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(Alphabet Module)

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Saya: INTAN NURMARZLINY BINTI MOHD AKMALLAH

(HURUF BESAR)

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TIDAKTERHAD

Disahkan oleh:

(TANDATANGAN PENULIS)

INTAN NURMARZLINY
**A225, Lorong Gaya 1, Tmn Rimba
Batu 7, 90000, Sandakan, Sabah**

Tarikh : 19 December 2013

(TANDATANGAN PENYELIA)

Name Penyelia:
DR.TUTY ASMAWATY BINTI ABDUL KADIR

Tarikh: 19 December 2013

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Early Stage Writing Application for Beginners with Precision Evaluation
(Alphabet Module)

INTAN NURMARZLINY BINTI MOHD AKMALLAH

A thesis submitted in fulfillment
of the requirement for the award of the degree of
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CHAPTER ONE

INTRODUCTION

1.1 Introduction

Alphabet is a collection of letters that from combining the letters, words are produced. This makes alphabet was a priority to learn in early children in order to overcome illiterate. One crucial aspect of learning alphabet is through writing. Writing an alphabet its make connection between recognize and speaking the letter. By writing, children can see the ideas of creating the letters and reading it to improvise their learning of alphabets.

During the early of childhoods, its importance for them to know the basic of alphabets as it is essential before learning making words and sentences. Learning the alphabet should begin early in a child's life [1]. Thus, learning how to write the alphabet is one of learning tools on getting know better to recognize the letters. By recognize the alphabet; the children can make preparation before entering kindergarten or primary school as it will make them easy to catch-up learning the alphabet in schools.

Children nowadays are easy to learning through modern technology that implements attractive applications [2]. Through this technology that were vast improve, everything is possible to make it was interesting and caught the children interest. Thus, when they interested in the application, they will easy to adapt the content and applied it in real life. Same goes to learning application, if the application were built attractive to children, they will tends to used it and learning it in easy way.

Furthermore, as mention above, modern technology easily attracted by children, not only because of the technology itself, the contents of the application also need to be attractive and fun to be explored. There are cute and suitable sound effects and music that make it fun. There are also, colourful buttons, images and backgrounds that cheerful to attract the children. Thus, the children will have fun learning and make them easy to learn the alphabet.

Thus, by building this application, children can have better understanding on learning writing alphabet and then, will easily recognize the alphabet. The learning to write application will help children improve their learning and at the same time learning in fun way. The children will have better preparation and parents will not worry on their children literacy.

1.2 Introduction

In experiencing technology that spreading widely nowadays, there are plenty of writing alphabet application that existed in application store and online internet. There are problem occurs on system constraints and unsuitable implementation of methods. Thus, several problem needs to be observed for improvise this application and overcome the problem that encounter by the user such as children, parents and teachers.

Traditional methods of learning involve manually writing the alphabet might be less attractive to the children. The teaching method that lack of technology and media used will be bored and not efficient to the children. For instance, writing in book that don't have sound, music and animation that children usually adapted in this modern era.

Mostly all the current applications just show basic learning of writing alphabet and not evaluate the accuracy of writing the alphabet. By evaluating the accuracy, parents and teachers will knew the improvement of the children. For example, the existing system such as at Spinner Pad Application just ask user to write to the page and there is no feedback and score display to show to user their writing skills level[3].

Thus, an application needs to be built to overcome this problem. An application that can teach children writing alphabet and get their writing accuracy calculated for further improvements.

1.3 Objective

The proposed solution need to achieve the objective stated below;

- To study the early stage writing application for beginner with precision evaluation using alphabet module.
- To evaluate the accurateness of alphabet writing by implement the vector graphic approach base on stroke order and coordinate range.
- To develop web application for children beginner learning of writing alphabet.

1.4 Scope

- Data - The data used was the vector graphic (coordinates to form curve and line) of alphabet letter from letter A to Z.
- User - The application targeting children from age 1 to 5 that in early learning phase. It also can be used by teacher or parents for guiding the learning method.
- Module - In building this application, the module involve are writing module and calculating accuracy module for writing the alphabet letters.

1.5 Assumption and Constraint

In early planning for developing this application, a few assumptions were stated as milestone and during building process of the application.

- The system will take time roughly 10 months and estimated to end at December 2013.
- Success or failure of the project is based on performance relative to the development process, and deliverables.

The system is overall implements of web – based system that will operates using web browser and can well-function using Google Chrome. The hardware used is personal computer (PC) devices that easy to handle by all types of user.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter discusses all the information relates to Alphabet Writing Application. Firstly, this chapter will be discussed about alphabet writing system including its meaning, type of alphabet and the style will be used in the application. Then, the importance of learning writing will be discussed that explain why learning to write is essential to the children. Next, all the existing system will be analyze for the case study to finds the advantages and disadvantage of every system. Then, the methodology used for this project will be explained in detail for each of its phases. Lastly, in this chapter will be discussed about the tools that will be used including the scripting and the database.

2.2 Alphabet Writing System

Writing alphabet is part of techniques in learning for alphabet recognition as in 3 learning style preferences includes kinesthetic learning by doing [4]. The symbolic method of visually recording (writing) some language is defined as writing system. While alphabet were a group of letters or basic written symbol to form the languages. Thus, the alphabet writing system is the set of letters that were symbolize by recording into some language. Alphabet writing system is one of important components need to be learn to starting the stage of learning making words and learn the languages.

English alphabet is one of type of alphabet writing system that existed in this world. English alphabet consists of 26 letters starting from A to Z. It consists of Majuscule forms (capital/uppercase letters) and miniscule forms (small/lowercase letters). English alphabet writing style divided into 2 types; there are manuscript and cursive letters. Manuscript can be defined as writing style that commonly used in printing and electronic communication as this

style is easy to read and separated from each other. However, manuscript writing style is slow type of style writing. While cursive is faster than manuscript as it was designed for quick writing the notes by using hand. Cursive writing commonly is handwritten. However, the difficultness of reading the cursive letter is depending on the writer.

2.3 Importance in learning alphabet writing

The most basic foundation for someone learning how to read is the ability of identifies the letters of the alphabet. Everyone learn most effectively is learning using methods or techniques that closely matched with their own preferred style [4]. Learning style preferences divided into 3 styles that was; auditory is learning style by hearing the audio or speech. Next is learning by visual also best known as observations. The person learns by watch the visual aid to memorize it. Lastly, it is learning by doing or defined as kinesthetic. The person is likely to learn by physically such as take notes and experiments. In writing alphabet, the most used learning style is kinesthetic style by learn to write the alphabet. By writing the alphabet, the kids will familiar with the shape, size and direction of each alphabets and practice it repeatedly. The children will be easy to recognize the alphabet as they learn through experience write the alphabet repeatedly.

The importance in learning words and sentence is the letters itself. Each letter is main component to produce words. Thus, its alphabet recognition is essential in learning as to read and speak, the alphabet must be known before knowing how to spell and making words. Moreover, alphabet is the most writing system that used in this era as alphabet is used in commonly in many countries such as at London, USA and Malaysia. Besides that, English language using alphabet writing system and English language is the most language used in international. Thus, learning to write the alphabet is importance as basic learning before learning the language.

Literacy is fundamental human right and the basic for lifelong learning. The uses of literacy for the exchange of knowledge are vastly evolving, through the advances in technology. Based on statistic by National Adult Literacy Survey, (1002) NCES, U.S. Department of Education, children who have not developed some basic literacy skills by the time they enter school are likely 3-5 times more to drop out of schools several years later [5]. Writing and reading is the most needed skill involve for literacy skill. The important of writing alphabet can

be concluded to prevent from illiteracy among kids as it's the important path to success in future.

Thus, to conclude all the explanation, writing alphabet is basic step for lifelong learning that proof that every child must learn it. Teacher, parents and guardian must take extra care and make sure the children can master the writing techniques and continue to learning to read and further their study and thus, become successful person.

2.4 Stroke Order for Writing Alphabet

Stroke is the lines produce either straight lines or curve lines. In order to create alphabet, one or more strokes were combined. There are different types of strokes, there are straight strokes as seen in letters k, l, v, w, x, y and z. In straight strokes, it divided into three types which are; horizontal (bar), vertical (stem) and diagonal. While there are also rounded strokes or curved strokes as in letters c, o and s. Rounded strokes (bowl) divided into open and closed types [6]. Stroke started with instroke where one starts writing the letter and outstroke which where the pen leaves of. All strokes mentioned above were just a basic stroke in anatomy of typeface. However, there are many other strokes time involved in building letter such as stem, serif, bowl and etc.

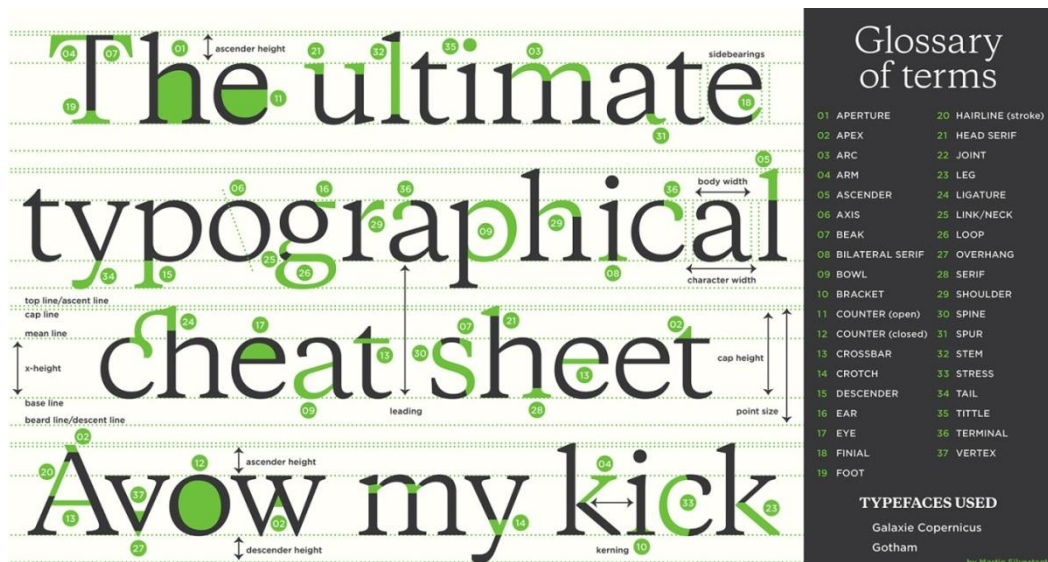


Figure 2.4.1 : All type of strokes involve in anatomy typeface of alphabet [7].

