that the obtained result is complements with system analysis and design in the previous chapter. In this chapter also discusses about user manual which will assist the user to use this application.

4.2 IMPLEMENTATION

This subtopic discusses about the procedure taken and the specific implementation process of this project. All processes that involved in the implementation phase are recorded and also described how the project was constructed. It also includes the example of coding implemented for all function and module as discussed in previous chapter and show the user interface of AELA.

4.2.1 Development Environment

For the implementation phase, the first thing to be done is set up the computer with development tool which is Unity software that used to develop AELA mobile application.

In Unity platform there have a game asset. The game assets usually divided into two which is art asset and script asset. The art assets refer to the game objects that needed in the game, game environment and music background. The script assets are the part where these assets programmed with the code to manage the game.

During the development of AELA, images are designed and download to create the user interface and environment of the games. Since this application is 2D environment game, all the image and environment can be design and edit using Adobe Photoshop and Adobe Illustrator as shown in Figure 4.1.

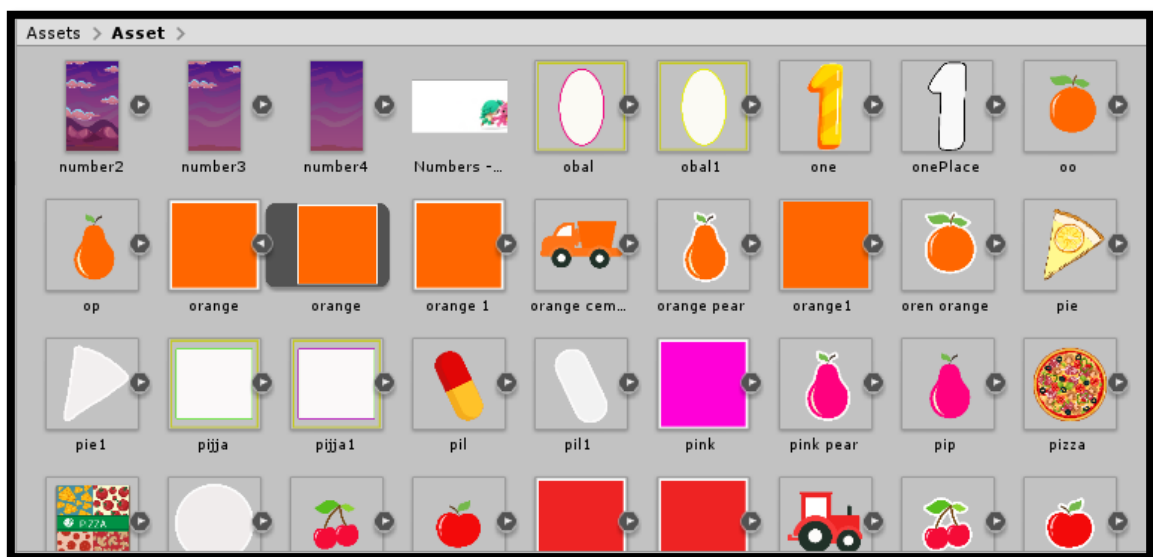


Figure 4.1 Game asset of AELA

The script assets are essential to the game as well. The scripts are the core part to make the game perform in the right way. During this project, I used C# to create the script. Figure 4.2 **Example of script** shows the example of script file that had been created for this application.

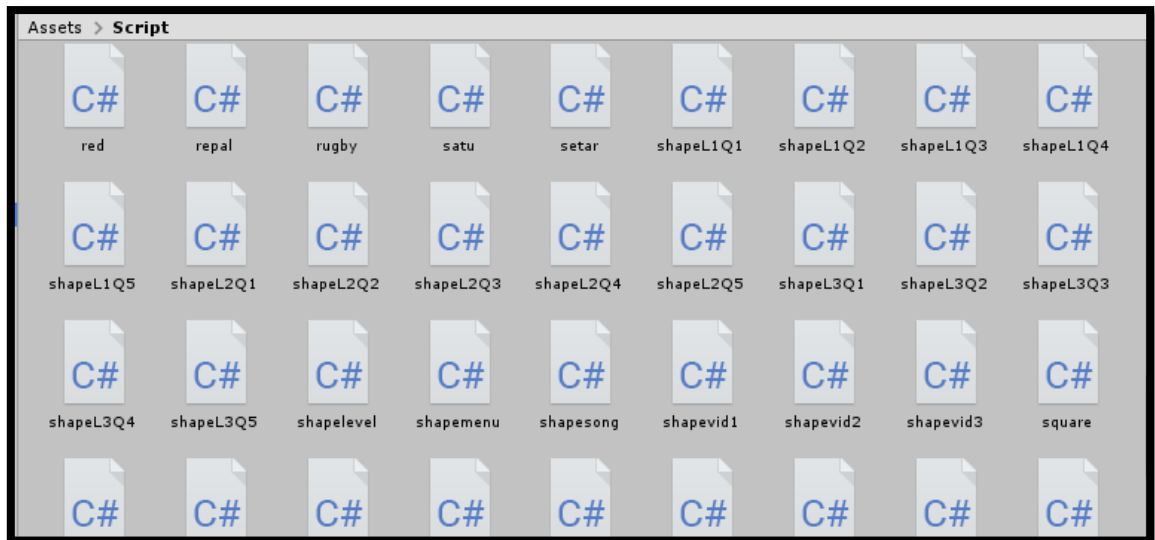


Figure 4.2 Example of script

Figure 4.3 is an example interface in canvas that design for start scene.



Figure 4.3 Interface design start scene

Coding below is the example to switch from the current scene to another scene. For examples in Figure 4.4, if user click “START”, the system will read this coding which it will change to Main Menu Page. While, when user click “EXIT” the system will quit the application.

```

public class startscene : MonoBehaviour
{
    public void startMenu(string startscene) => Application.LoadLevel(startscene);

    public void quit()
    {
        Application.Quit();
    }
}

```

Figure 4.4 Coding start scene

In this application there will display a few videos for autism kid to watch. The video can do a pause when the kids click play pause button. Below is the coding to do the action.

```

public void PlayPause()
{
    if (!firstRun && !isPaused)
    {
        videoPlayer.Pause();
        audioSource.Pause();
        playIcon.SetActive(true);
        isPaused = true;
    }
    else if (!firstRun && isPaused)
    {
        videoPlayer.Play();
        audioSource.Play();
        playIcon.SetActive(false);
        isPaused = false;
    }
    else
    {
        StartCoroutine(playVideo());
    }
}

```

Figure 4.5 Play pause coding

Each module in level 1 and 2 need the autism kids to drag the component to the correct place. Below show how the coding works.

```

[SerializeField]
private Transform berryPlace;

private Vector2 initialPosition;
private float deltaX, deltaY;

public static bool locked;

private void Start()
{
    initialPosition = transform.position;
}

private void Update()
{
    if (Input.touchCount > 0 && !locked)
    {
        Touch touch = Input.GetTouch(0);
        Vector2 touchPos = Camera.main.ScreenToWorldPoint(touch.position);

        switch (touch.phase)
        {
            case TouchPhase.Began:
                if (GetComponent<Collider2D>() == Physics2D.OverlapPoint(touchPos))
                {
                    deltaX = touchPos.x - transform.position.x;
                    deltaY = touchPos.y - transform.position.y;
                }

                break;
        }
    }
}

```

Figure 4.6 Dragging activity coding

Figure 4.7 show how the coding work on set timing when the kids answer the question and display the mark at the end of the.

```

void Update()
{
    if (triangle.locked)
    {
        GameWin.SetActive(true);
        Time.timeScale = 0;
    }

    if (timeLeft > 0)
    {
        timeLeft -= Time.deltaTime;
    }
    else
    {
        timeLeft = 0;
        Time.timeScale = 0;
    }

    time.text = "time:" + (int)timeLeft;

    if( timeLeft < 5)
    {
        score = 5;
    }
    else
    {
        score = 3;
    }

    scoretext.text = "Your Score :" + score;
}

```

Figure 4.7 Set timing code and mark setting

Before the application launch, we need to do some step for connect to the device.

Figure 4.8 shown the interface for set up the device.

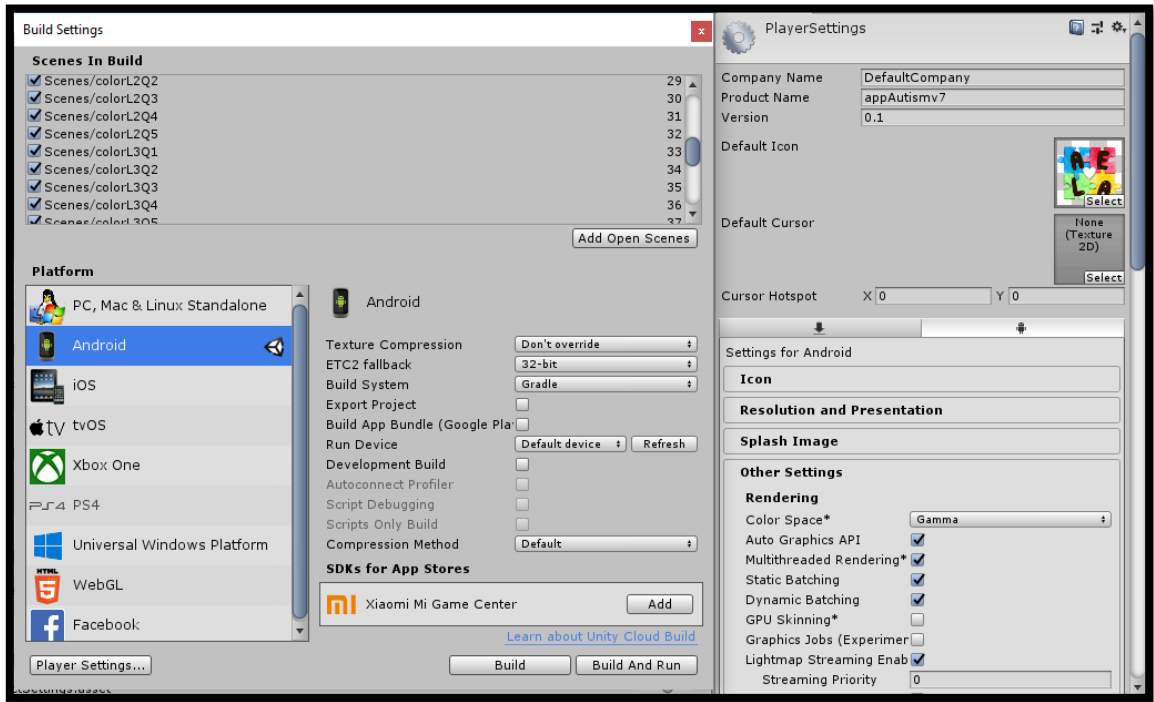


Figure 4.8 Interface for set up device

4.2.2 System Functionality

This section describes about system functionality, how the application work to interact with the user. The first thing is user interface of the system, user interface should be nice to ensure the understandability of the user.

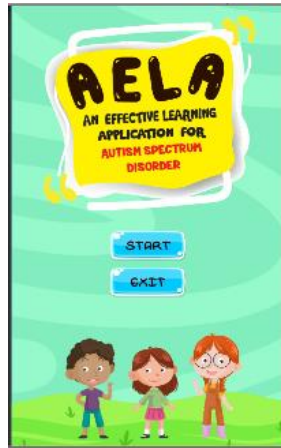


Figure 4.9 AELA home page

Figure 4.9 shows the Home page for the apps. User can choose whether want to click start button to go to the main menu page or exit button for quit the application.

