FINAL YEAR PROJECT

FINAL REPORT

STUTTERER AID MOBILE APPLICATION

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15159

INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

Stutterer Aid Mobile Application

by

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Dissertation submitted in partial fulfillment of
the requirements for the
Bachelor of Technology (Hons)
Information and Communication Technology

December 2013

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CERTIFICATION OF APPROVAL

Stutterer Aid Mobile Application

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A project dissertation submitted to the

Information & Communication Technology Programme

Universiti Teknologi PETRONAS

in partial fulfillment of the requirement for the

BACHELOR OF TECHNOLOGY (Hons) INFORMATION & COMMUNICATION TECHNOLOGY

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DECEMBER 2013

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or person.

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(HANI YASMIN BINTI AHMAD ZAKI)

ABSTRACT

The main objective of this project is to develop a mobile application as an alternative way for stutterers to have personal practice guidance to reduce their stuttering problem besides attending speech therapy. This project will identify the appropriate methods that can treat stutterer's stuttering problem and to evaluate the user acceptance towards the developed mobile application. This is because none of current mobile application provides function that allows stutterers and speech pathologist to know the stage of stuttering through assessment result. Moreover, devices which are specially designed to aid stuttering are expensive. This application is targeted for children's stutterers in Malaysia and it is built for Android platform. Moreover, this application is applies effective approaches or treatments for curing stuttering problems recommended by Pathologist who are specializes in this area. From the interview session with the Pathologist in Hospital Kuala Lumpur, it is found that there are a lot of treatments or methods to help stutterers to improve their speech patterns and boost their confidence level. The methods include Metronome, Music, Mirroring, Delayed Auditory Feedback, and word repetition. This Stutterer Aid Mobile Application will implement only three methods from all methods that been recommended by the Pathologists which are Metronome, Mirroring and Delayed Auditory Feedback and a device called "Stutter Rate". This application provides an assessment results for Pathologist reference so that pathologist can monitor their recovery. After the user testing, it can be conclude that this application is able to become another alternative ways for stutterers having personal speech exercise. Moreover, mostly users are satisfied with this application based on the user testing results.

ACKNOWLEDGEMENT

First and foremost, thanks to God for giving me the spirit and strength to work and proceed with this project and He is the One who made everything happen according to plan without any major problems.

I would like to thank the countless number of people who have helped to get this final year project into a complete success. This final year project would not be completed successfully without the support of many people.

Deepest appreciation also goes to my supervisor, Dr Noreen Izza bt Arshad, who always been there when I need advice and opinion to tackle problem during the development of this project. The supervision and support that she gave truly helped the progression and smoothness of my final year project.

I would also like to express my thanks to all lecturers for their help and for giving me some guidance in a few areas where my skills were deficient. Many thanks to pathologists and patients in Hospital Kuala Lumpur and Klinik Audiologi dan Sains Pertututan in UKM for giving good cooperation and support me by giving knowledge and input for this project. The input made this project a much better product.

Last but not least, special thanks to my family and friends who always been there for me through hard and bad time. All your help, support and guidance are highly appreciated.

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CHAPTER 1:

INTRODUCTION

1.1 Background of Study

Stutterer is an interruption or break in flow of speech. It begins during childhood and in some cases can lasts throughout life. According to the American Speech-Language-Hearing Association (n.d.), it was stated that the disorder is characterized by distraction in the middle of communication which is also called "disfluencies". A person who stutters may repeat part of a word or hold a single sound for a long time. Stuttering is a complex problem and may affect speech. They may have a tough time to speak. It also can cause a lot embarrassment and frustration.

There are no immediate ways to cures stuttering. Those who stutter however can fight the condition by themselves, as well as improving their fluency of speech by attending speech therapy and also by doing self therapy. Seeing a speech therapist is highly recommended in some cases but at most cases patients requires personal vocal trainings and speech exercise besides solely depending speech therapy. By having this personal vocal training, it can help them improve their confidence level as well as smoothing their speech. Thus, since nowadays everyone has Smartphone and tablets, developing the personal vocal training and speech exercise by using mobile application is the most efficient and interesting ways to help stutterers recover from stuttering problem.