In learning to write, the basic strokes identified need to be applied and have to be stressed out for better understanding. By these simple strokes, children can easily learn to write the alphabet because the stroke is simplified enough for children to draw the lines.

Farris maintains, "By age 3, children produce drawings that are composed of the same basic lines that constitute manuscript letters: (1) vertical lines, (2) horizontal lines, and (3) circles... Because of such early experience, most 6 and 7 year-olds can create these vertical and horizontal lines more easily than the relatively complicated connections associated with D'Nealian manuscript or cursive handwriting. Because vertical lines are made with a straight up-and-down motion and horizontal lines by a left-to-right motion, they rely predominately on already acquired gross motor skills" [8].

Unlike in Chinese character writing, the strokes order is not importance in writing English alphabets is as long the final result look same with the alphabet. But, in early of learning, usually children will apply the techniques based on their observation. Thus, the order of the strokes to produce the alphabet can guide the children to produce better writing. The teachers or parents can give guidance for the order of writing the strokes as beginning of learning to write. After they master the writing skills, the children can use their own writing style and strokes order.



Figure 2.4.2 : Stroke order for uppercase letters.



Figure 2.4.3 : Stroke order for lowercase letters.

Therefore, for alphabet writing application that focus for the children beginner learning, the strokes for making the alphabet has to focused on and the order of stroke were applied for guide the children in primary learning for better writing results.

2.5 Drawing Techniques and Touch Screen Devices for Writing Alphabet Application Technology

As discussed in subtopic Stroke Order of Alphabets, strokes were main elements that produce the letters. Strokes are a line produce either straight lines or curved lines. While line is drawing terms that can be define as a type of mark that contains both a direction and a length. Thus, in producing the letters in writing, drawing techniques are applied in making the sets of basic lines.

In 2001, Marc Prensky an IT and education writer, popularized the term digital natives to label the first generations of children growing up in the technology of computers, video games, and other devices [9]. Children in this generation have tendencies in using modern technology such as laptops, tablets computers or any handheld devices specifically involving touch screen. Thus, by building application that applying touch screen technology will attract the children to use the application and consequently they will interest to learn through it.

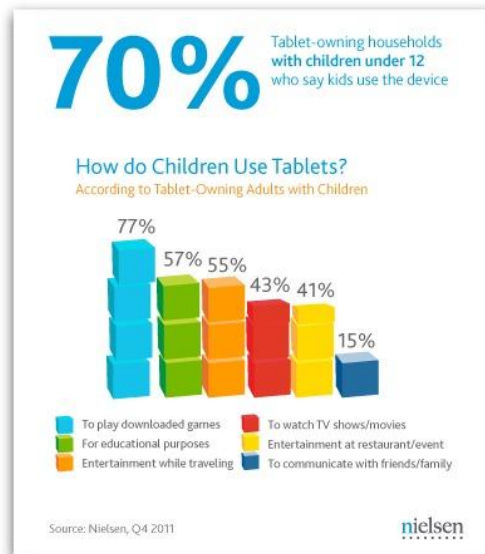


Figure 2.5.1 : Statistic on tablet-owning for families that have children under 12 and used the tablet [10].

Combination of drawing and touch screen device, hence, will produce great application for children. Drawing techniques were applied for writing the alphabet as drawing is part of making the alphabet. By using touch screen, besides than attracting them to use the application, children also can know the movement of writing the alphabet.

2.6 Case Studies on Existing Writing Application System

2.6.1 Write Uppercase Letters game at www.turtlediary.com

Turtlediary website provides tools such as games and exercise for children in elementary school. All preschool learning games, kindergarten games in math and science, first grade games and second grade games for reading help also can be found in this website. Turtlediary provide online learning games and activities because it can maintaining the classic spirit of educational fun and provide learning experiences that build on children’s technology skills.



Figure 2.6.1 : Turtlediary logo.

Write Uppercase Letters is a learning to write an alphabet games provided by Turtlediary website under Preschool English Games category. It focus on children at age 3 to 5 using virtual alphabet writing lesson for preschoolers. Its objective is for kids learn how to identify and write alphabet from A to Z in uppercase.

Contents of the application

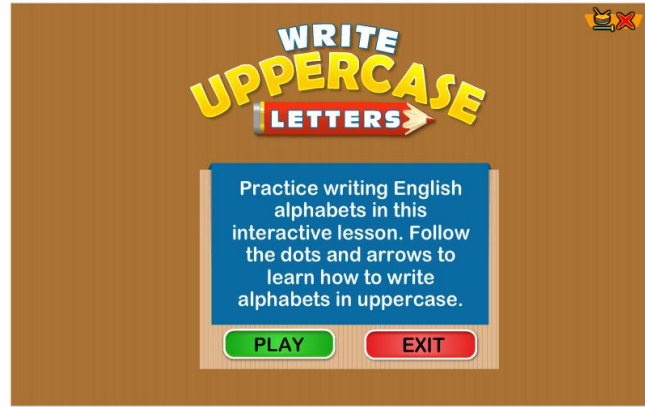


Figure 2.6.2 : Main page of Write Uppercase Letters application.

Main page of the system shows that it gives the information about the game. It also gives instruction to the user how to practice write in this application. It provides two buttons which button PLAY to enter the application and EXIT to close the application.



Figure 2.6.3 : First alphabet interfaces.

This page consists of the list of the alphabets from A to Z. User can click which alphabet that they wants. The dots will guide the user to write in correct way. The user only needs to mouse over the dots by follow the guide shown in every dot. When mouse over, the writing will show like picture below;



Figure 2.6.4 : The movement of writing the alphabet.

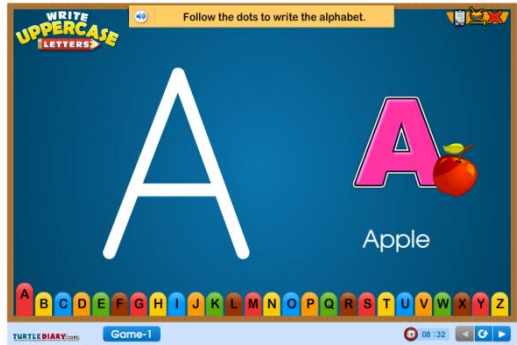


Figure 2.6.5 : Interface after one writing the letter.

When all dots were done followed, the letter will be finished and it will show the picture next to the letter to give example of the alphabet refer to. Then, it will proceed to the next alphabet.

Advantages and Disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none"> • Interactive by using multimedia including voice and attractive button sounds. • Provide guide for each steps by using both audio and text direction. • Have stroke order to guide user how to write alphabets. • Colorful and attractive interfaces suitable for children. 	<ul style="list-style-type: none"> • Doesn't have lowercase letter. • Not user friendly because the movement of writing the letter is draw by computer as user only navigate the mouse through each dots. • Don't have writing evaluation.

Table 2.6.1 : Advantage and Disadvantages of Write Uppercase Letter application

2.6.2 Learn to Write Alphabets mobile application

Learn to Write application also known as ABC Guru is a mobile application that developed by Sudheer Kumar Peddireddy. The main function of this application is to teaches how to write numbers and alphabets. This application comes with varies of languages including Tamil, Canadian and Korean language.

Contents

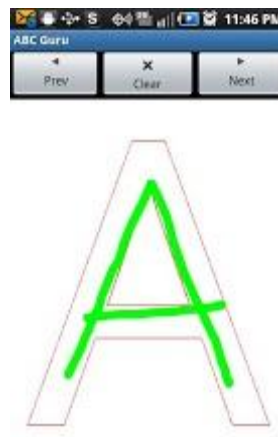


Figure 2.6.6 : First interface when user enter the application.



Figure 2.6.7 : Recording user voice.

When user enters this application, it will display as shown in figure 2.6. The application consists of 3 main buttons that guide user to the previous and next letter. Then, user can clear the writing by touch button Clear. Then, user can write the alphabet by it tracing given and record it in the application. User also can record their own voice to learn how to spell the letters as shown in figure 2.7.



Figure 2.6.8 : Color picker for pen color

Besides that, user can pick the color of the pen for writing the letters. It also have other several menus such as change pen width and change the language as shown in figure below.



Figure 2.6.10 : Other menus provide in the application

Advantages and Disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none">• Provide Multilanguage.• Use multimedia by using audio and text media.• Can record user writing and audio for spelling the letter.• User friendly because have many menus and button to user interact with the system.• Have stroke order to guide user how to write alphabets.	<ul style="list-style-type: none">• Do not provide navigation or direction to the user what they need to do.• Don't have evaluation of user writing.• Design was dull and not attractive enough for children.

Table 2.6.2 : Advantages and Disadvantages of Learn to Write application.

2.6.3 Write the alphabet mobile application

Write the Alphabet is a mobile application developed by Alexandre Minard that available both on iTunes and Android Market. The system teach user how to write alphabet as they will discover how to draw letter and will able to practice to copy the letter repeatedly.

Contents



Figure 2.6.11 : Main interface of Write the Alphabet application.



Figure 2.6.12 : Main menus for the application

Based on figure 2.11, it shows the homepage interface of the application. It provide touch feedback to ask user to enter the system by touch the enter button. Then, menu interface show as can be seen at figure 2.12. This application provides alphabet writing and games to attract the children.

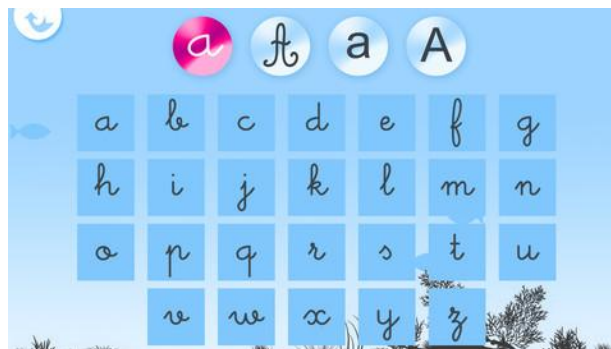


Figure 2.6.13 : All alphabet lowercase and uppercase style for manuscript and cursive style.