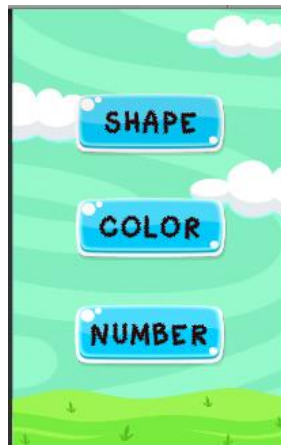


Figure 4.10 AELA main menu page

Figure 4.10 shows the main menu page for the application. User can select shape button to go to the shape menu page, color button to go to the color menu page or number button to go to the number menu page.



Figure 4.11 Shape menu page

Figure 4.11 shows the shape menu page. In this page user can select Let's Sing button or Let's Play button. User also can click the menu button for go to the main menu page.



Figure 4.12 Shape song menu

Figure 4.12 show the shape song menu page. In this page user can click song 1 button, song 2 button or song 3 button to view the shape video. User also can click the back button for go to the shape menu page.



Figure 4.13 Shape song 1 page

Figure 4.13 show the shape song 1 page. This is the result when user click the song 1 button. User can click pause button to pause the video while watching. User also can click the menu button for go to the shape menu page.



Figure 4.14 Shape level menu page

Figure 4.14 show the shape level menu page. This is the result when user click the let's play button. User can click level 1 button, level 2 button or level three to play the game. User also can click the back button for go to the shape menu page.

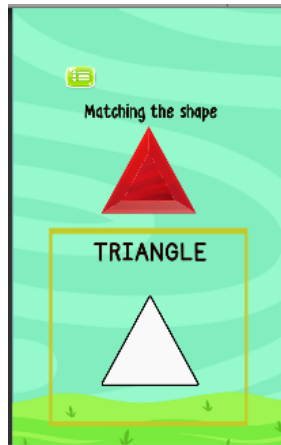


Figure 4.15 Shape Level 1 page

Figure 4.15 show the shape level 1 page. This is the result when user click the level 1 shape button. In this page user need to drag the triangle shape into the triangle in box until it locked. User also can click the menu button for go to the shape menu page.



Figure 4.16 Shape Level 2 page

Figure 4.16 show the shape level 2 page. This is the result when user click the level 2 shape button. In this page user need to drag all the component with the correct image until it locked. User also can click the menu button for go to the shape menu page.

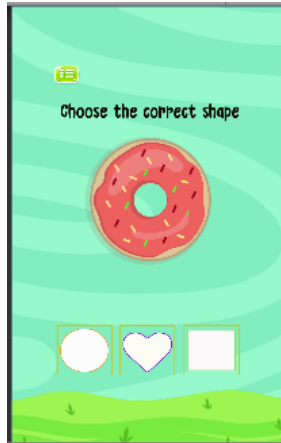


Figure 4.17 Shape Level 3 page

Figure 4.17 show the shape level 3 page. This is the result when user click the level 3 shape button. In this page user need to click the correct answer that given there. User also can click the menu button for go to the shape menu page.



Figure 4.18 Shape module report score

Figure 4.18 Shape module report score show the shape module report score. This is the result when user finish all the level. In this page will display total mark that user get. User also can click the menu button for go to the shape menu page.



Figure 4.19 Color menu page

Figure 4.19 Color menu page shows the color menu page. In this page user can select Let's Sing button or Let's Play button. User also can click the menu button for go to the main menu page

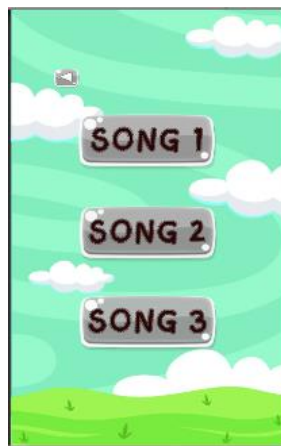


Figure 4.20 Color song menu

Figure 4.20 Color song menu show the color song menu page. In this page user can click song 1 button, song 2 button or song 3 button to view the shape video. User also can click the back button for go to the color menu page.

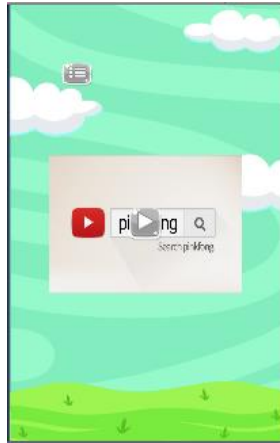


Figure 4.21 Color song page

Figure 4.21 Color song page show color song 1 page. This is the result when user click the song 1 button. User can click pause button to pause the video while watching. User also can click the menu button for go to the color menu page.



Figure 4.22 Color level menu page

Figure 4.22 Color level menu page show the color level menu page. This is the result when user click the let's play button. User can click level 1 button, level 2 button or level three to play the game. User also can click the back button for go to the color menu page.

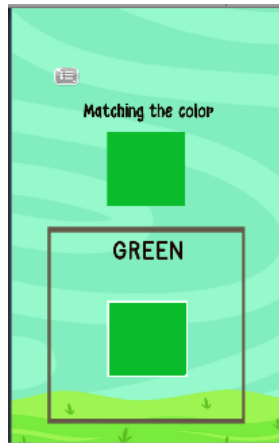


Figure 4.23 Color level 1 page

Figure 4.23 Color level 1 page show the color level 1 page. This is the result when user click the level 1 shape button. In this page user need to drag the triangle shape into the triangle in box until it locked. User also can click the menu button for go to the color menu page.

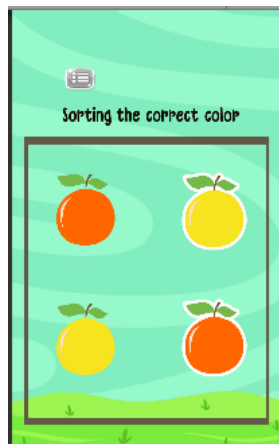


Figure 4.24 Color Level 2 page

Figure 4.24 Color Level 2 page show the color level 2 page. This is the result when user click the level 2 color button. In this page user need to drag all the component with the correct image until it locked. User also can click the menu button for go to the color menu page.

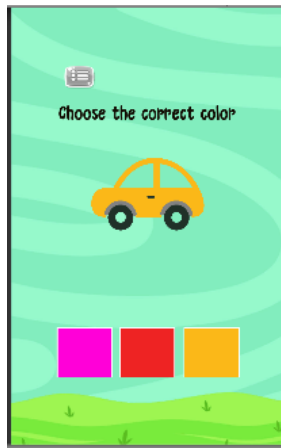


Figure 4.25 Color Level 3 page

Figure 4.25 Color Level 3 page show the color level 3 page. This is the result when user click the level 3 color button. In this page user need to click the correct answer that given there. User also can click the menu button for go to the color menu page.



Figure 4.26 Color module report score

Figure 4.18 Shape module report score show the color module report score. This is the result when user finish all the level. In this page will display total mark that user get. User also can click the menu button for go to the color menu page.



Figure 4.27 Number menu page

Figure 4.27 Number menu page shows the number menu page. In this page user can select Let's Sing button or Let's Play button. User also can click the menu button for go to the main menu page.

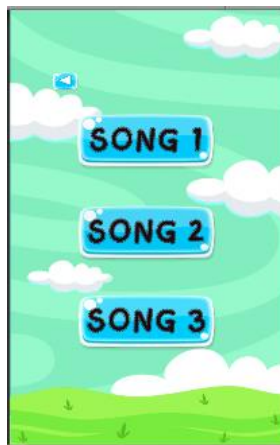


Figure 4.28 Number song menu page

Figure 4.28 Number song menu page show the number song menu page. In this page user can click song 1 button, song 2 button or song 3 button to view the shape video. User also can click the back button for go to the number menu page.



Figure 4.29 Number song 1 page

Figure 4.29 Number song 1 page show number song 1 page. This is the result when user click the song 1 button. User can click pause button to pause the video while watching. User also can click the menu button for go to the number menu page.



Figure 4.30 Number level menu page

Figure 4.30 Number level menu page show the number level menu page. This is the result when user click the let's play button. User can click level 1 button, level 2 button or level three to play the game. User also can click the back button for go to the number menu page.

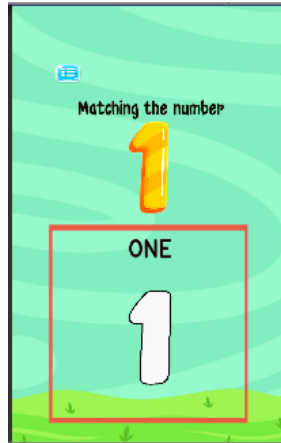


Figure 4.31 Number level 1 page

Figure 4.31 Number level 1 page show the number level 1 page. This is the result when user click the level 2 number button. In this page user need to drag only one component into the blank box until it locked. User also can click the menu button for go to the number menu page.

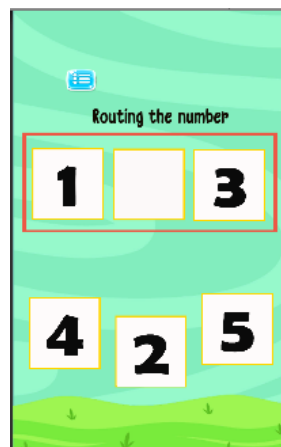


Figure 4.32 Number level 2 page

Figure 4.32 Number level 2 page show the number level 2 page. This is the result when user click the level 2 number button. In this page user need to drag only one component into the blank box until it locked. User also can click the menu button for go to the number menu page.



Figure 4.33 Number level 3 page

Figure 4.33 Number level 3 page show the number level 3 page. This is the result when user click the level 3 number button. In this page user need to click the correct answer that given there. User also can click the menu button for go to the number menu page.



Figure 4.34 Number module report score

Figure 4.34 Number module report score show the shape module report score. This is the result when user finish all the level. In this page will display total mark that user get. User also can click the menu button for go to the number menu page.

4.3 TESTING AND RESULT DISCUSSION

In this process, testing is one of the essential parts and it will keep running during development process. Testing will be done after implementation stage complete, depends on upgrade or update that have been made.

4.3.1 Functional Testing

The functional testing part of the testing methodology is divided into four component which are Unit Testing, Integration Testing, System Testing and Acceptance Testing. Each of them will interpreted below:

i. Unit testing

In this testing, the developer of AELA will test each of the module available in this application. If there any error occurred, the error will be settled down by the developers and run the test again.

ii. Integration Testing

After past of Unit Testing, the Integration Testing is run to the AELA to ensure there is no error between each of the module integrated together. This test proved all the module can communicate among other module.

iii. System Testing

For this part the whole AELA is tested for its functionality, interdependency and communication. System Testing verifies that functional and non-functional requirements in AELA has been made.

iv. User Acceptance Testing

This part is where the application is presented to the client to make sure it operates as expected and meets all the defined requirement. They will verify that delivered application meets all the requirement and the application is ready to use. Further detail on UAT can be referred in Appendix E.

v. Usability Testing

For AELA there are 3 respondents involved in this usability test which is autism kids four to six years old. They were test to use the application and their parent will answer a few questionnaires to give a feedback that can be referred in Appendix F.