Furthermore, every day, millions of users around the world use their Smartphone and Tablets to access web applications and other activities anywhere and at anytime. The increase amount of mobile application that been developed allows people to perform a wide range of task. Example of mobile applications are, in communication i.e (Facebook, to communicate with people from all over the world), Personalization i.e (Diary application, help people to manage their lifestyle), and Education i.e (Dictionary application, give knowledge to people). Moreover, there are some mobile application can cure someone illness. According to an online article by Moffett (2013), stated that a

mobile application called Supporting LIFE app can helps and treat sick children in Malawi and could give significant impact on survival rates across the continent. Therefore, by using mobile application, it would be easy for stutterers to practice speaking at home.

This study proposes an application known as the "Stutterer Aid Mobile Application". Stutterer Aid Mobile Application will be developed as an alternative way to treat stutterers. This application aims to help stutter people to improve their speech patterns and confidence level. Stutterer Aid Mobile Application is designed primarily for children's' stutterer with guided exercise that has been approved by Pathologists. Stutterer Aid Mobile Application will also be used by Pathologist, for them to know the improvement of their patients.

1.2 Problem Statement

Stuttering is a speech impediment that happens when regular speech pattern is interrupted by repeated syllable or sounds of letters. This happens when a person cannot pronounce a complete sentence all at once. The person may experience eye blinking while stuttering. Stuttering can happen while they are talking to a bunch of people or to one person. A person who is stuttering may have a tough time to speak. It can affect their confidence level in order to speak in front of people. It also can be embarrassing to have a speech problem and it can make them feel sad and shy. They might even decide that it would be easier if they just talk less. Because of this, according to the Stuttering Foundation of America (n.d.), it was stated that stutterers need to attend speech therapy. It is considered as one of the most successful approaches for treating stutterers. Speech therapy is a class or meeting with a speech pathologist who will teach and provide therapy for stutterers. Many teens and adults attend to speech therapy at least once in their lives (Stuttering Foundation of America, n.d.).

As mentioned by the Stuttering Foundation of America (n.d.) it was also stated that some people have been through years of therapy. The amount of therapy needed and the length of time involved are different for each person. It depends on the level or stage of the stuttering problem. Having many times of treatment or meeting with speech pathologist is costly and expensive. According to an online article, also from the Stuttering Foundation of America (n.d.) it was stated that, the therapy usually ranges from two to four hours and may cost between US$300 and US$500, depending on the speech pathologist's charges.

Other than that, stutterers need to undergo personal vocal trainings and speech exercises besides attending speech therapy for them to practice speaking it alone at home. There are several applications develops to treat and help stutterers but none of these application have functions that can track the stutterers practice and can see whether they have improved after using the application. Moreover, although there are some devices which can be used for stuttering treatment, unfortunately the devices are very expensive (Dan Slater, 2010). For example, Dan Slater (2010), stated that, Delayed Auditory Feedback is a device for stuttering and it costs about $4000 to $5000. This shows that, devices which are specially designed to aid stuttering problem is expensive and many people are unable to afford it (Dan Slater, 2010). Based on these reasons, this study is motivated to develop a mobile application for stutterers to guide them to practice by themselves.

1.3 Objectives

The main objective of this project is to design a mobile application known as "Stutterer Aid Mobile Application". Other objectives include:

- To identify the appropriate methods that can treat stutterer's stuttering problem
- To develop a mobile application as an alternative way for stutterers to have personal practice in order to reduce their stuttering problem

- To assess the effectiveness of the Stutterer Aid Mobile Application with the target audience.

1.4 Scope of Project

For this Stutterer Aid Mobile Application, the scopes of the application are stated as follows:

- Created primarily for stutterer in Malaysia from 7-12 years old

  The target user of Stutterer Aid Mobile Application is focused more for children's stutterer in Malaysia. So, the design, assessment and features in the application is suitable for children.

- Include the treatment or methods which are Metronome, Mirroring and Delayed Auditory Feedback

  This application is embeds these three treatment methods as recommended and guided by Pathologists in order to treat and help stutterers in reducing stuttering problem. Stutterers will use these three methods in this application as their personal practices at home.

- Developing a mobile application for Android platform

  Stuttering Aid is a mobile application which is developed for Android platform only. This is because by using mobile application it is the fast and efficient ways for stutterers to use this application as their personal speech exercise. Therefore, stutterers who are using Smartphone that have Android platform can use this application since the numbers of Android users in the world is ranked the highest. Based on an online article by McCracken (2013), it was stated that all companies that produce and making Android phones sell a lot more units as compared to other competitors worldwide.