In this page, the user can choose 4 different style of alphabet. There are two main styles which is manuscript alphabet and cursive alphabet. Then, for each style, it provides both capital and small letters. User can choose which letter they want to learn to write either cursive, manuscript, uppercase or lowercase letter.

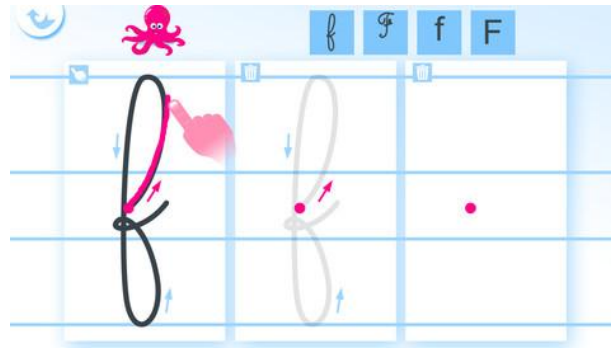


Figure 2.6.14 : Direction show by the application to guide user how to write the letter.

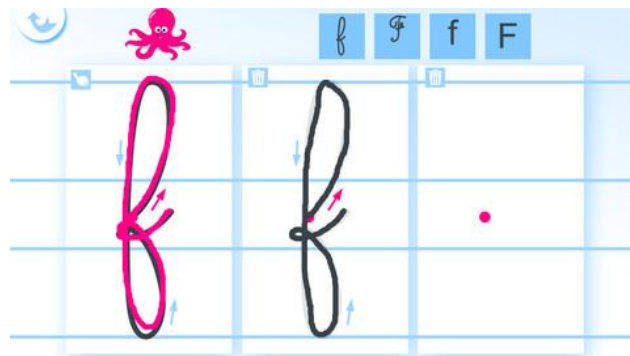


Figure 2.6.15 : User try to write the letter.

In this application, it implement the navigation techniques as it show the step to write the letter first at the first box on the left of the screen. Then, user will write the letter based on the direction given and the tracing font at the background for first trial at the middle box. If the user writes out of the tracing letter and misdirection, the wrong alert will pop up near the wrong line. Then, user will write again the letter without tracing letter at last box on the right of the screen.

Advantages and Disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none"> • Design was colorful, cherish and attractive for children. • Have multimedia such as text, sounds and animation. • Provide both manuscript and cursive letters. • Have both uppercase and lowercase 	<ul style="list-style-type: none"> • The evaluation of user writing is to strict and not suitable for children that first time to learn. • Not provide the sound of spelling the words.

<p>alphabet letters.</p> <ul style="list-style-type: none"> • Provide guide for user writing and have two trials for user to try to write. • User can know the writing is correct or not by the alert for wrong writing. • User friendly by menus and navigation buttons. • Have stroke order to guide user how to write alphabets. 	
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Table 2.6.3 : Advantages and disadvantages of Writing the Alphabet application.

2.6.4 ABC Letter Tracing

One of the techniques children can learn to write is letter tracing. This technique is implemented by ABC Letter Tracing application that was free mobile application for iPhone user. Main objective of the application is for children learning to write and recognize their ABC's. It provides both uppercase and lowercase letters for English alphabet. This application also provides real objects that can relate to the alphabet letters to help they learn the alphabet.

Contents

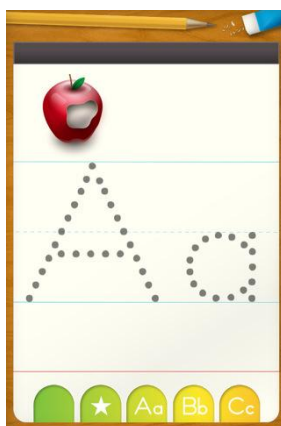


Figure 2.6.16 : First alphabet interface.

This application provides simple design that consists all of the letters at the bottom of the interfaces as shown in figure 2.16. It provides dots tracing of the letter for uppercase and lowercase letter of the alphabet. Then, at the top of the interface, there are real object that can their name start with the alphabet shown.

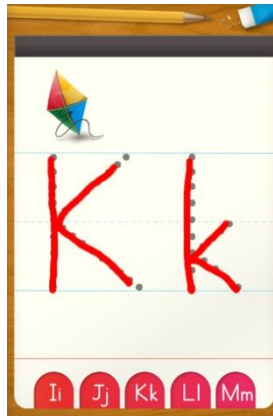


Figure 2.6.17 : The writing write by the user.

User can write overlap the dots tracing and continue to the next alphabet. User also can freely choose which alphabet they want to write.

Advantages and Disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none"> • Attractive design suitable for children. • Provide real objects that can relate to alphabet and make the children easy to learn the alphabet. • Provide alphabet tracing using dots techniques. • Have both uppercase and lowercase letters. • Contain sound of spelling the letters. 	<ul style="list-style-type: none"> • Doesn't have feedback for two way communication between application and the user. • Doesn't have evaluation for user writing. • Navigation was not included and make user don't know how to use the application. • Don't have stroke order to guide user how to write alphabets.

Table 2.6.4 : Advantages and disadvantages of ABC Letter Tracing application

2.7 Study on techniques and methods of algorithm.

2.7.1 Mouse eventhandler.

Event handler is instalment to capture events surrounding including the mouse movement, the position and clicking and other events. The event allows the developer to perform an action when it occurs. All these events are tied to individual elements in the html pages. A specific element on the page must be clicked in order for an onclick or other event to capture.

For touch screen devices, the event handler involved is touch events. Touch events giving ability to the devices to interpret finger activity when it touches the screens or track pads. Touch events consists of four main interfaces or functions [11]. The interfaces are;

1. TouchEvent
 - a. Represent the event that occurs when the state of touches on the surface changes.
2. Touch
 - a. Represent a single point of contact between the user and the touch surface.
3. TouchList
 - a. Represent a group of touches; this is used when the touch events applied multiple fingers touch at the same time.
4. DocumentTouch
 - a. Contains methods to create Touch and TouchList objects.

2.7.2 Evaluation Algorithm – Crossing Number Algorithm.

Through the grid produce in writing the alphabets, it will make polygon that have side at each side of grid boundary. By using this polygon formed, the user writing that consists of several coordinates can be determining whether the coordinates follow the alphabet strokes or not. The method can be used is called Point-in Polygon. Point-in polygon is solution when fundamental problem encountered in two-dimensional computation polygon to decide whether the points lies within the polygon [12].

There are many algorithms for point-in polygon that can calculate the point's lies in the polygon whether overlaps multi-polygons or simple polygon. For example crossing number method, ray casting and winding number. Winding number method is simple algorithm by casting an infinite ray from point to infinite downward/upward and count how many edges of the polygon the ray intersects [13]. If the point is outside, the crossing number is even, while if the crossing number is odd, the point lies inside the polygons. This method highly referred as "even-odd" method.

Steps of algorithm

Q = the points of need to be determined.

P = polygon

For example coordinates of $Q = (0,0)$. Thus the start vertex of the ray is $(0,0)$ and the end of vertex of the ray is $(x_{max}, 0)$. X_{max} must greater than x-coordinates of any vertices of P .

1. Determine whether if Q is equal to any vertices of P or lies to any edges that connecting the vertices. If yes, then the result is *inside*.
2. A vertex P_s that does not lie on the x-axis is searched in the set of vertices of P . If no such vertex exists, the result is *outside*.
3. Starting from vertex P_s the following steps are repeated until all vertices of P have been visited:
 - a. The index s is increased to $s + i$ until next vertex P_{s+i} not lying on the x-axis is found. If the index $s + i > n$ then i is set to $-s$ and the search is continued.
 - b. Depending on step a, one of the following steps is taken :
 - i. No vertex has been skipped: the line segment from P_s to P_{s+i} is intersected with the positive x-axis.
 - ii. At least one vertex with a positive x-value has been skipped : the line segment from P_s to P_{s+i} is intersected with the complete x-axis.
 - iii. At least one vertex with a negative x-value has been skipped: nothing is done
 - c. P_{s+i} is the starting vertex for the next iteration.
4. If the count of intersection with the x-axis is even, then the result is *outside*, if it is odd the result is *inside*.

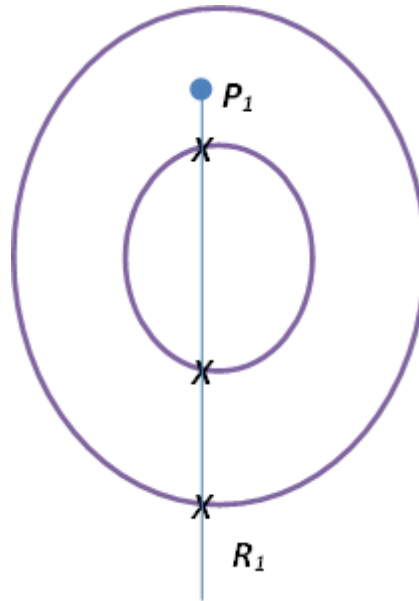


Figure 2.7.6.1 : “even-odd test”

For instance, in figure 3.2.3.7 above, alphabet O polygon have one point to decide using even-odd test. A ray were casting downward to infinity or more than the most downward vertex for polygon O. There are 3 points were intersected at polygon O edges, thus, 3 were odd number than point P_1 is inside polygon O.

2.7.3 Evaluation Algorithm – Distance between two points.

The Distance Transform (DT) is a general operator forming the basis of many methods in computervision and geometry, with great potential for practical applications [14].Eucledian distance is type of Distance Transformation that is an algorithm in calculating, compared the distance between two points. The distance between x and y geometry coordinate will calculated for check the coordinate within the range (radius).

The formula for calculate the distance using Eucledian Distance formula are shown in Figure 2.7.3.1 below.

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Figure 2.7.3.1 : Eucledian Distance’s formula.

The Euclidian distance is implementation of Pythagoras Theorem that used to calculate shortest distance from two point using triangle function. From Pythagoras' Theorem, we know that

$$AB^2 = dx^2 + dy^2$$

Solving this for AB gives us the formula:

$$AB = \sqrt{dx^2 + dy^2}$$

Thus, Euclidian Distance can implemented through calculate the distance between database coordinates and tracing writing coordinates to check whether the points lies within the range needed to satisfy the tracing of the alphabet. Therefore, using Euclidian Distance is more easy and simplified algorithm for evaluation of precision and stroke ordering.