Based on the testing, it can be concluded that AELA is helpful to the autism kids for learning process. The result is shown in Figure 4.35 **Bar Chart of acceptance application**. From the graph showing that all of the autism kids progress is increasing after play level by level.

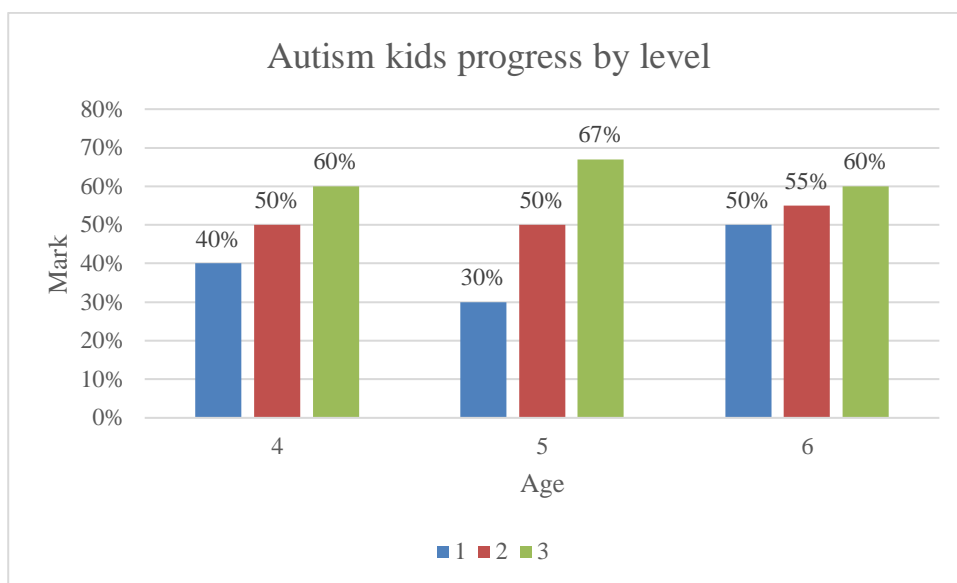


Figure 4.35 Bar Chart of acceptance application

4.3.2 User Manual

User manual is a technical communication document design to give a guidance for the user that use the application. In user manual will explain all the function of AELA and describe the way how to use the applications step by step. This user manual can be referred in Appendix G.

CHAPTER 5

CONCLUSION

5.1 INTRODUCTION

For the conclusion, An Effective Learning Application for Autism Spectrum Disorder (AELA) was proposed to help the parent give an early exposure to the autism kids about shape, color and number. This project was developed based on requirements from Permata Kurnia, Kuala Lumpur.

By doing this project, the essential part was focused on designing and developing the application in order to achieve all the objectives that have been stated earlier. All the objectives of this project are achieved successfully based on positive feedback from the user. The first objective is to study the related autism application and find the idea to improve it. The second objective is to develop a mobile application via game based on module learning for autism kids and the third objective is to evaluate the functionality of the purpose mobile application for android user.

Methodology is the most crucial approach in a development of a project. To make the project smooth, RAD had been used in this development. It consists of four (4) phases which are requirement planning, system design, development and cutover. It is very simple to understand and use. Therefore, each process will run smoothly without major problems.

5.2 PROJECT CONSTRAINT

There some constraints in implementing this project. The constraints for this project are as follows:

- i. Development tools.

For implement the application I have changed development tools by three time because I cannot find the suitable tools to make the application more efficient.

- ii. Lack of knowledge in Unity

Normally, to make game application we need to learn game programming for some basic knowledge. Apart from that, the subject just as an elective which is not compulsory for my course. As a result, I need to learn by myself and asked friend for help.

5.3 FUTURE WORK

There are several enhancements that can be carried out for future improvement of AELA.

- i. Develop the application using iOS version for multiple platform to make sure that AELA can use widely.
- ii. Add a database for keep in track the autism progress throughout the game. Those data are useful for the parent to monitor their kids progress. The data also useful for the developer team to increase the feature and performance of AELA.
- iii. Add more activity for the game such as tracing and colouring for increase the occupational therapy skill of autism kids. This will be one of the many factors to make the user choose AELA other than existed application out there.

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<https://play.google.com/store/apps/details?id=com.expensenote.orca.expensenote>

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APPENDIX A (LIST OF REQUIREMENTS)

No.	Requirement	Description
1.	[SRS-AELA-01]	Develop three basic module :- shape, color and number consist of 3 level which follow autism learning syllabus.
2.	[SRS-AELA-02]	The application must include video as a tutorial.
3.	[SRS-AELA-03]	The application can display the mark after finish answer the question.

APPENDIX B (SOFTWARE REQUIREMENT SPECIFICATION (SRS))

1.0 PRODUCT DESCRIPTION

1.1 User characteristics

An Effective Learning Application for Autism Spectrum Disorder has an autism kids as a user. They have their own unique characteristics requirement for the system usability. Below is detail of user:

Table 1.1: User Characteristics

User	Education Level	Background experience
Autism Kids	Autism kids age two to six years old.	Know how to use smartphone.

1.2 Constraints

The sub-section below will explain briefly the constraints that consider when the development of this project is done.

- i. Only android user can use the application.

2.0 INTERFACE REQUIREMENTS

This should be detailed description of all inputs and outputs from the software system.

2.1 User Interface

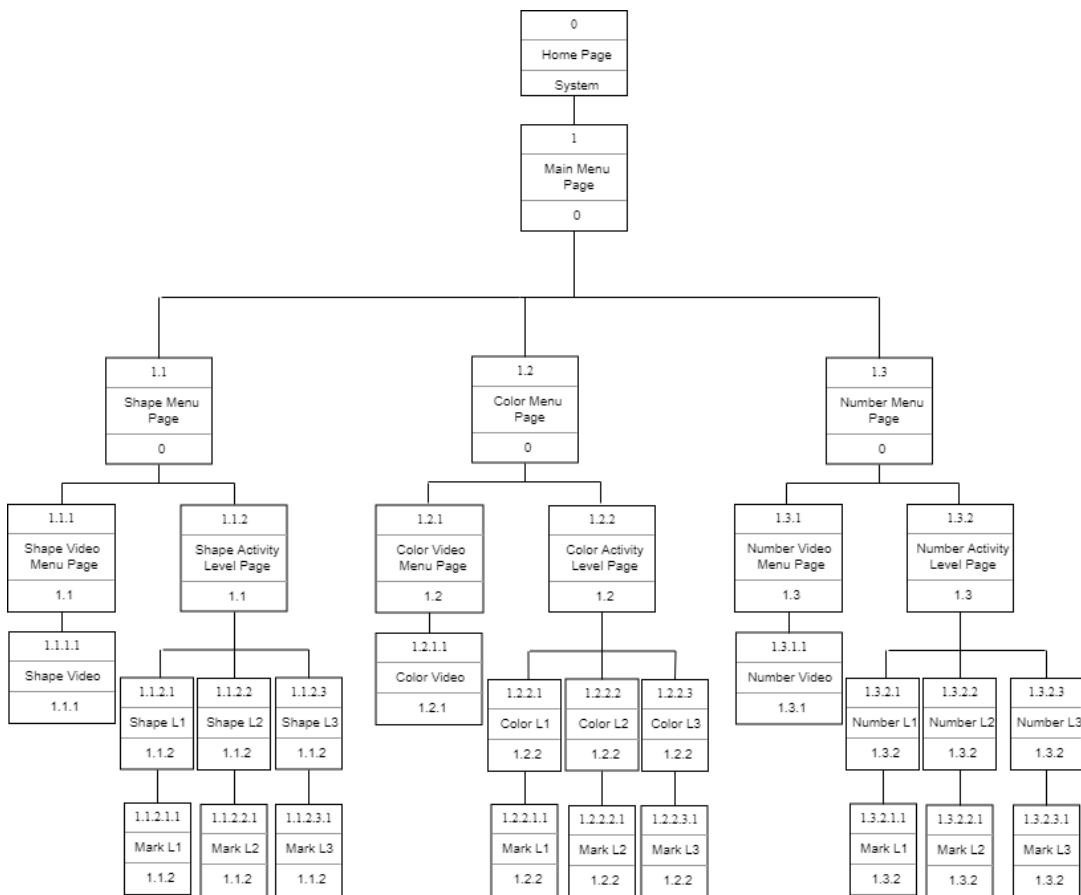


Figure 2.1 Dialogue Diagram of An Effective Learning Application for Autism Spectrum Disorder

Table 2.1 User Interface Description

User Interface Name	Description	User Interface Layout
Home Page	The interface of the AELA and provide button play that allow user to access the application and button exit to quit the application.	Refer Appendix B.1
Main Menu Page	This interface shows list of modules that have in the application.	Refer Appendix B.2
Shape Menu Page	This interface consists of two menu which are “LET’S SING” and “LETS PLAY” of the shape.	Refer Appendix B.3
Shape Video Menu Page	This interface provides list of shape video that kids can view.	Refer Appendix B.4
Shape Activity Level Page	This interface shows three level menu of shape which is level 1, level 2 and level 3.	Refer Appendix B.5
Shape Level 1 Page	This page consists of activities that need kids to answer the question for level 1 of shape module.	Refer Appendix B.6
Shape Level 2 Page	This page consists of activities that need kids to answer the question for level 2 of shape module.	Refer Appendix B.7
Shape Level 3 Page	This page consists of activities that need kids to answer the question for level 3 of shape module.	Refer Appendix B.8

Color Menu Page	This interface consists of two menu which are “LET’S SING” and “LETS PLAY” of the color.	Refer Appendix B.9
Color Video Menu Page	This interface provides list of color video that kids can view.	Refer Appendix B.10
Color Activity Level Page	This interface shows three level menus of color which is level 1, level 2 and level 3.	Refer Appendix B.11
Color Level 1 Page	This page consists of activities that need kids to answer the question for level 1 of color module.	Refer Appendix B.12
Color Level 2 Page	This page consists of activities that need kids to answer the question for level 2 of color module.	Refer Appendix B.13
Color Level 3 Page	This page consists of activities that need kids to answer the question for level 3 of color module.	Refer Appendix B.14
Number Menu Page	This interface consists of two menu which are “LET’S SING” and “LETS PLAY” of the number.	Refer Appendix B.15
Number Video Menu Page	This interface provides list of number video that kids can view.	Refer Appendix B.16
Number Activity Level Page	This interface shows three level menu of number which is level 1, level 2 and level 3.	Refer Appendix B.17

Number Level 1 Page	This page consists of activities that need kids to answer the question for level 1 of number module.	Refer Appendix B.18
Number Level 2 Page	This page consists of activities that need kids to answer the question for level 2 of number module.	Refer Appendix B.219
Number Level 3 Page	This page consists of activities that need kids to answer the question for level 3 of number module.	Refer Appendix B.20

2.2 Hardware Interface

Not Applicable

2.3 Software Interface

Not Applicable

3.0 SOFTWARE PRODUCT FEATURES

3.1 Use Case Diagram

Figure 3.1 below shows the Use Case diagram from An Effective Learning Application for Autism Spectrum Disorder. This application consists of four main function and one actor involved.