1.5 Significance of the Project

The Stutterer Aid Mobile Application is considered important in such that:

- Provide efficient treatment: Stutter Aid provides methods or techniques which are designed to help stutterer to controls over their speech and thus may increase their confidence level in communication.
- User friendly application: This application is developed with simple design and easy to use interfaces that help user to easily use and understand the application's methods and exercise.
- Anytime and Anywhere Usage: Stutterer Aid is an offline application where user can use this application without having internet connection.
- Focus on providing convenience: Mobile application is easy to use since most people use Smartphone and can easily download the application.

1.6 The Relevancy of Project

The relevancies of this project can be classified into two; which are:

1. The relevancy towards stutterers:

    - Can help stutterers to reduce their stuttering problem and boost their confidence level by using this application.
    - Stutterers can use this application as a guided personal practice wherever they are
    - Stutterers can know their rate of stuttering.
    - Stutterers can use this application everywhere and at any time since this application is installed in their own Smartphone.
    - Stutterers can use this application as an alternative if they can't attend the speech therapy meetings.

2. The relevancy towards Pathologists (therapists)

- Pathologists can listen back their patient' speech from the recording file
- Pathologists can know whether their patient practice and do self therapy practices
- Pathologists can use this application as another way of giving their patients extra exercises.

1.7 Feasibility of Project

The tangible benefit that stutterers can get is that they can reduce the cost of buying devices for stuttering treatment. There are a lot of devices specially designed for treating speech disorder; unfortunately it is very costly and expensive. However, Stutterer Aid Mobile Application is a free application where they can easily download it and can install it directly to their Smartphone. Electronic devices that are available in the market have the same concept with the methods in this application.

Other than that, other tangible benefit includes that stutterers can know their rate of stuttering by knowing the numbers of words they speak and how many stutters per words in specific time. Other than that, stutterers can record their speech in their phone so that they can hear and know their speech pattern. Therefore, Pathologist can use the recording file for them to know the improvement of their patients.

Furthermore, the benefit of this application can be seen through practices that stutterers take. Therefore, stutterers can speak in a simple way and at the same time can get more information about their stuttering problem. This application is a user friendly application where it is developed and designed with simple function and features. Other than that, this application can be used everywhere and stutterers can have their own time to practice.

CHAPTER 2:
LITERATURE REVIEW

2.1 What is Stutter?

According to Stuttering Foundation of America (n.d.), stuttering is a disruption in the middle of communication where the flow of the speech is unsmooth because of repetitions e.g. "(li-li-like this)", prolongations e.g. "(lllllike this)", or abnormal stoppages i.e. (without any sound) of sounds and syllables. Kids who stutter may say that their words get stuck or describe their speech patterns as rough because that's how it sounds to them. What differentiates the person who stutters from someone with normal speech is the type and amount of the stuttering and also the behavior of the person. The results from the Communication Attitude Test that have been conducted by Brutten (1985) showed that the stuttering children have more negative attitudes as compared to non-stuttering children. What is known about stuttering is that children who stutter are no more likely to have psychological or developmental problems than children who don't stutter.

2.2 What Causes Stuttering?

Nobody really knows what are the causes for some people to stutter. Genetics may play a role and because of this, children have a tendency to stutter if a parent also stutters. Possible conditions that may cause stuttering include in coordination of the speech muscles, family history of stuttering, rate of language development and head injury or unusual brain activity. Functional brain imaging research over the last 10-15 years has consistently shown that the speech of people who stutter is related with unusual brain activity. Foundas, Bollich, Corey, Hurley and Heilman (2001), found that structural brain anomalies have been reported in adults who stutter.

A study conducted by Packman, Code and Onslow (2006) has found that "stuttering typically begins in the third year and fourth years of life as children starts putting words together into short utterances". Some children stutter more when they are excited and try to talk really fast, when they are afraid to talk to a certain people or when they are thinking about the word that they want to say. Other than that, when they feel shy because of the stutter problem, they might have tendency to stutter even more.