2.8 Development Tools and Support

2.8.1 Software Development Methodology Model

Methodology model is the model that represents the software development methodology for the system created. It is a framework that acts as structure, plan, and control the process of developing an information system. One software development methodology framework is not necessarily suitable to use for all project. Furthermore, each methodology not specifically can focus only with one framework. It can also working with different framework and different methodologies also can be considered to combine to suite with specific framework.

2.8.1.1 Software Development Life Cycle

One of the methodology models are System Development Life Cycle (SDLC). SDLC can be defined as the process of developing system or software to meet some requirements. It covers activities such as understanding the reason of building the system, studying the project feasibility, analyzing the problems, choosing the system design and it structure, implement the system and testing it until delivering the system to the client [15].

Planning is the first process involved in SDLC as it is the process of understanding the system and preparation before continue to analysis phase. All the objectives, scopes and

problems statements need to be identified as guideline in building the requirements for the system. The general ideas for building the system need to be studied for preliminary analysis to plan how to develop the system.

In the analysis stage, all the requirement will be gathered, analyzed, validate and specified to prepare the requirement specification document. Besides that, it will include the planning for design phase, performance, software, hardware and also network requirements of the projects. The lists of requirement produce need to meet user needs and compatibility. The deliverables products of this phase will drive how the system will be built and guide the developers' works.

The next stage after analysis is design phase. System analysis will leads to design decision, which determines how the systems operates in fields of process, data, hardware, network architecture, user interface, and other important factors that will contribute to build the system. All features, operations will describe in details involving screen layouts, diagrams, calculation, pseudo code and other documentation.

Implementation phase is the most resource, cost and time consuming phase of all because at this phase the system was actually build. The coding and technical construction will be implemented. After implementation phase, the user system will be tested and have maintenance at testing phase. User also will be given training to be guide how to use the system. Finally it will be delivered to the user after completing all the phases.

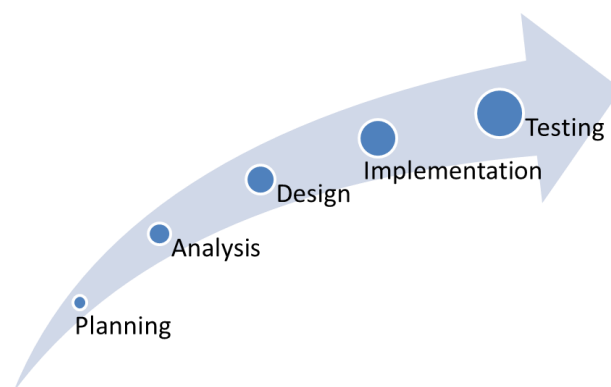


Figure 2.7.1 : Software Development Life Cycle (SDLC) phases.

Advantages and disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none">• Increased Speed<ul style="list-style-type: none">○ By using CASE tools, which focus on development phase as quickly as possible make the application releases in quick time.• Increased Quality<ul style="list-style-type: none">○ Quality in development found when the application conforms to specifications needs and lack of defects.	<ul style="list-style-type: none">• Reduce Scalability<ul style="list-style-type: none">○ It only focuses on development of prototype that may lack the scalability of a solution that was designed as full application from start.• Reduced Features<ul style="list-style-type: none">○ Due to pushing time, some features might be pushed off that result it less featured than traditionally developed applications.

Table 2.7.1 : Advantage and disadvantages of SDLC.

2.8.1.2 Rapid Application Development

Rapid Application Development (RAD) is one of the models listed in Software Development Methodology. RAD is a concept that was applied so that the system can be developed faster and high-quality through certain process and steps. It focus on building applications in very short time and it involves application of prototyping and iterative development. RAD consists of four main phases which are requirement planning, user design, construction and implementation.

First process involve in RAD are requirements planning stage. In the meeting, it will focused on both developing a high level list of initial requirements as well as setting the project scope. In this stage, it should come out with a list entities and also diagrams that can define the interaction between processes and data elements and should finish in between one to four weeks. At the end of this stage, project estimation should be considered including project cost and time estimation.

Next, the phase after requirement planning was user design. During user design stage, the analysis team meets with the end users. The entities that develop during requirement planning phases were flushes out the detail and were developed into data model, business rules,

test plan and create storyboard for all flows and layout that essential in the system. Before continue to the next stage, the initial iteration of the construction phase should be focus on a feature light prototype. In order to keep the development iteration as short as possible, core requirements should be identified and targeted for future development iteration. The user design phase estimated to last between three to five weeks.

In construction phase, application in iterative cycles of development, testing, requirement refining and development has to develop until the system complete. The development iteration should finish between one day to three weeks. The data model that was developed should be converted into functional database. The CASE tool should generate large section of the application. Once the prototype has been developed, it must be test based on the test planning constructed during User Design stage. The system and customer review will be reviewed. Then, the meeting with client will be arranged again for the net iteration. After the meeting, the requirement, data model, test script and project plan need to be updated and will repeat all over again in construction phase until the system approach the required system.

At the final stage, the implementation stage consists of embedding the new system into the business. The data will be prepared and the system will be implemented. The user will be trained and will be help to transfer the old data and procedures into the new system. After the deployment, the system will trouble shoots and potential enhancement will be identified. Finally, the system deliverables will be handed to the client.

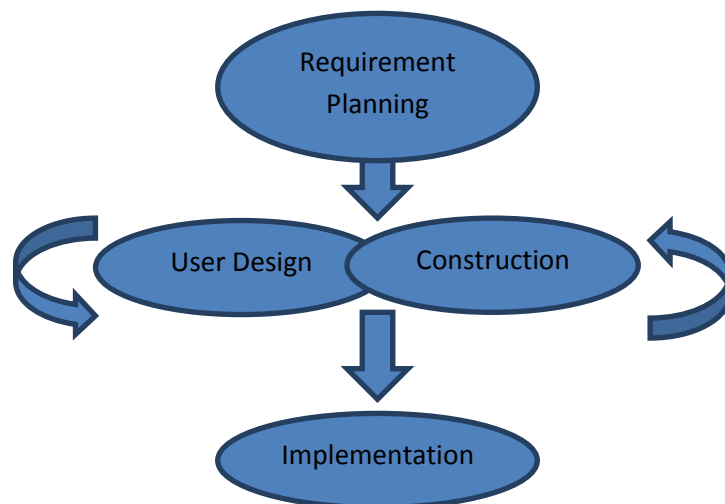


Figure 2.7.2 : Rapid Application Development Phases

Advantages and disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none"> • Increased Speed <ul style="list-style-type: none"> ○ By using CASE tools, which focus on development phase as quickly as possible make the application releases in quick time. • Increased Quality <ul style="list-style-type: none"> ○ Quality in development found when the application conforms to specifications needs and lack of defects. 	<ul style="list-style-type: none"> • Reduce Scalability <ul style="list-style-type: none"> ○ It only focuses on development of prototype that may lack the scalability of a solution that was designed as full application from start. • Reduced Features <ul style="list-style-type: none"> ○ Due to pushing time, some features might be pushed off that result it less featured than traditionally developed applications.

Table 2.7.2 : Advantages and disadvantages of RAD.

2.8.2 Scripting Language

2.8.2.1 HTML5

HTML5 is Markup Language as the newest version of HTML (Hypertext Markup Language) developed by World Wide Web Consortium (W3C). Nowadays, all major web browsers such as Chrome, Safari, Firefox and Opera offer HTML5 support. HTML5 is made to make the coding process easier and more logical. It comes out with new features such as offline storage, canvas drawing, native video and audio streaming support, geolocation, smarter forms and web application focus.

Advantages and disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none"> • Standardize semantics <ul style="list-style-type: none"> ○ Increasing the semantic value of the web page as codes are standardized 	<ul style="list-style-type: none"> • Browser support <ul style="list-style-type: none"> ○ Only modern browser support HTML5. Even if it were, there some people that will use older

<ul style="list-style-type: none"> • Fulfill the need of Web application <ul style="list-style-type: none"> ○ New features and standards have emerged. Main focus is to make easiest application with easy front ends, drag and drop tools and other useful elements. • Smarter forms <ul style="list-style-type: none"> ○ Search boxes, text inputs, validating data and many more forms function were simplified. 	<p>version that not support HTML5.</p> <ul style="list-style-type: none"> • Multiple device functionality <ul style="list-style-type: none"> ○ Different levels of support for HTML5 available on different platform and browser.
---	--

Table 2.7.3 : Advantages and disadvantages of HTML5.

2.8.2.2 Javascript

Javascript is developed by Netscape as a scripting language. Javascript lines of codes are executable computer codes and can be inserted into HTML page. As javascript is one of open scripting language that anyone can use without purchasing a license, it supported by all major browser including Internet Explorer.

Advantages and disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none"> • Can put dynamic text into HTML Page <ul style="list-style-type: none"> ○ It can write a variable text into the display of an HTML pages. • Gives designer a programming tool to HTML <ul style="list-style-type: none"> ○ Since JavaScript is a very light programming language with a simple syntax, any programmer can start putting small “snippets” of code into their HTML documents. • Can be used to validate data 	<ul style="list-style-type: none"> • Security issues <ul style="list-style-type: none"> ○ Once appended javascript snippets onto web pages, it can be used to exploit the user system. • Rendering variation <ul style="list-style-type: none"> ○ Different layout engine may render javascript differently caused inconsistency in functionality and interfaces.

<ul style="list-style-type: none"> ○ Can apply validation in a form before submitter to server and particularly save the server from more processing. 	
--	--

Table 2.7.4 : Advantages and disadvantages of Javascript.

2.8.2.3 CSS

CSS is known as Cascading Style Sheet. Style sheet are using for a layout for designing. Designer use style sheets to ensure the design are designed exactly for specification. It refers to the document itself. While cascade means the web style sheet is intended to cascade through a series of style sheets.