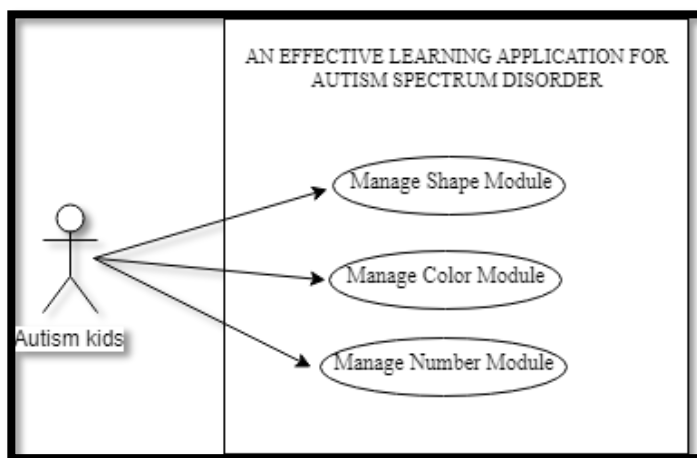


Figure 3.1 Use Case Diagram of An Effective Learning Application for Autism Spectrum Disorder.

The following are the list of use case description:

i. Manage Shape Module

Autism kids can select the “LET’S SING” button or “LET’S PLAY” button in the shape module menu. In ‘LET’S SING’ menu, they can view all the shape video while in the ‘LET’S PLAY’ menu, the kids can play a shape game which consist of three level.

ii. Manage Color Module

Autism kids can select the “LET’S SING” button or “LET’S PLAY” button in the color module menu. In ‘LET’S SING’ menu, they can view all the color video while in the ‘LET’S PLAY’ menu, the kids can play a shape game which consist of three level.

iii. Manage Number Module

Autism kids can select the “LET’S SING” button or “LET’S PLAY” button in the number module menu. In ‘LET’S SING’ menu, they can view all the number video while in the ‘LET’S PLAY’ menu, the kids can play a shape game which consist of three level.

3.1.1 Use Case Manage Shape Module

Use case for Manage Shape Module is shown in Figure 3.2 Use case description for Manage Shape Module was explained in Table 3.1

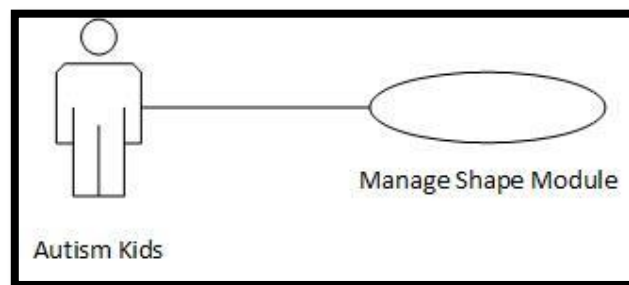


Figure 3.2 Use Case Manage Shape Module

Table 3.1: Use Case Description for Manage Shape Module

Use Case ID	AELA_UC1
Use Case Name	Manage Shape Module
Brief Description	This use case is for autism kids play the shape module.
Actor	Autism Kids.
Pre-Conditions	Autism kids click start button.
Basic Flow	<ol style="list-style-type: none"> 1. User click the Shape Module. 2. User click “Let’s Play” button shape. [A1] 3. User select level 1 & 2 button. [A2] 4. User play the game and the time started. 5. User pass the game 6. Application show the mark based on time taken to complete the question. 7. User goes to next question. 8. Application repeat step 4 until 7 for five times. 9. Application display the total mark in every level. 10. End use case.
Alternative Flow	<p>A1: User click “Let’s Sing” shape button</p> <ol style="list-style-type: none"> 1.1 User select list of the song. 1.2 User view the video. 1.3 End use case. <p>A2: User click level 3 button.</p> <ol style="list-style-type: none"> 2.1 User play the game. 2.2 User pass the game. 2.3 Application show the mark base on the correct answer. 2.4 User goes to next question.

	2.5 Application repeat step 4 until 7 for five times 2.6 Application display the total mark. 2.7 End Use case.
Exception Flow	N/A
Post-Conditions	User have completed the activity.
Rules	1. User must pass each question to go next question.
Constraints	-
Sequence Diagram	Refer Appendix B-1: Sequence Diagram for Manage Shape Module

3.1.2 Use Case Manage Colour Module

Use case for Manage Colour Module is shown in Figure 3.3 Use case description for Manage Colour Module was explained in Table 3.2

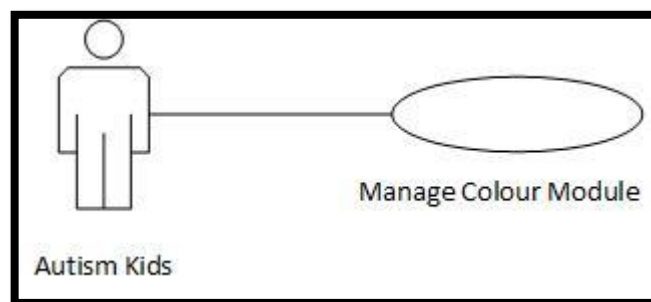


Figure 3.3 Use Case Manage Colour Module

Table 3.2: Use Case Description for Manage Colour Module

Use Case ID	AELA_UC2
Use Case Name	Manage Color Module
Brief Description	This use case is for autism kids play the shape module.
Actor	Autism Kids.
Pre-Conditions	Autism kids click start button.
Basic Flow	<ol style="list-style-type: none"> 1. User click the Color Module. 2. User click “Let’s Play” button color. [A1] 3. User select level 1 & 2 button. [A2] 4. User play the game and the time started. 5. User pass the game 6. Application show the mark based on time taken to complete the question. 7. User goes to next question. 8. Application repeat step 4 until 7 for five times. 9. Application display the total mark in every level. 10. End use case.
Alternative Flow	<p>A1: User click “Let’s Sing” color button</p> <ol style="list-style-type: none"> 1.1 User select list of the song. 1.2 User view the video. 1.3 End use case. <p>A2: User click level 3 button.</p> <ol style="list-style-type: none"> 2.1 User play the game. 2.2 User pass the game. 2.3 Application show the mark base on the correct answer. 2.4 User goes to next question.

	2.5 Application repeat step 4 until 7 for five times 2.6 Application display the total mark. 2.7 End Use case.
Exception Flow	N/A
Post-Conditions	User have completed the activity.
Rules	2. User must pass each question to go next question.
Constraints	-
Sequence Diagram	Refer Appendix B-2: Sequence Diagram for Manage Color Module

3.1.3 Use Case Manage Number Module

Use case for Manage Number Module is shown in Figure 3.4 Use case description for Manage Number Module was explained in Table 3.3

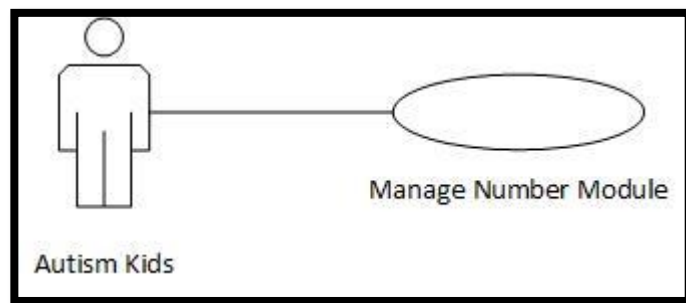


Figure 3.4 Use Case Manage Number Module

Table 3.3: Use Case Description for Manage Number Module

Use Case ID	AELA_UC3
Use Case Name	Manage Shape Module
Brief Description	This use case is for autism kids play the shape module.
Actor	Autism Kids.
Pre-Conditions	Autism kids click start button.
Basic Flow	<ol style="list-style-type: none"> 1. User click the Number Module. 2. User click “Let’s Play” button number. [A1] 3. User select level 1 & 2 button. [A2] 4. User play the game and the time started. 5. User pass the game 6. Application show the mark based on time taken to complete the question. 7. User goes to next question. 8. Application repeat step 4 until 7 for five times. 9. Application display the total mark in every level. 10. End use case.
Alternative Flow	<p>A1: User click “Let’s Sing” number button.</p> <ol style="list-style-type: none"> 1.1 User select list of the song. 1.2 User view the video. 1.3 End use case. <p>A2: User click level 3 button.</p> <ol style="list-style-type: none"> 2.1 User play the game. 2.2 User pass the game. 2.3 Application show the mark base on the correct answer. 2.4 User goes to next question.

	<p>2.5 Application repeat step 4 until 7 for five times</p> <p>2.6 Application display the total mark.</p> <p>2.7 End Use case.</p>
Exception Flow	N/A
Post-Conditions	User have completed the activity.
Rules	1. User must pass each question to go next question.
Constraints	-
Sequence Diagram	<p>Refer Appendix</p> <p>B-3: Sequence Diagram for Manage Number Module</p>

4.0 REQUIREMENTS TRACEABILITY

Table 3.4: Requirement Traceability for AELA

NO	ID	Details	Source
1.	AELA_UC1_01	Autism kids can view the shape video	Stakeholder
2.	AELA_UC1_02	Autism kids can play the shape activity based on the level.	Stakeholder
3.	AELA_UC1_03	Autism kids can view mark upon completion of each level of shape.	Stakeholder
4.	AELA_UC2_04	Autism kids can view the color video	Stakeholder
5.	AELA_UC2_05	Autism kids can play the color activity based on the level.	Stakeholder
6.	AELA_UC2_03	Autism kids can view mark upon completion of each level of color.	Stakeholder
7.	AELA_UC3_07	Autism kids can view the number video	Stakeholder
8.	AELA_UC3_08	Autism kids can play the number activity based on the level.	Stakeholder
9.	AELA_UC3_09	Autism kids can view mark upon completion of each level of number.	Stakeholder

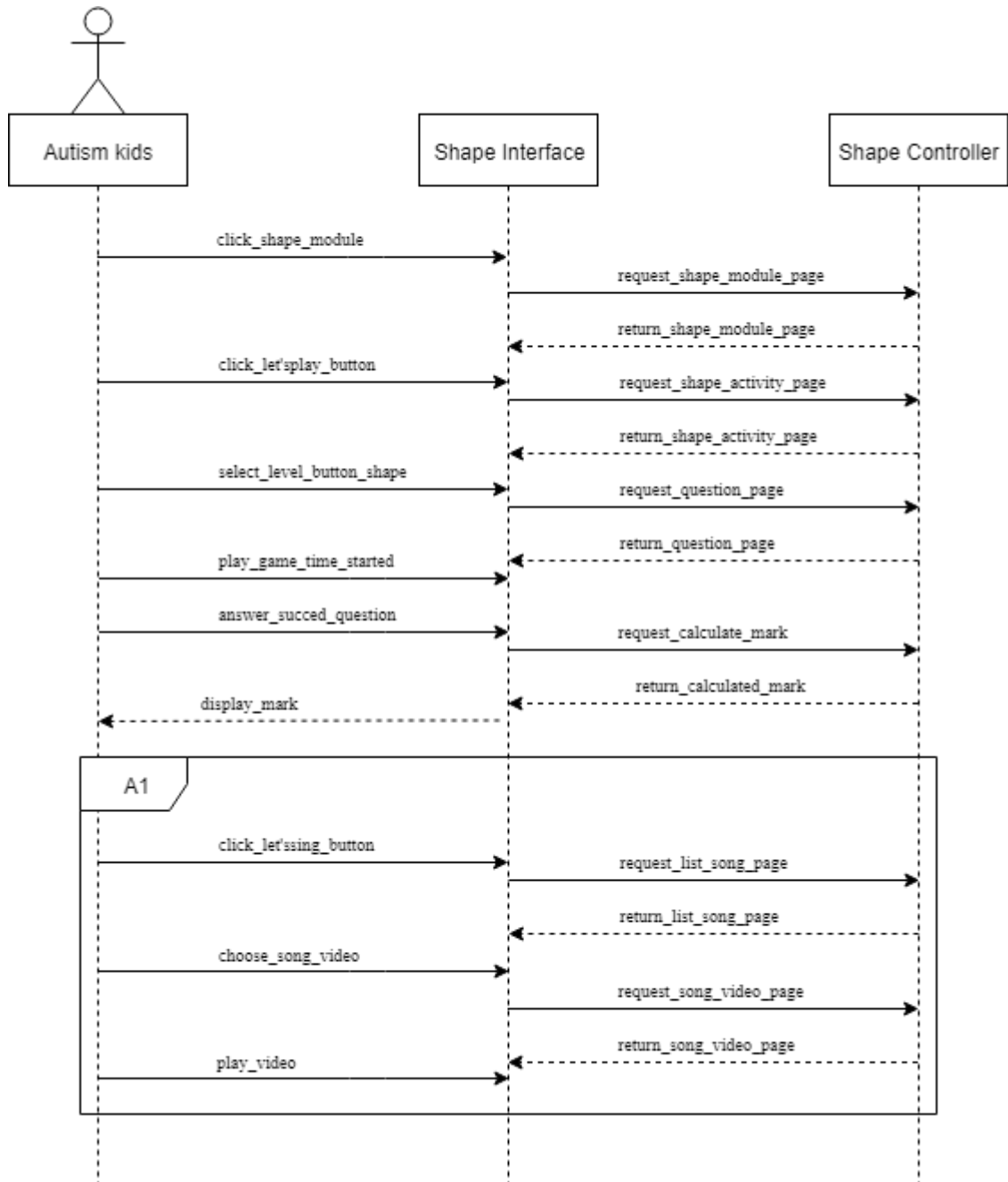
5.0 SYSTEM REQUIREMENTS APPROVAL

	Name	Date
Verified by: <hr/> Developer	NUR AQILAH BINTI OSMAN	
Approved by: <hr/> Client	PERMATA Kurnia	

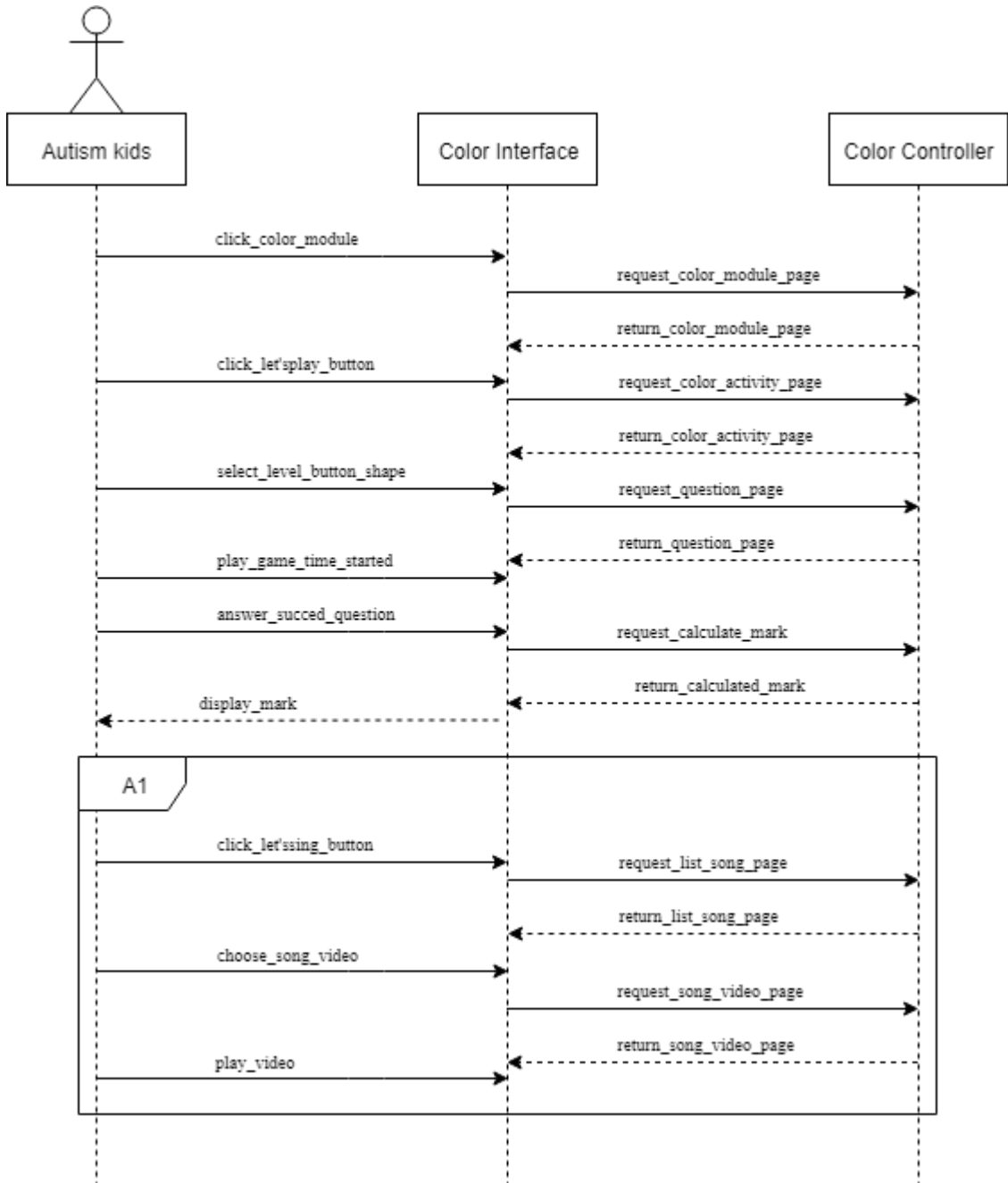
APPENDIX B-1

SEQUENCE DIAGRAM

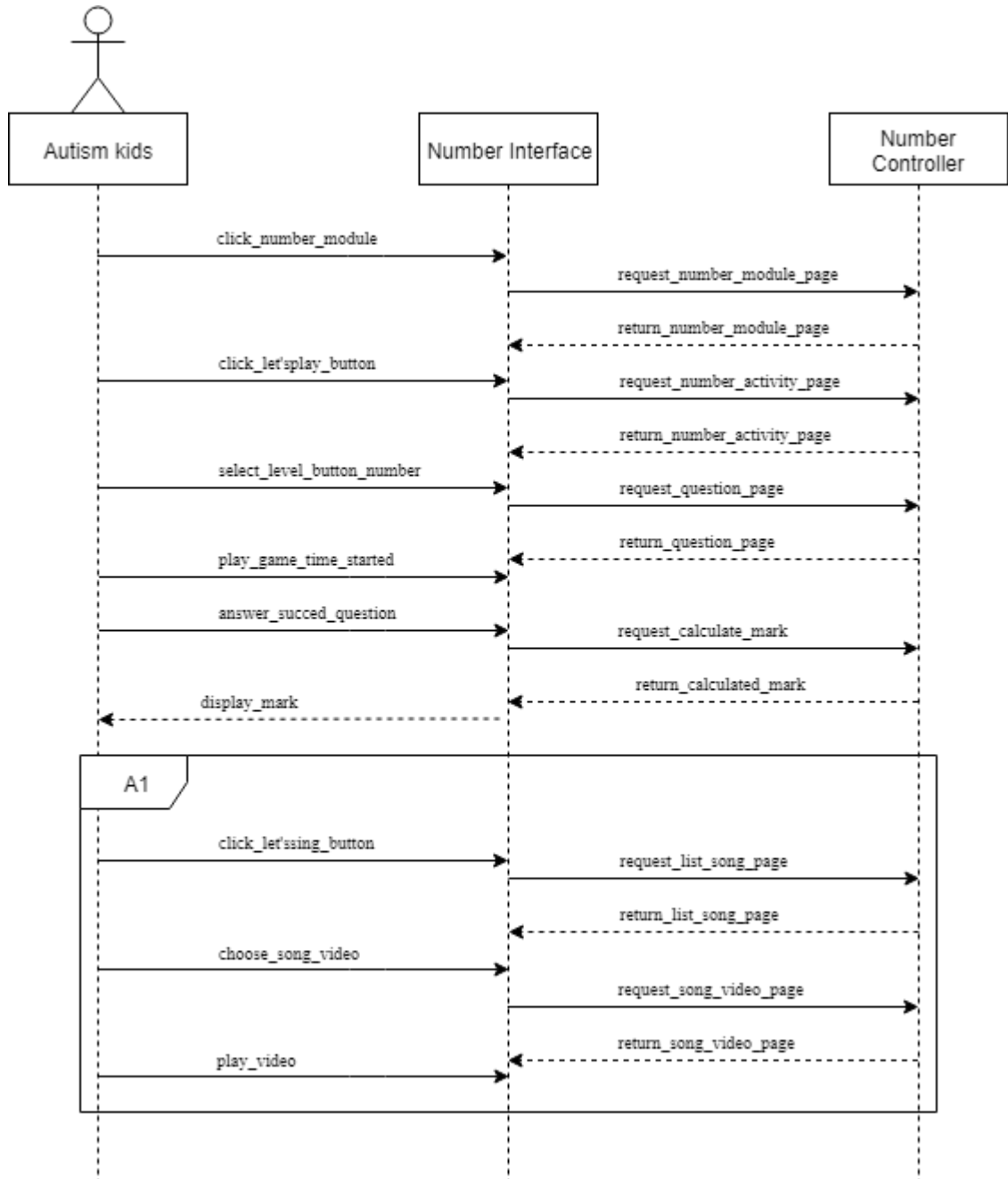
B-1: Sequence Diagram for Manage Shape Module