Advantages and disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none"> • Page load faster <ul style="list-style-type: none"> ○ Less code implement in HTML as CSS will generalize it and make it fasten the download time. • Easy maintenance <ul style="list-style-type: none"> ○ To change the code, it only just edit it in one place. 	<ul style="list-style-type: none"> • Browser compatibility <ul style="list-style-type: none"> ○ Some browser are support extra features, some browser don'ts because the style sheets varying with different browser.

Table 2.7.5 : Advantages and disadvantages of CSS.

2.8.3 Database

2.8.3.1 XML

XML is derived from eXtensible Markup Language as it is the basis for the new XHTML. It comes from SGML and used to represent data in standard format. It developed by World Wide Web Consortium's (W3C) XML Working Group. XML is a widely supported open technology for electronic data exchange and storage. It is actually a language used to create other markup languages to describe data in a structured manner.

Advantages	Disadvantages
<ul style="list-style-type: none"> • Complete requirement <ul style="list-style-type: none"> ○ Focus on detailing the documentation such as existing system, requirements, software, hardware, materials and etc. • Complete system design <ul style="list-style-type: none"> ○ Consists of every pieces of design and developments that can meet user requirements. 	<ul style="list-style-type: none"> • Slow and time consuming <ul style="list-style-type: none"> ○ Due to high detailed and step-by step processes require much time and has to keep up with the clients dateline.

Table 2.7.6 : Advantages and disadvantages of XML.

2.9 Conclusion

English alphabet is one of importance components for children learning as it English is international language and the alphabets are widely used across the worlds including in virtual world. Thus learning to get to know with the letters is really significance for primary education. Write alphabet learning is one of learning parts in introducing English alphabet to the children by make them recognize the alphabet using kinesthetically method. Besides that, the orders of the strokes although were not important but, it can guide the children for their primary learning and after they are excellent in writing, they can choose which style and order of stroke with their own personal writing style.

The existing system that already been build consists of online application using personal computers and mobile application such as tablet and smartphones. Based on the comparison of those existing systems, this application will be using mobile devices that have touch screen devices and applying web application as web application were flexible and doesn't have much compatibility strictness. The application will provide guide for the stroke order instruction to write the letters and will evaluate the user writing based on the order of the strokes and the accuracy of the writing.

Methodologies that are best can relate to software application are using Software Development Life Cycle (SDLC) methodology. However, for web application that needed to

repeat the prototype as requirement needs in shortest time, Rapid Application Development (RAD) also suitable to be implemented. Thus, the repetitive processes in RAD were implementing in SDLC to repeat the design process and implementation for better results.

As the application applying web technology, HTML5 languages will be used as it was latest web technology that can combining HTML and javascript using canvas techniques. The database used to store the coordinates to make the letters are using XML languages

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter will discuss the methodology used to develop the “Early Stage Writing Application for Beginners with Precision Evaluation (Alphabet Module)”. For the purpose of developing this application, the methodologies that were chosen were Software Development Life Cycle (SDLC) and Rapid Application Development (RAD). The details of those combined methodologies will be explained and based on the phases in the methodology, the details will be pointed out from the planning phase until the testing phase. Finally, the chapter will discuss the requirements, which consist of both hardware and software requirements.

3.2 Proposed Solution

In order to complete the project, the application will be developed based on a combination of two methodology models. The models involved were Software Development Life Cycle (SDLC) and Rapid Application Development (RAD). Each phase plays an important role in the production of the application. There are five (5) phases implemented in this methodology: planning, analysis, design, implementation, and testing. Figure 3.1 shows the methodology's structure for this application. The Design and Implementation phases are repetitive phases that will repeat the development of the application until it meets the requirements of this application.

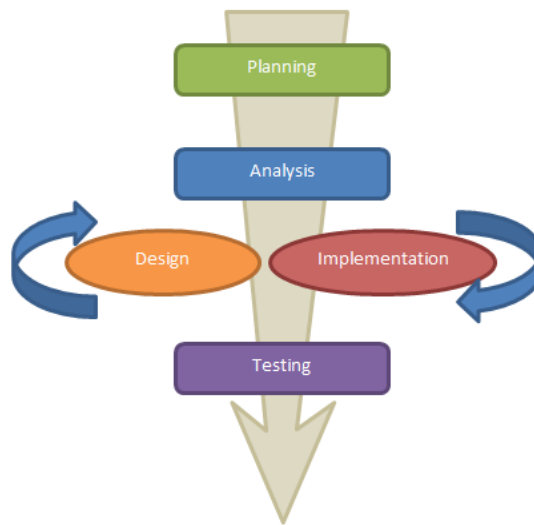


Figure 3.1 : Proposed methodology models for the solution.

3.2.1 Planning Phase

In phase, all the planning how the activity and the entire task to be completed based on the methodology steps that consist of planning, analysis, design, implementation and testing phase. (explain gantt chart)

3.2.2 Analysis Phase

Analysis is process of gathering, analysing, validate, and specify the requirement that needed in design and implementation phase. The requirement will be analysing based on the understanding for four case studies of existing system at both online and mobile application. By the analysing the case studies, data on English alphabet letters were collected as English alphabet consists of 26 alphabets. Then, to evaluate the stroke order, the data on stroke order for every letters need to be identified for both uppercase and lowercase letters.

3.2.2.1 Alphabet

This application was generally to teach how to write alphabets specifically in English alphabet. English alphabet have 26 letters begins with A and end with Z. This application will be focused on manuscript letters that are separated from each other and easily to be learnt by children. English alphabet divided into two types; which are majuscule forms (uppercase letters)

and miniscule forms (lowercase letters). Below shows both uppercase and lowercase of English alphabet letters.

Uppercase	Lowercase	Uppercase	Lowercase	Uppercase	Lowercase
A	a	J	j	S	s
B	b	K	k	T	t
C	c	L	l	U	u
D	d	M	m	V	v
E	e	N	n	W	w
F	f	O	o	X	x
G	g	P	p	Y	y
H	h	Q	q	Z	z
I	i	R	r		

Table 3.2.1 : Uppercase and lowercase for each letters.

3.2.2.2 Stroke order

Each letters has its own style of writing that consists of steps by steps order of stroke to produce the letters. Strokes are types of line that were made to mark with a single short line. Strokes order were not important in deciding alphabet making, however, this application targeted for early stage of learning which is important for the beginner to learn constants way of stroke order and choose their own style when they able to write well.

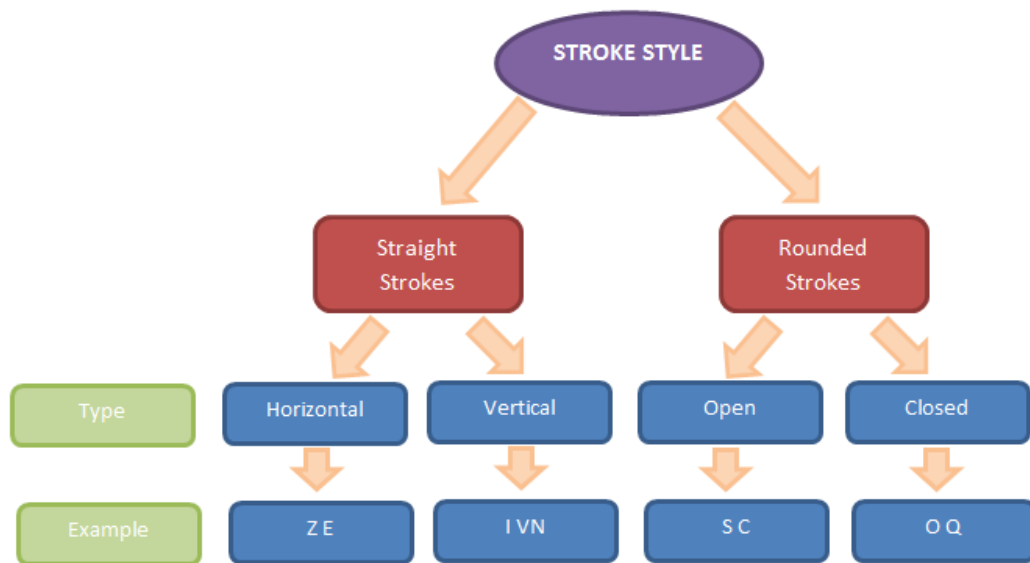


Figure 3.2.2.1 : Type of basic strokes.

For example stroke order for letter A is firstly slanted vertical strokes from up to down slightly to the left. Then from the top beginning of first stroke, write slanted vertical strokes from up to down slightly to the right. Next, connect the first stroke to the second stroke by horizontal stroke, starting from middle of the first stroke to the middle second stroke (Refer to figure below).

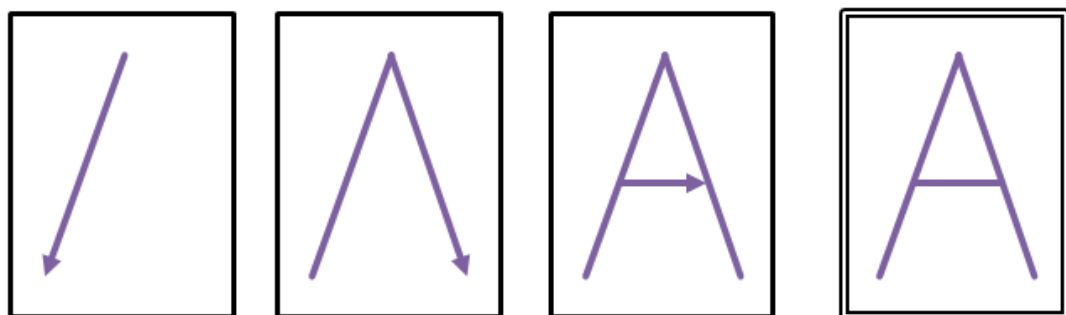


Figure 3.2.2.2 : Steps of stroke order for letter 'A'.

Another example is writing letter T by firstly write straight horizontal stroke then from the middle of the first stroke write straight vertical as shown in figure below.