B-2: Sequence Diagram for Manage Shape Module



B-3: Sequence Diagram for Manage Number Module



APPENDIX B-2

USER INTERFACE

B.1 Home Page Interfaces



B.2 Main Menu Page Interface



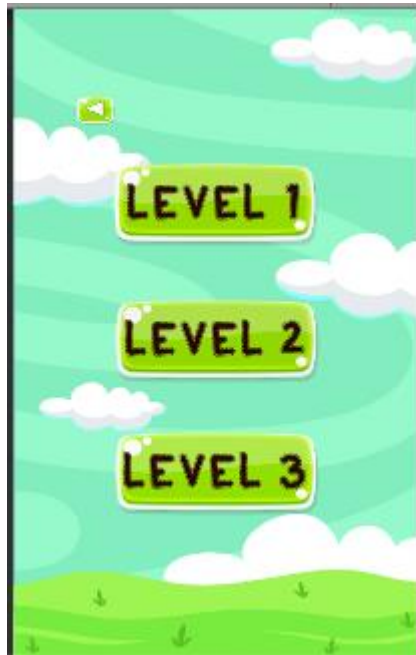
B.3 Shape Menu Page Interface



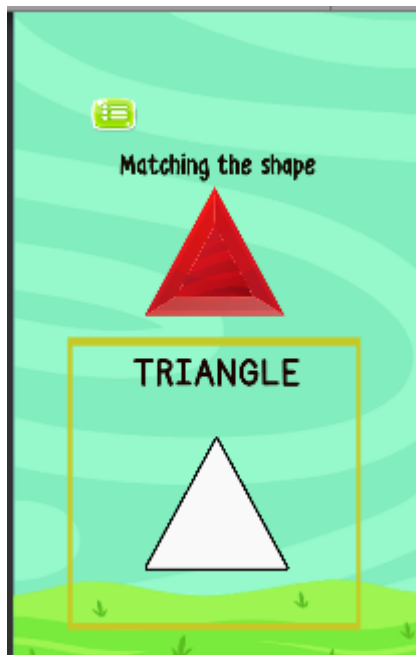
B.4 Shape Video Menu Page Interface



B.5 Shape Activity Level Page Interface



B.6 Shape Level 1 Page Interface



B.7 Shape Level 2 Page Interface



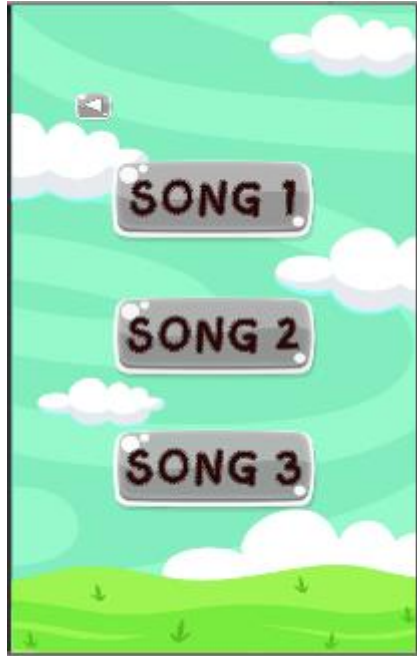
B.8 Shape Level 3 Interface



B.9 Color Menu Page Interface



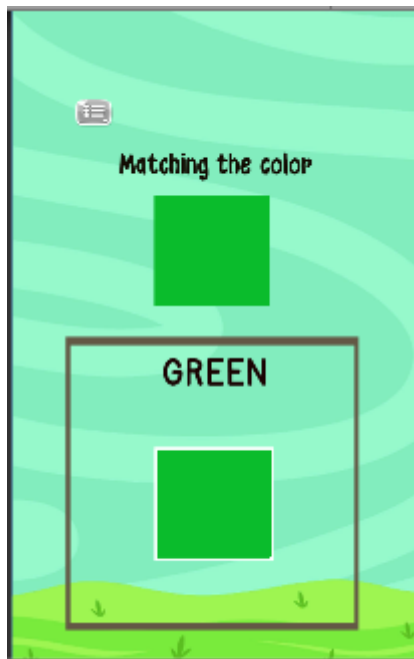
B.10 Color Video Menu Page Interface



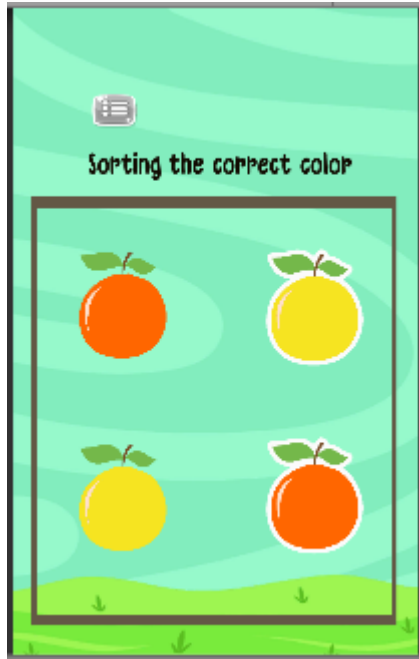
B.11 Color Activity Level Page Interface



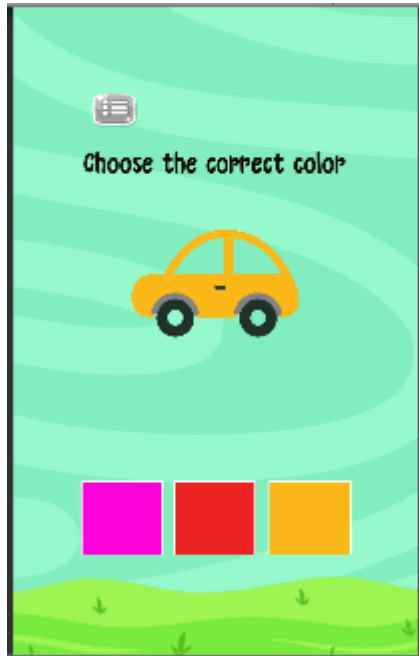
B.12 Color Level 1 Page Interfaces



B.13 Color Level 2 Page Interface



B.14 Color Level 3 Page Interface



B.15 Number Menu Page Interface



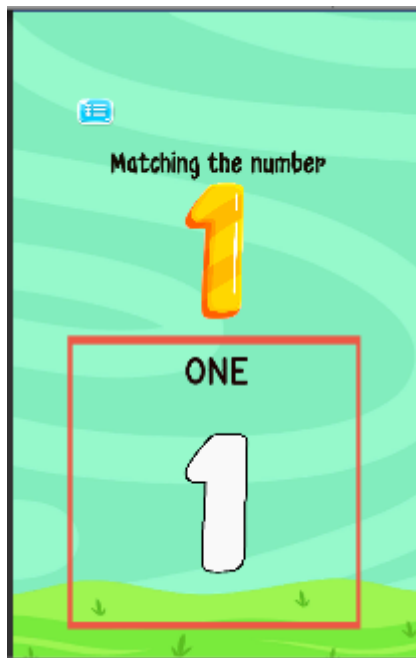
B.16 Number Video Menu Page Interface



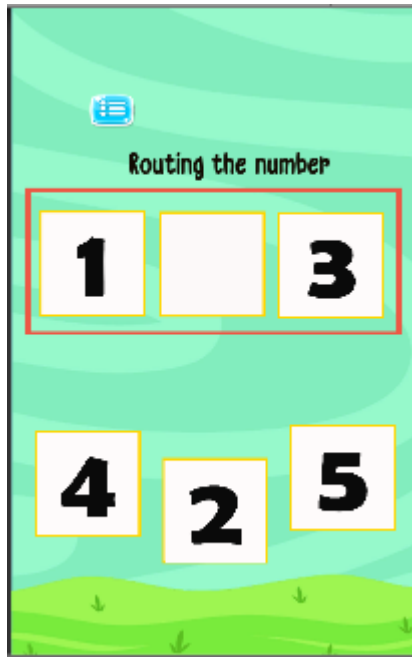
B.17 Number Activity Level Page Interface



B.18 Number Level 1 Page Interface



B.19 Number Level 2 Page Interface



B.20 Number 3 Page Interface



APPENDIX C
SOFTWARE DESIGN DOCUMENT(SDD)

1. DATA DICTIONARY

1.1 SHAPE MODULE

Table 1.1 Shape Module

Field Name	Description	Data Type	Type Constraint
shapeL1mark	Mark of level 1 question in shape module	integer	Null
shapeL2mark	Mark of level 2 question in shape module	integer	Null
shapeL3mark	Mark of level 3 question in shape module	integer	Null
shapeTotalmark	Total mark in every level of shape module	integer	Null

1.2 COLOUR MODULE

Table 1.2 Color Module

Field Name	Description	Data Type	Type Constraint
colorL1mark	Mark of level 1 question in color module	integer	Null
colorL2mark	Mark of level 2 question in color module	integer	Null
colorL3mark	Mark of level 3 question in color module	integer	Null
colorTotalmark	Total mark in every level of color module	integer	Null

1.3 NUMBER MODULE

Table 1.3 Number Module

Field Name	Description	Data Type	Type Constraint
numberL1mark	Mark of level 1 question in number module	integer	Null
numberL2mark	Mark of level 2 question in number module	integer	Null
numberL3mark	Mark of level 3 question in number module	integer	Null

numberTotalmark	Total mark in every level of number module	integer	Null
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2. PRELIMINARY DESIGN

2.1 System Architecture

This paragraph identifies the internal organization structure of the system.

The relationship among system subsystem will be described.

2.1.1 Static Organization

The static organization for An Effective Learning Application for Autism Spectrum Disorder is shown in Figure 2.1. It consists of three module which are Module, Color Module and Number Module

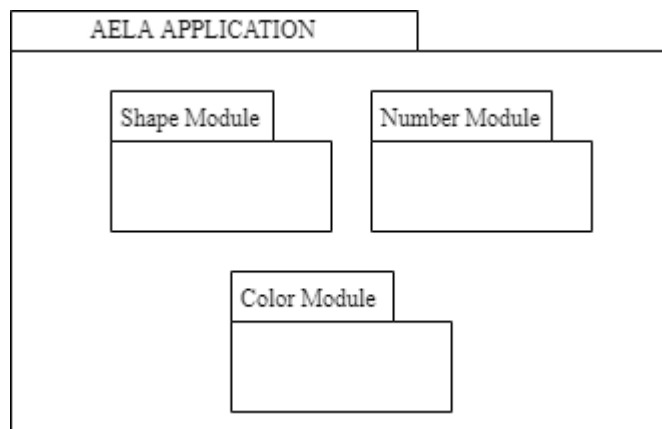


Figure 2.1 Static Organization of An Effective Learning Application for Autism Spectrum Disorder

Each package defines a set of roles in AELA. The packages of AELA is describe as following:

1. Shape Module

The shape module package is allowed autism kids to view the shape video and play the shape activity. This package consists of the following classes:

- a) ManageShapeModule class

2. Color Module

The colour module package is allowed autism kids to view the colour video and play the colour activity. This package consists of the following classes:

- a) ManageColorModule class

3. Number Module

The number module package is allowed autism kids to view the number video and play the number activity. This package consists of the following classes:

- a) ManageNumberModule class

2.1.2 Dynamic Organization

Figure 2.2 show components and their relationships between each other in the application.

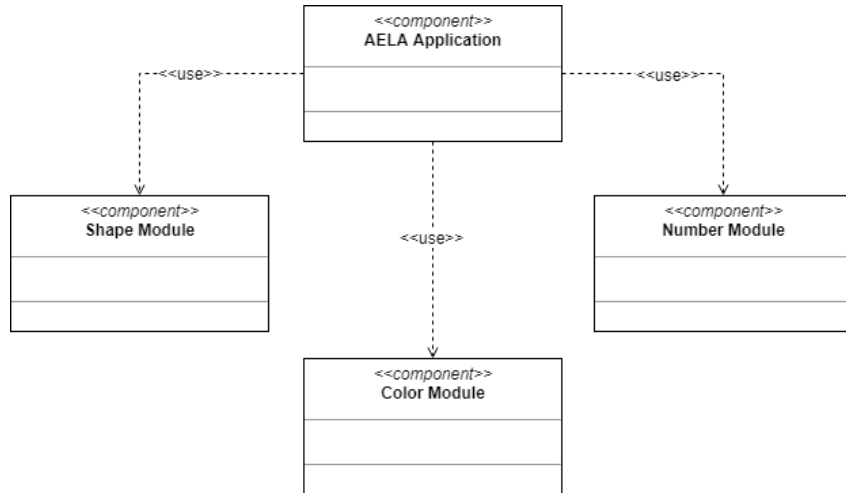


Figure 2.2 Component Diagram of An Effective Learning Application for Autism Spectrum Disorder

3. DETAILED DESIGN

This section divided into the following paragraphs and subparagraphs to describe each software unit of the systems.