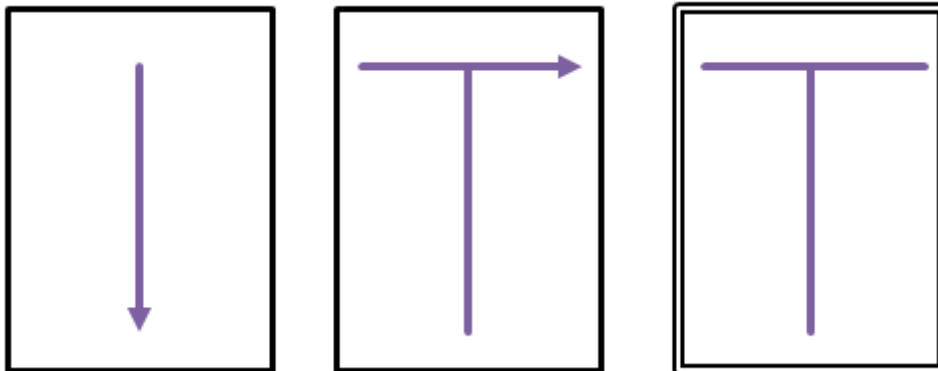


Figure 3.2.2.3 : Steps of stroke order for letter 'T'.

Figure 3.2.3 and 3.2.4 below shows stroke order guide for other alphabets for each uppercase and lowercase letters given in children learn writing alphabets book.



Figure 3.2.2.3 : Stroke order for uppercase letters.



Figure 3.2.2.4 : Stroke order for lowercase letters.

3.2.3 Design Phase

Design phase consists of 3 main tasks which the first task is modules that describe the main modules to make the application successfully built. Next is the interface design for the application that describe in detail each media used in designing the interface for main pages. The last component in design phase is the algorithms that were implied in the application such as mouse event handler and crossing number method.

3.2.4 Implementation Phase

Implementation phase consists of working with codes and process of developing the application. Based on the requirement and data gathered, the coding will be build and the interface will be designed.

3.2.5 Testing Phase

After implementation phase, testing phase will be conducted to test the application and ensure it working well. All modules and touch event handling must be functioning according its function.

3.3 Project Requirement

Project requirement consists of two (2) major categories; Software Requirements and Hardware Requirements. When a requirement for the project is completed, every item that needs to be used for the requirement will be implemented and analyzed to ensure the rightful use of the system.

3.3.1 Software Requirements

The software requirements for developer has been listed and described as below for reference:

Item	Name	Purpose
Operating System	Window 7 Professional 32 bit	As the operating system to run the system development tools.
Software	Microsoft Office 2007 <ul style="list-style-type: none">○ Microsoft Word○ Microsoft Power Point○ Microsoft Project○ Microsoft Visio	To make and edit the system documentation such as system presentation, system's user manual and system planning and scheduling.
Web Browser	<ul style="list-style-type: none">○ Internet Browser 7.0 or higher○ Google Chrome 2.0 or higher	To run the system.
Database	SQL Server 2008	To develop the database of the system.
Programming Languages	<ul style="list-style-type: none">○ HTML5○ Javascript○ XML	To develop the coding of the system.
Programming Tool	Adobe Dreamweaver CS5	As a platform to implement the programming language to develop the system
Implement Website	Filezilla	Turns a computer into a Web server that can provide World Wide Web publishing services.

Table 3.3.1 : Software requirement for the developer.

While the software requirements for the user has been listed and described below for reference:

Item	Name
Operating System	<ul style="list-style-type: none"> ○ Window 7 Professional 32 bit ○ Window 7 Professional 64 bit
Web browser	<ul style="list-style-type: none"> ○ Internet Browser 7.0 or higher ○ Google Chrome 2.0 or higher ○ Mozilla FireFox 15 or higher

Table 3.3.2 : Software requirement for the user.

3.3.2 Hardware Requirements

The hardware requirements for the developer has been listed and described for reference in Table 3.3.2.

Computer Hardware	Quantity (Unit)	Description	Purpose
Personal Laptop	1	<ul style="list-style-type: none"> ○ Processor (Intel ® Core™ 2 Duo processor T6500 (2.1 GHz, 800 MHz FSB) ○ RAM (3GB) ○ Hard Disk Space (120MB) ○ Display screen resolution (1280X1080) 	Personal research and project development
Pendrive	1	<ul style="list-style-type: none"> ○ Kingston 4GB 	Data backup for files and documentation.
Printer	1	<ul style="list-style-type: none"> ○ Canon MP258 	Printing

Table 3.3.3 : Hardware requirement for the developer.

The hardware requirements for user has been listed and described below for reference:

Item	Minimum Requirement
Processor	<ul style="list-style-type: none"> ○ Intel Core2 Duo E8200 2.66 GHz or ○ AMD Phenom X3 8750 2.4 GHz
RAM	<ul style="list-style-type: none"> ○ 2GB for 32-bit OS or ○ 4GB for 64-bit OS
Hard Disk Space	-
Display Card	<ul style="list-style-type: none"> ○ Nvidia GeForce 8800GT 512MB or ○ ATI Radeon HD 3870 512 MB
Net Framework	<ul style="list-style-type: none"> ○ Net Framework 4.0
Browser	<ul style="list-style-type: none"> ○ Internet Browser 7.0 or higher ○ Google Chrome 2.0 or higher ○ Mozilla FireFox 15 or higher

Table 3.3.4 : Hardware requirement for the user.

CHAPTER FOUR

DESIGN & IMPLEMENTATION

4.1 Introduction

This chapter will discuss on both design and implementation in each module. The design and implementation divided to four modules, there are general modules, display modules, storing modules and evaluation modules. The details of the modules were explained through flowchart algorithm, user interface and source code.

4.2 Modules

This application divided into three modules. The first module is display module that used to display the letter tracing for guide the user to write inside the area of the letter tracing. The second module is writing module for children write the alphabet and store the coordinates for evaluation the precision of the alphabet. Next module was evaluating the precision of the alphabet writing and the order of the stroke. Finally it will display the results of the evaluation.

In display modules, the modules were used to display the guide to write letter. The guide will animate the user and show the step by step from first stroke until the last stroke to write the letter properly based on the stroke data collected in analysis phase. The module started to the application check whether the current stroke to write is not exceeding the total strokes. Then, it will check the coordinates for writing the letter and form line from first coordinates to the last coordinates for the current strokes. After that, it will repeat all the process until the last stroke was written.

The next module is storing module that functioned for storing the coordinates of the user writing that later will be needed to evaluate its precision. The module started with initializing the number of stroke to 0 for further use. Then, when user touches the device using stylus, the number of stroke will increment. While the user hold the stylus, and move it, the application will store every coordinates for the location of the stylus when it moves. When the stylus was up from touching the screen, the process will repeat if the user touches the screen again. If not, the flow will end.

The last module is evaluation module that shows function to calculate user writing and stroke order to determine their writing precision. The module started with reading the number of strokes user that user write and while the stroke not reach maximum stroke, all the coordinates for the current stroke will be calculated using even-odd test. The order of the stroke also will be evaluated to ensure it write in correct order as the guide given by the application. After all coordinates were evaluated, the precision will be calculated and will be display at the application.

Both modules will be implementing to evaluate precision of letter tracing and the order of alphabet stroke. In order to get original/tracing coordinates, the display modules will store the coordinates to the variable of original coordinates. Then, the storing module will store the coordinates of user writing. Then, both original and user coordinates will be compared in evaluation module.

4.2.1 General Function/Process

For implementation the technical process for building the application, several process were included as general requirement in making the application functioning well. First process is home page design that tells the user the application title. Then, the menu page that used to user chooses learning method whether to use existing guideline or parent's guideline. After choosing existing guideline, user need to choose which alphabet that they want to learn to write, and the next page is writing application page that includes the main three modules that will discuss in next sub topic.

The process of the application pages were shown in Figure 4.2.1.1 below. The figure shows the storyboard design that showing the flow and step from main page to the writing page.

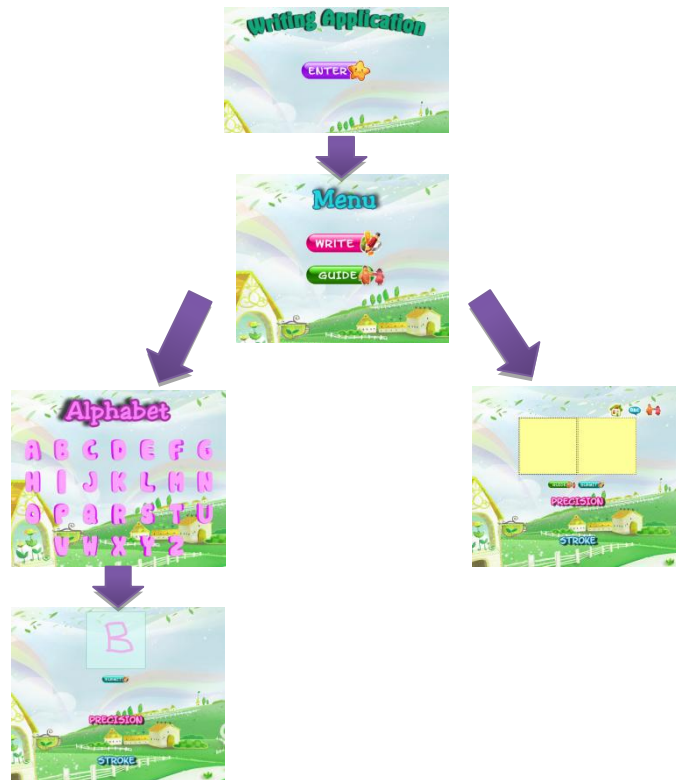


Figure 4.2.1.1 : Storyboard of the design involve in general module.

4.2.2 Display Module

Tracing area in this application is guideline for user to write inside the area in order to write the alphabet. Lines drawn in this module based on coordinates of each point that derived from database. Then, the lines are thickened to form the tracing area for each alphabet. In this module, the coordinates called from database form lines based on each stroke order.

Flowchart Algorithm

Based on the algorithm in the flowcharts in Figure 4.2.1.1, the algorithm shows step by step of algorithm for display module. Firstly, the application will get the coordinates and stroke value from text file from selected alphabet. Then, the application will read coordinates by stroke order. By reading each coordinate of each stroke, the line was formed. While forming line, the thickness of the line was increase to make the line bolder and form tracing area. Next, the flow continues for the next stroke.