3.1 Shape Module

Figure 3.1 shows Shape Module Detail Design. This subsystem need to describe the relationship among the other subsystem classes.

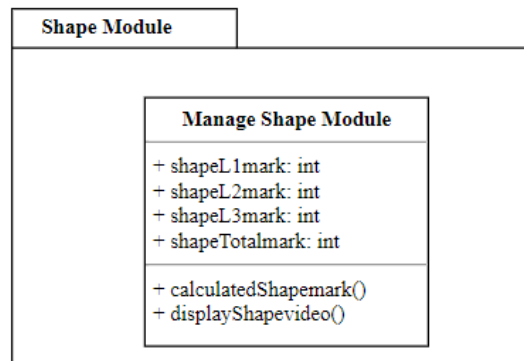


Figure 3.1 Shape Module Detail Design

3.1.1 Manage Shape Module class

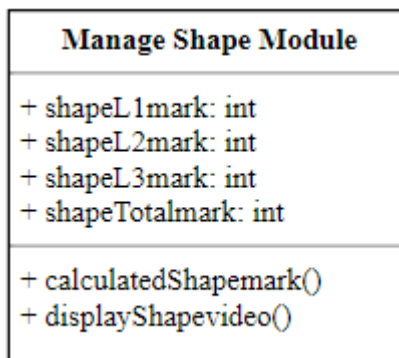


Figure 3.2 Manage Shape Module class

Class type : Manage Shape Module class
Responsibility : To manage all the operation in Shape Module.
Attribute : shapeL1mark, shapeL2mark, shapeL3mark,
shapeTotalmark
Method : calculateShapemark(): To do the calculation in shape module.
displayShapevideo(): To display the shape video.

3.2 Color Module

Figure 3.3 shows Color Module Detail Design. This subsystem needs to describe the relationship among the other subsystem classes.

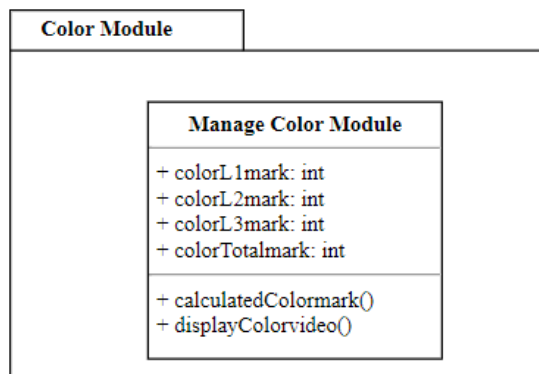


Figure 3.3 Colour Module Detail Design

3.2.1 Manage Colour Module class

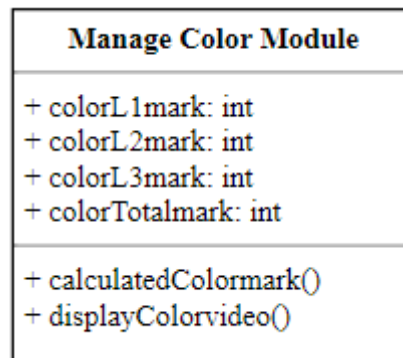


Figure 3.4 Manage Colour Module class

Class type : Manage Shape Module class
Responsibility : To manage all the operation in Shape Module.
Attribute : colorL1mark, colorL2mark, colorL3mark, colorTotalmark
Method : calculateColormark(): To do the calculation in shape module.
displayColorvideo(): To display the color video.

3.3 Number Module

Figure 3.5 shows Number Module Detail Design. This subsystem needs to describe the relationship among the other subsystem classes.

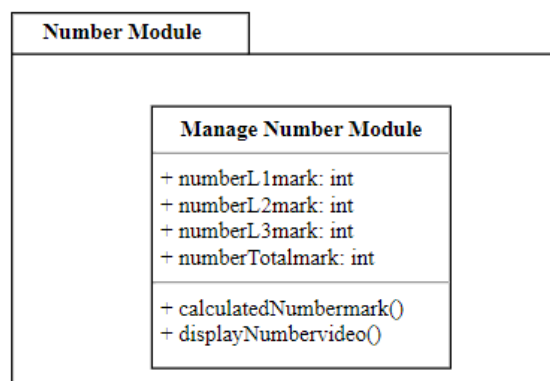


Figure 3.5 Number Module Detail Design

3.3.1 Manage Number Module class

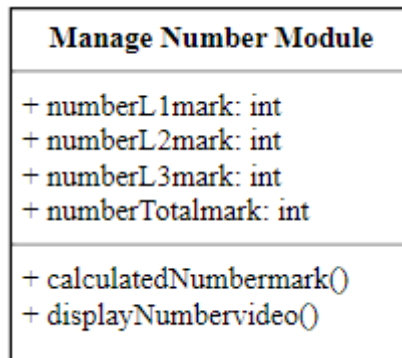


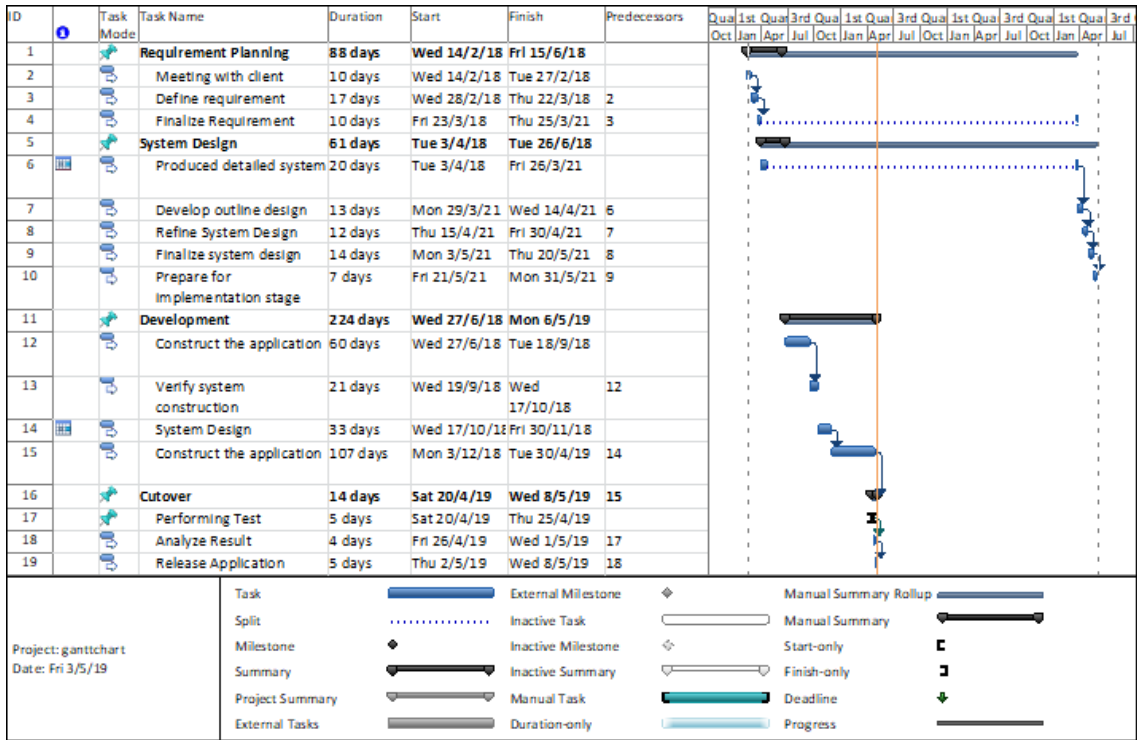
Figure 3.6 Manage Number Module class

Class type : Manage Shape Module class
 Responsibility : To manage all the operation in Shape Module.
 Attribute : colorL1mark, colorL2mark, colorL3mark, colorTotalmark
 Method : calculateColormark(): To do the calculation in shape module.
 displayColorvideo(): To display the color video.

4. SYSTEM APPROVAL

	Name	Date
Verified by: <hr/> Developer	NUR AQILAH BINTI OSMAN	
Approved by: <hr/> Client	PERMATA Kurnia	

APPENDIX D (GANTT CHART)



APPENDIX E (USER ACCEPTANCE TEST)

1. TESTING REPORT

The purpose of this section is to recorded the User Acceptance Test (UAT) process for AELA application. Approval of this testing implies that reviewers are confident that following the execution of the test plan, the resulting system will be considered full- tested and eligible for implementation.

Test Case for Main Menu Module

Event	Test Data	Expected result	Pass	Fail	Comment
Click on 'Home' button	-	Navigate to Home scene	Pass		
Click on 'Shape' button	-	Navigate to Shape scene	Pass		
Click on 'Color' button	-	Navigate to Color scene	Pass		
Click on 'Number' button	-	Navigate to Number scene	Pass		

Test case for Shape Module

Event	Test Data	Expected Result	Pass	Fail	Comment
Click on 'Level' button (Shape Menu)	-	Navigate to Main Menu scene	Pass		
Click on 'Let's Sing' button	-	Navigate to Shape Video Menu scene	Pass		
Click on 'Let's Play' button	-	Navigate to Shape Activity Level scene	Pass		
Click on 'Song 1' button	-	Navigate to Shape video 1 scene	Pass		
Click on 'Song 2' button	-	Navigate to Shape video 2 scene	Pass		
Click on 'Song 3' button	-	Navigate to Shape video 3 scene	Pass		
Click on 'Level 1' button	-	Navigate to Shape Level 1 scene	Pass		
Click on 'Level 2' button	-	Navigate to Shape Level 2 scene	Pass		

Click on 'Level 3' button	-	Navigate to Shape Level 3 scene	Pass		
Click on 'back' button (Shape video)	-	Navigate to Shape Menu scene	Pass		
Click on 'level' button (Shape Level 1)	-	Navigate to Shape Menu scene	Pass		
Click on 'level' button (Shape Level 2)	-	Navigate to Shape Menu scene	Pass		
Click on 'level' button (Shape Level 3)	-	Navigate to Shape Menu scene	Pass		

Test case for Color Module

Event	Test Data	Expected Result	Pass	Fail	Comment
Click on 'Level' button (Color Menu)	-	Navigate to Main Menu scene	Pass		
Click on 'Let's Sing' button	-	Navigate to Color Video Menu scene	Pass		
Click on 'Let's Play' button	-	Navigate to Color Activity Level scene	Pass		
Click on 'Song 1' button	-	Navigate to Color video 1 scene	Pass		
Click on 'Song 2' button	-	Navigate to Color video 2 scene	Pass		
Click on 'Song 3' button	-	Navigate to Color video 3 scene	Pass		
Click on 'Level 1' button	-	Navigate to Color Level 1 scene	Pass		
Click on 'Level 2' button	-	Navigate to Color Level 2 scene	Pass		
Click on 'Level 3' button	-	Navigate to Color Level 3 scene	Pass		
Click on 'back' button (Color video)	-	Navigate to Color Menu scene	Pass		
Click on 'level' button (Color Level 1)	-	Navigate to Color Menu scene	Pass		
Click on 'level' button	-	Navigate to Color Menu scene	Pass		

(Color Level 2)					
Click on 'level' button (Color Level 3)	-	Navigate to Color Menu scene	Pass		

Test case for Number Module

Event	Test Data	Expected Result	Pass	Fail	Comment
Click on 'Level' button (Number Menu)	-	Navigate to Main Menu scene	Pass		
Click on 'Let's Sing' button	-	Navigate to Number Video Menu scene	Pass		
Click on 'Let's Play' button	-	Navigate to Number Activity Level scene	Pass		
Click on 'Song 1' button	-	Navigate to Number video 1 scene	Pass		
Click on 'Song 2' button	-	Navigate to Number video 2 scene	Pass		
Click on 'Song 3' button	-	Navigate to Number video 3 scene	Pass		
Click on 'Level 1' button	-	Navigate to Number Level 1 scene	Pass		
Click on 'Level 2' button	-	Navigate to Number Level 2 scene	Pass		
Click on 'Level 3' button	-	Navigate to Number Level 3 scene	Pass		
Click on 'back' button (Number video)	-	Navigate to Number Menu scene	Pass		
Click on 'level' button (Number Level 1)	-	Navigate to Number Menu scene	Pass		
Click on 'level' button (Number Level 2)	-	Navigate to Number Menu scene	Pass		
Click on 'level' button (Number Level 3)	-	Navigate to Number Menu scene	Pass		

APPENDIX F (QUESTIONNAIRE)

Questionnaire of the An Effective Learning Application for Autism Spectrum Disorder (AELA)

A. General Information

1. Kids Age:

2 years old

3 years old

4 years old

5 years old

6 years old

2. Kids Sex:

Male Female

B. Parent observation

BIL	Question	Yes	No
1.	Does the application is easy to use for the autism kids?		
2.	Does the design applicable for the autism kids to attract their attention?		
3.	Does the time limit for answer the question is suitable to the autism kids?		
4.	Does the application help the autism kids in learning process?		
5.	Does the autism kids enjoy playing the application?		

APPENDIX G (USER MANUAL)

1. GENERAL INFORMATION

1.1 Application Overview

The application entitled An Effective Learning Application for Autism Spectrum Disorder. This application is mobile application using Android platform. The user for this application is autism kids which is two to six-year-old. This application consists of three module which is Shape, Color and Number.

1.2 Organizational of the Manual

This user manual is divided into three (3) parts; first part is about general information of the system. Second part of this user manual is system summary while user guideline is the last part of this manual.

2. SYSTEM SUMMARY

2.1 System Configuration

An Effective Learning Application for Autism Spectrum Disorder only can be run and support by android smartphone only.

2.2 User Access Level

For this application user is focus to autism kids which is two to six years old. Autism kids can access all the module in the application.

2.3 Contingencies and Alternates mode of operation

None

3. GETTING STARTED

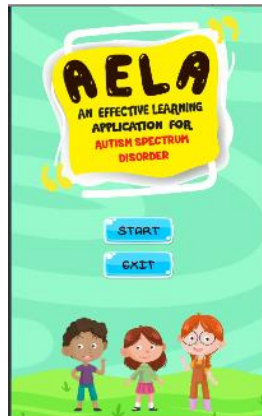
3.1 Installation the application

To use this application, user have to download the application from the Android Play store.

- i. Open the App Store and search for “AELA”.
- ii. Download and install AELA mobile app on your device.
- iii. Open the AELA mobile app and you are ready to go.

3.2 Application Menu

- i. Home page



Functions:

- i. Click <<Start>> button to go to Main Menu page.
- ii. Click <<Exit>> button to quit the application.

ii. Main Menu page



Functions:

- i. Click <<Shape>> button to go to Shape Menu page.
- ii. Click <<Color>> button to go to Color Menu page.
- iii. Click <<Number>> button to go to Number Menu page.
- iv. Click <<Home>> button to go to Home page.

iii. Shape Menu page



Functions:

- i. Click <<Let's Sing>> button to go to Shape Video page.
- ii. Click <<Let's Play>> button to go to Shape Activity Level page.
- iii. Click <<menu>> button to go to Main Menu page.

iv. Color Menu page



Functions:

- i. Click <<Let's Sing>> button to go to Color Video page.
- ii. Click <<Let's Play>> button to go to Color Activity Level page.
- iii. Click <<menu>> button to go to Main Menu page.

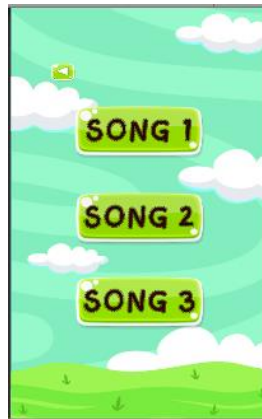
v. Number Menu page



Functions:

- i. Click <<Let's Sing>> button to go to Number Video page.
- ii. Click <<Let's Play>> button to go to Number Activity Level page.
- iii. Click <<menu>> button to go to Main Menu page.

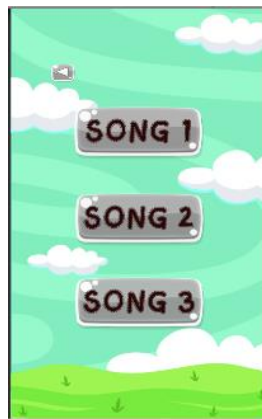
vi. Shape Video Menu page



Functions:

- i. Click <<Song 1>> button to go to Shape Song Video1 page.
- ii. Click <<Song 2>> button to go to Shape Song Video2 page.
- iii. Click <<Song 3>> button to go to Shape Song Video3 page.
- iv. Click <<back>> button to go to Shape Menu page.

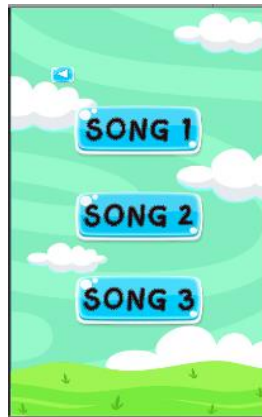
vii. Color Video Menu page



Functions:

- i. Click <<Song 1>> button to go to Color Song Video1 page.
- ii. Click <<Song 2>> button to go to Color Song Video2 page.
- iii. Click <<Song 3>> button to go to Color Song Video3 page.
- iv. Click <<back>> button to go to Color Menu page.

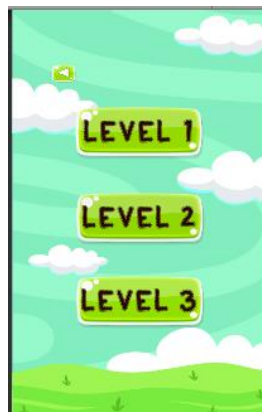
viii. Number Video Menu page



Functions:

- i. Click <<Song 1>> button to go to Number Song Video1 page.
- ii. Click <<Song 2>> button to go to Number Song Video2 page.
- iii. Click <<Song 3>> button to go to Number Song Video3 page.
- iv. Click <<back>> button to go to Number Menu page.

ix. Shape Activity Level Menu page



Functions:

- i. Click <<Level 1>> button to go to Shape Level 1 page.
- ii. Click <<Level 2>> button to go to Shape Level 2 page.
- iii. Click <<Level 3>> button to go to Shape Level 3 page.
- iv. Click <<back>> button to go to Shape Menu page.

x. Color Activity Level Menu page



Functions:

- i. Click <<Level 1>> button to go to Color Level 1 page.
- ii. Click <<Level 2>> button to go to Color Level 2 page.
- iii. Click <<Level 3>> button to go to Color Level 3 page.
- iv. Click <<back>> button to go to Color Menu page.

xi. Number Activity Level Menu page



Functions:

- i. Click <<Level 1>> button to go to Number Level 1 page.
- ii. Click <<Level 2>> button to go to Number Level 2 page.
- iii. Click <<Level 3>> button to go to Number Level 3 page.
- iv. Click <<back>> button to go to Number Menu page.

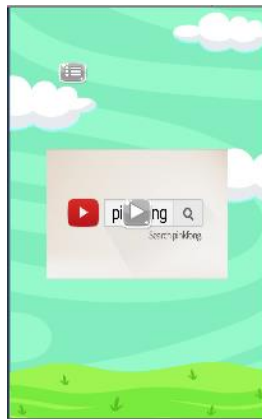
xii. Shape Video Page



Functions:

- i. Click <<Play>> button to play and pause the video.
- ii. Click <<menu>> button to go to Shape Video Menu page.

xiii. Color Video Page



Functions:

- i. Click <<Play>> button to play and pause the video.
- ii. Click <<menu>> button to go to Color Video Menu page.

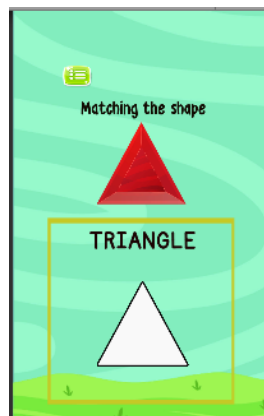
xiv. Number Video Page



Functions:

- i. Click <<Play>> button to play and pause the video.
- ii. Click <<menu>> button to go to Number Video Menu page.

xv. Shape Level 1 Page



Functions:

- i. Click <<menu>> button to go to Shape Activity Level page.
- ii. User need to drag the component until it locked for go to the next question.

xvi. Shape Level 2 Page



Functions:

- i. Click <<menu>> button to go to Shape Activity Level page.
- ii. User need to drag all the components there until it locked for go to the next question.

xvii. Shape Level 3 Page



Functions:

- i. Click <<menu>> button to go to Shape Activity Level page.
- ii. User need to click the answer given for go to the next question.

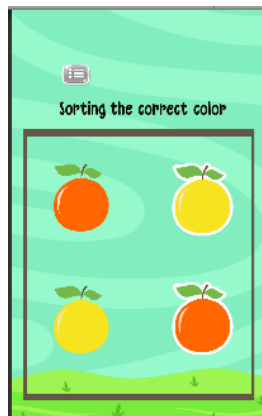
xviii. Color Level 1 Page



Functions:

- i. Click <<menu>> button to go Color Activity Level page.
- ii. User need to drag the component until it locked for go to the next question.

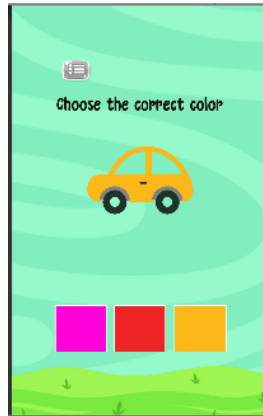
xix. Color Level 2 Page



Functions:

- i. Click <<menu>> button to go to Color Activity Level page.
- ii. User need to drag all the components there until it locked for go to the next question.

xx. Color Level 3 Page



Functions:

- i. Click <<menu>> button to go to Color Activity Level page.
- ii. User need to click the answer given for go to the next question.

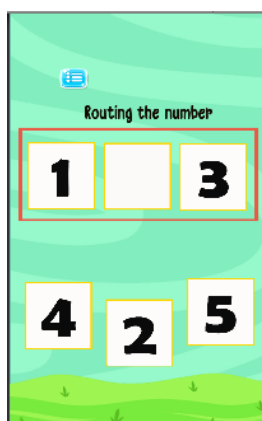
xxi. Number Level 1 Page



Functions:

- i. Click <<menu>> button to go Number Activity Level page.
- ii. User need to drag the component until it locked for go to the next question.

xxii. Number Level 2 Page



Functions:

- i. Click <<menu>> button to go Number Activity Level page.
- ii. User need to drag the component until it locked for go to the next question.

xxiii. Number Level 3 Page



Functions:

- i. Click <<menu>> button to go to Number Activity Level page.
- ii. User need to click the answer given for go to the next question.