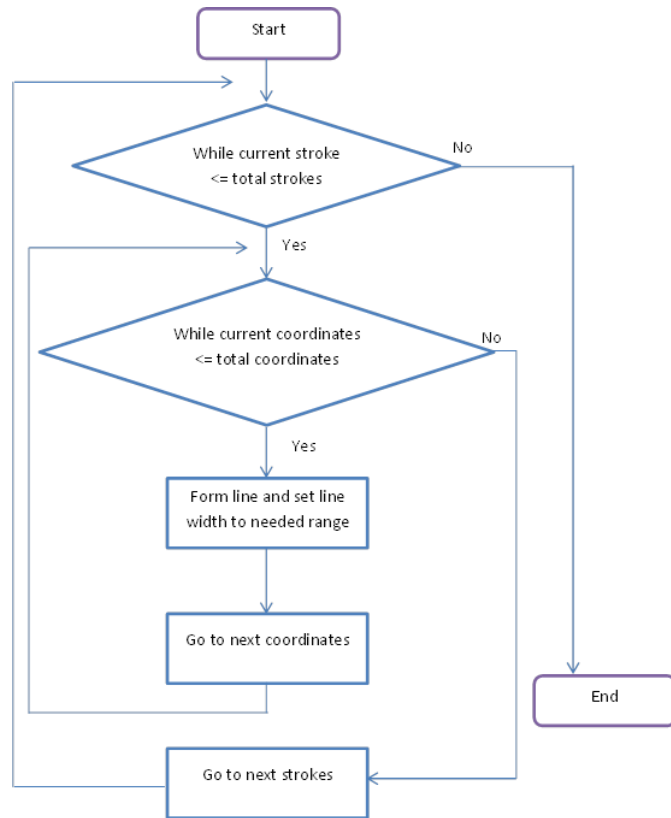


Figure 4.2.2.1 : Flowchart for algorithm in display module.

User Interface



Figure 4.2.2.2 : Red box shows the tracing area implementing display module.

Source Code

Based on the interface at Figure 4.2.2.2, to build the interface shown, codes to call coordinates from database were showed in Figure 4.2.2.3 and 4.2.2.4. The language used is JSON that pass PHP variable to Java Script variable. Next, codes built for display module are shown in Figure 4.2.2.5 below using HTML5 and Javascript language.

```
<?php
$file_handle = fopen("letter_T.txt", "rb");
$line = 0;
$text = array();

while (!feof($file_handle) ) {
$line_of_text = fgets($file_handle);
$parts[] = explode(',', $line_of_text);
$text[$line] = trim($line_of_text);
$line++;
}
fclose($file_handle);
?>
```

Figure 4.2.2.3 : PHP language coding for calling value from text file.

```
var j_text = new Array();
j_text = <?php echo json_encode($text); ?>;
var j_line = <?php echo json_encode($line); ?>;
var j_drag = new Array();
var j_stroke = new Array();
var j_x = new Array();
var j_y = new Array();

for(var i =0;i<j_line;i++) {
    var arr = j_text[i].split(",");
    j_drag[i] = arr[0];
    j_stroke[i] = arr[1];
    j_x[i] = arr[2];
    j_y[i] = arr[3];
}
```

Figure 4.2.2.3 : JSON language combining PHP and Java Script.

```

ctx.beginPath();
ctx.lineWidth = 9;
ctx.lineCap = "round";
ctx.strokeStyle = '#edb2ec';

for(p=0;p<j_x.length;p++){
    if(j_drag[p]==1){
        ctx.moveTo(j_x[p-1],j_y[p-1]);
    }
    else{
        ctx.moveTo(j_x[p],j_y[p]);
    }
    ctx.lineTo(j_x[p],j_y[p]);
}

ctx.stroke();

```

Figure 4.2.2.5 : Code built in display tracing by implementing canvas method using HTML5 + Java Script language.

4.2.3 Storing Module

In storing module, the user writing was stored to compare in evaluation module. Each time user click on drawing area, application stored the coordinates on each stroke. When user clicked again, the stroke value is incremented to store for next stroke's coordinate. The flowchart shown in Figure 4.2.3.1 shows the algorithm for storing module.

Flowchart Algorithm

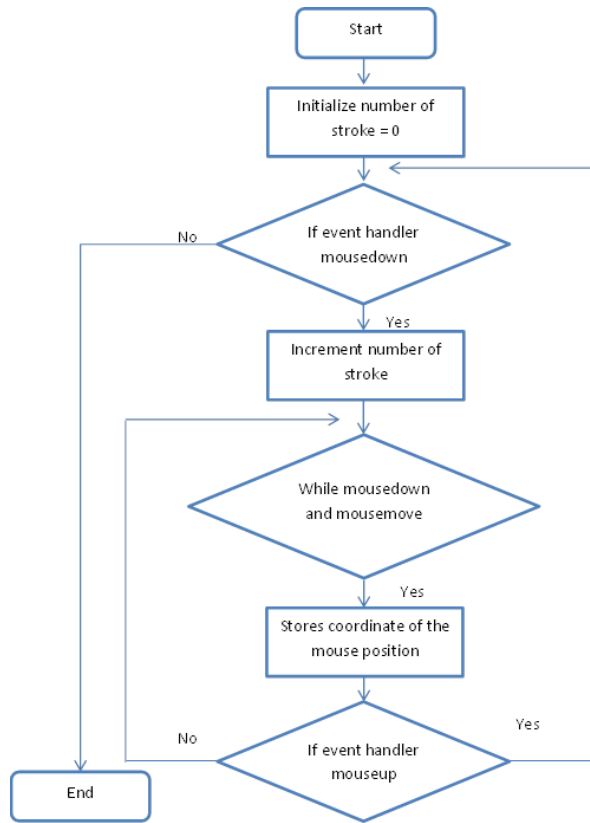


Figure 4.2.3.1 : Algorithm for Storing Module

User Interface



Figure 4.2.3.2 : User interface shows the drawing area (Red Box) for implementation Storing Module.

Based on Figure 4.2.3.2, the user interface shows the drawing area that has tracing alphabet in lighter color for guide the user. The, drawing for alphabet writing are overlap with the tracing alphabet with brighter and strong color.

Source Code

In storing module, the source code built to pull the coordinates of user click and drag. Then, the application will store the values of coordinate within each stroke in local variable and used it for comparison in evaluation module.

The source code for event handling for user mouse click (mousedown), mouse drag (mousemove) and mouse unclick (mouseup) were shown in Figure 4.2.3.3. While the codes for storing the stroke and coordinates in array were shown in Figure 4.2.3.4.

```
// Add mouse events
$('#canvas').mousedown(function(e)
{
    // Mouse down location
    var mouseX = e.pageX - this.offsetLeft;
    var mouseY = e.pageY - this.offsetTop;
    var timestamp = Number(new Date());

    if(mouseY > drawingAreaY && mouseY < drawingAreaY
+ drawingAreaHeight)
    {}
    paint = true;
    addClick(mouseX, mouseY, false);
    stroke_no++;
    redraw();
});
$('#canvas').mousemove(function(e){
    if(paint==true)
    {
        addClick(e.pageX - this.offsetLeft, e.pageY -
this.offsetTop, true);
        redraw();
    }
});
$('#canvas').mouseup(function(e){
    paint = false;
    redraw();
});
$('#canvas').mouseleave(function(e){
    paint = false;
});
});
```

Figure 4.2.3.3 : Mouse event handling using JavaScript coding.

```

        context.beginPath();
        context.rect(drawingAreaX, drawingAreaY, drawingAreaWidth,
drawingAreaHeight);
        context.clip();

        var radius;
        var i = 0;
        for(; i < clickX.length; i++)
        {
            radius = 5;
            context.beginPath();
            if(clickDrag[i] == 1){
                context.moveTo(clickX[i-1], clickY[i-1]);
            }else{
                context.moveTo(clickX[i], clickY[i]);
            }
            context.lineTo(clickX[i], clickY[i]);
            corX[j] = clickX[i];
            corY[j] = clickY[i];
            times[j] = new Date().getTime();
            stroke_cor[j] = stroke_no;
            j++;
            context.closePath();
            context.strokeStyle = clickColor[i];
            context.lineJoin = "round";
            context.lineWidth = radius;
            context.stroke();
        }
        context.restore();

```

Figure 4.2.3.4 : Java Script codes implement canvas HTML5 for writing and storing user alphabet writing.

4.2.4 Evaluation Module

After display and storing module, the coordinate that were used in both modules were applied in evaluation module. The coordinate of alphabet tracing in display module and users writing coordinate in storing module were compared and calculated. In this module, it divided into two evaluation process, firstly is tracing area evaluation and next is stroke order evaluation.

Both of the results of process in evaluation module were shown in the interface as shown in Figure 4.2.4.1. It shows the percentage of both process and summary of the score using star rating/ranking.



Figure 4.2.4.1 : Evaluation marks based on user's writing shown both precision and stroke order evaluation

4.2.4.1 Tracing Precision

Tracing precision is process to calculate the preciseness of user's writing following the tracing area that guided by the application. The process evaluated the precision and calculate the percentage to shows to the user how many per cents the accurateness of user writing.

Flowchart Algorithm

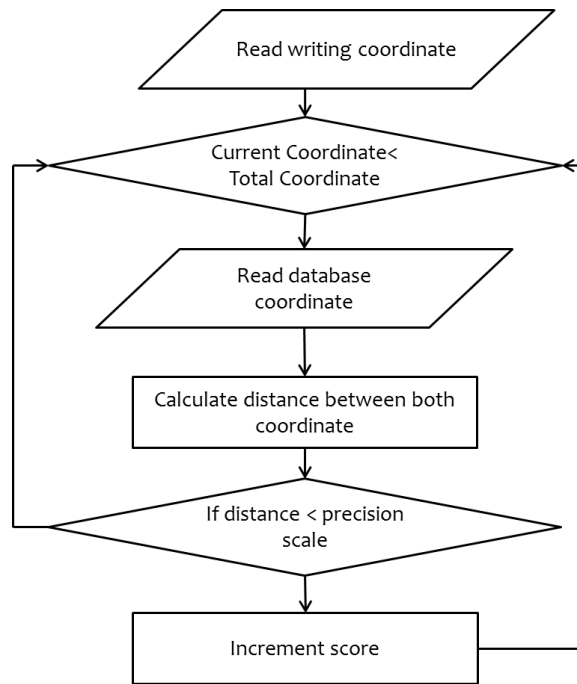


Figure 4.2.4.2: Flowchart shows the evaluation module focus on tracing precision evaluation.

Based on flowchart shown in Figure 4.2.4.2, the evaluation tracing precision is evaluated through reading the user's writing coordinates and compare with all existing coordinate in database. The comparison is using Euclidean distance algorithm to verify if the coordinates is within the scale of precision. If the distance is less than the scale, thus the score will counted and incremented. The source code that implement the process are shown in Figure 4.2.4.3 below.

Source Code

```
var last_coordinate = corX.length-1;
var last_cor_ori = j_x.length-1;
var tot_stroke = stroke_cor[last_coordinate];
var cor=0;
var cur_s = 1; //for incrementing/indexes looping stroke

//calculate precision
var precision_marks=0,check_marks =0;
var scale =5;

for(var precise=0;precise<last_coordinate;precise++)
{
for(var precise_search=0;precise_search<last_cor_ori;precise_search++)
{
var check_x = Math.abs(corX[precise]-j_x[precise_search]);
var check_y = Math.abs(corY[precise]-j_y[precise_search]);
var sumPower = Math.pow(check_x,2)+Math.pow(check_y,2);
sumPower = Math.round(sumPower);
var distance = Math.sqrt(sumPower);

if(distance<=scale)
{
check_marks++;
}
}
if(check_marks>0)
{
precision_marks++;
}
}
```

Figure 4.2.4.3 : Source code for tracing precision process.

4.2.4.2 Stroke Order

Flowchart Algorithm

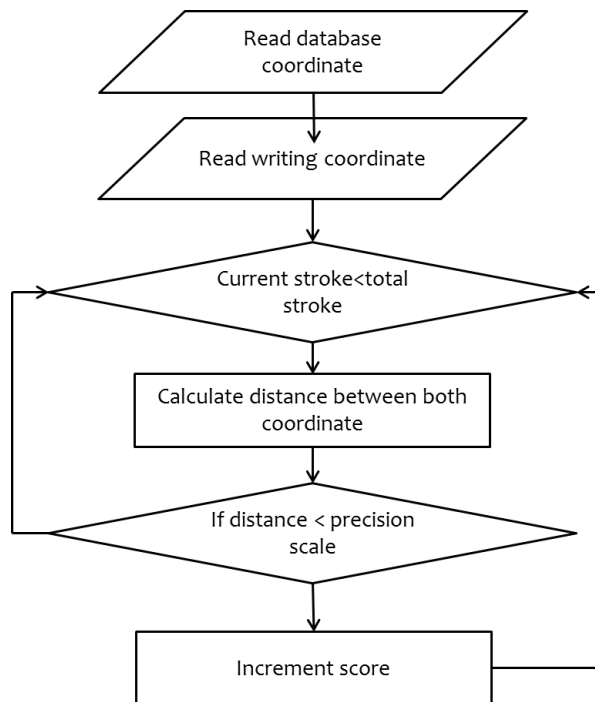


Figure 4.2.4.4: Flowchart shows process of evaluation on stroke order.

Based on coordinates stored in database, the application will identify the correct order of stroke and compared it with the user's writing of stroke. If first and last coordinate of user writing within the radius of database coordinates, the stroke was calculated as correct order. Based on flowchart shown in Figure 4.2.4.4, the coding that implement the process are shown in Figure 4.2.4.5.

Source Code

```
//for calculate stroke order
for(cor=0; cor<last_coordinate; cor++){
    if(cor==0) {
        stroke_first_cor[cur_s]=0;
    }
    if(stroke_cor[cor]==cur_s) {
        stroke_last_cor[cur_s]=cor;
    }
    else{
        cur_s++;
        stroke_first_cor[cur_s]=cor;
    }
}

//for original stroke order
cur_s=0;
for(cor=0; cor<last_cor_ori; cor++){
    if(cor==0) {
        stroke_first_ori[cur_s]=0;
    }
    if(j_stroke[cor]==cur_s) {
        stroke_last_ori[cur_s]=cor;
    }
    else{
        cur_s++;
        stroke_first_ori[cur_s]=cor;
    }
}
```

Figure 4.2.4.5 : Source code for stroke order evaluation (continue).

```

//calculate precision stroke order
var f_difX=new Array(), f_difY=new Array(), l_difX=new
Array(),l_difY=new Array();
var stroke_marks=0;
var stroke_scale = 15;

for(var s = 1; s<=tot_stroke; s++){
    f_difX[s] = Math.abs(corX[stroke_first_cor[s]]-
j_x[stroke_first_ori[s]]);
    f_difY[s] = Math.abs(corY[stroke_first_cor[s]]-
j_y[stroke_first_ori[s]]);

    l_difX[s] = Math.abs(corX[stroke_last_cor[s]]-
j_x[stroke_last_ori[s]]);
    l_difY[s] = Math.abs(corY[stroke_last_cor[s]]-
j_y[stroke_last_ori[s]]);

    //distance first coordinate
var sumPower = Math.pow(f_difX[s],2)+Math.pow(f_difY[s],2);
sumPower = Math.round(sumPower);
var distance = Math.sqrt(sumPower);

    //distance last coordinate
var sumPower2 = Math.pow(l_difX[s],2)+Math.pow(l_difY[s],2);
sumPower2 = Math.round(sumPower2);
var distance2 = Math.sqrt(sumPower2);

    //in given radius
if((distance<=stroke_scale)&&(distance2<=stroke_scale)){
        stroke_marks++;
    }
}

```

Figure 4.2.4.6 : Source code for stroke order evaluation (continue).

CHAPTER FIVE

RESULT AND DISCUSSION

5.1 Introduction

This chapter discuss the result on testing the application and discussion on overall result of the application. After the development has been performed, the expected results are identified in order to ensure that the requirements are met.

5.2 Testing Result

The three main modules (display, storing and evaluation) were used to evaluate the main function of the application that were precision and stoke order. Based on implementation of the algorithms and coding of the modules, several tests were conducted. The parameter on tracing precision and stroke order were tested to check whether the modules and functions were working well.

Figure below shows the tracing precision and stroke order parameter that were tested to get various results. Each test conducted were tested by follow both rule of evaluation (precision and order), ignore either one rule or both rules. Thus, the percentages and stars shown will guide the user to know the performance based on both parameters.

Parameter/Test	1	2	3	4
Tracing Precision	Good	Bad	Good	Bad
Stroke Order	Good	Bad	Bad	Good
Result	Figure 5.2.1	Figure 5.2.2	Figure 5.2.3	Figure 5.2.4

Table 5.2.1 : The result on both precision and stroke order.



Figure 5.2.1 : Result when good on both Tracing Precision and Stroke Order



Figure 5.2.2 : Result showed if user performance bad on both parameters



Figure 5.2.3 : Result shows if user good in letter tracing.



Figure 5.2.4 : Test result for user good in stroke order but bad in tracing.

Thus, based on test result achieved, the application can process on both letter tracing precision and stroke order evaluation. The result shown that the proposed solution has a capability in identify the weakness of the user writing skill by showing user level of tracing and stroke ordering.

5.3 System Constraint

The writing system application was built by referring the method on precision and stroke order evaluation. The application that was deployed using web-based application still in development phase and in evolving based on current technologies. Thus, this application may have some constraint and disadvantages. Several constraints found after testing the application was;

- Stroke order animation to guide alphabet writing to the user.
- Deploy in mobile application using touch event handler.
- User score not able to be stored.

5.4 Future Research

This application still in research and testing states, thus, for future research in continuing the same methods, several implementation, additional methods and techniques are suggested.

- Upgrading the application using mobile devices and implementing touch event handler.
- Additional method of evaluation on stroke direction such as upward and downward stroke.
- Implementation using pinyin (mandarin) writing system or other language writing system.
- Enhance the web based application through HCI rules implementation.

5.5 Conclusion

In conclusion, “Early Stage Writing for Beginners with Precision Evaluation (Alphabet Module)” is an application developed for evaluate the precision and stroke order of user’s writing that focused on early stage writing. The objective of the research was to identify suitable precision evaluation technique for early stage writing application. Besides that, the research was study to develop web application for children beginner learning of writing alphabet. Then it was to evaluate the accurateness of alphabet writing by implementing vector graphic approach base on stroke order and coordinate range. The research was focusing the scope on vector graphic alphabet for children age 1 to 5 or parents or teachers. The main module consists of display, storing and evaluation module. The platform involve in building the application was web based application implementing HTML5, PHP, Java Script, JSON and CSS languages. The methodologies used in the research were combination of waterfall methodology and Rapid Application Development (RAD). Thus, the stages involves in the combined methodology were planning, analysis, design, implementation and testing. The purpose of research was because lack of precision and stroke order evaluation in application for early writing alphabet. With this research, the application built can help the user identify the deficiency of their tracing alphabet or their stroke ordering. Through showing the percentages evaluation user can identify the problems and correct their writing and furthermore they can improve their writing. Hopefully this research application may meet all the objectives and give advantages to the users.

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APPENDIX A

GANTT CHART

APPENDIX B

UESR INTERFACE DESIGN

a) Home Page



Figure B1 : Home Page User Interface

b) Menu Page



Figure B1 : Menu Page User Interface

c) Alphabet Page



Figure B3 : Alphabet List Page User Interface

d) Guide Page

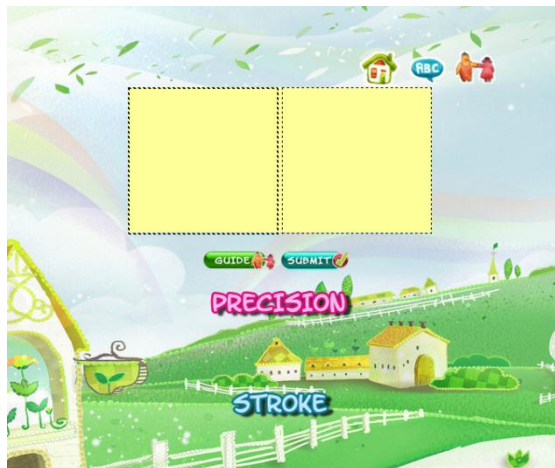


Figure B4 : Guide Page User Interface

a) Writing Page



Figure B5 : Writing Page User Interface

APPENDIX C

PLAGIARISM DETECTED BY TURNITIN



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