2.3 What treatments or methods can be used to treat stuttering?

There are many treatments currently available for stuttering, for both children and adults. One of the treatments for stuttering is by going to speech therapy. Many people who stutter from children until adults have been to speech therapy for reducing stuttering at least once in their lives. Some people have been through years of therapy. Speech therapy can reducing the flow of the speech, decreasing the tension and struggle of stuttering moments, working to decrease word or situation avoidances, build confidence and using effective communication skills such as eye contact or phrasing. According to article by Stuttering Foundation of America (n.d.), wrote that speech therapy for people who stutter means involve in switching the behaviors of speech, emotions, and attitudes about talking and communicating in general. Based on another online article by Dodge (2008), he mentioned that speech therapy used approaches that are effectives such as ability to modify speech motor movements and lower negative effect during stuttering. Speech therapy is a two way communication between the stutterer and the pathologist. In this project, the author will try to apply the speech therapy but only focusing on communication between the stutterer and the mobile application. People who are stutter can use this application to practice alone by using methods that been recommended by pathologist.

The second treatment that is effective in reducing stuttering is Metronome. Metronome is a high tech, neurologically based treatment tool. Metronome is a technique to encourage fluency of the speech using rhythm that requires stutter people to

speak one syllable word to each beat of a metronome. Based on research paper by Botterill (2011), he stated that, in early 1840, rhythm was already been used when Colombat dal'Isere used syllable timed speech and developed the use of the metronome to regulate the rhythm as fluency shaping therapies. Andrews, Guitar, and Howie (1980) found that the next largest effect sizes for stuttering treatment outcome is by using metronome stimulation after prolonged speech type procedures during the treatment studies for meta analysis. London R. (2006) stated that after going through some readings on stuttering, based on the knowledge that he get and the experienced with behavior modification techniques, he used the metronome technique because this technique can offer a relearning/behavioral approach. Other than that, based on studies conducted by specialist under the Stuttering Foundation of America (2007), William, a six years old boy start to recover from stuttering when he had less stuttered-like disfluency (SLDs), less sound repetitions and a greater number where whole word is pronounce without repetitions after using Metronome therapy. Based on this result, it shows that Metronome therapy is efficient for stuttering treatment.

Another treatment that can be used in order to cure stuttering is by stand in front of the mirror while practicing pronouncing and imagine the person in the mirror being someone else. Stutterer can start talking about anything such as how your day went, what you're feeling like or what you're planning on eating later on. This activities need to do every day until they watch their stutter disappear. Based on the online article, it stated that when we talk in front of the mirror, the situation is different when we talk to someone, but by practicing this technique, it can boost the level of confidence of someone while talking (Wikihow, n.d.). According to another online article, stated that mirroring can boost the level of confidence and ability to know that you are able to not stutter while being in front of people (Stop Stuttering, 2011).

Moreover, one of stuttering treatment that is always been used by Pathologist is Delayed Auditory Feedback. Based on online book by Fraser (2007), stated that delayed auditory feedback (DAF) is people hear what they have said a short time after they have said it. DAF can be used to help stutterer fluent their speech as well as control their stuttering (Fraser, 2007, p. 176). Dan Slater (2010), he mentioned that Delayed Auditory

Feedback (DAF) devices are hearing aid like gadgets such as MP3 that play back stutterer's speech after a delay of time for the repeated voice. Other than that, John Haskell, a speech therapist in New York stated that, DAF will be more effective if the device is used with another speech therapy such as breathing exercise (as cited by Dan Slater, 2010).

Moreover, Speaking rate is use to measure the number of syllables or words produced in a speech sample. By using speaking rate, Pathologist can identify the stutter rate of their patients and can improve the fluency of speech while they speak. Speaking rate is gradually increased until it closely approximates to normal. Meyers and Freeman (1985) stated that children who stuttered spoke slower than normal children.

Stuttering is graded by its degree of severity. Most pathologist rate stuttering by stuttered syllables per minute (spm) or words per minutes (wpm), (Australian Stuttering Research Centre, 2011; Ryan 2000; Robb, Gilbert, Reed & Bisson, n.d.). According to research paper by Australian Stuttering Research Centre, stated that the classification methods for speaking rate are:

- Mild - below 5% of syllables stuttered
- Mild to moderate – 5% to 10% of syllables stuttered
- Moderate - 10% to 15% of syllables stuttered
- Moderate to severe – 15% to 20% of syllable stuttered
- Severe - above 20% of syllables stuttered

Based on another research article by Chermak and Schneiderman (1986), reported that speaking rate for normal adults is 260 syllables per minutes and speaking rate for children 8 to 10 years old is approximately 190 syllables per minutes.

2.4 Related works

In Play Store, there are a few mobile applications that are specifically created to help and treat stutterer's stuttering problem. One of the applications is known as StutterHelp created by Priju Paul in 2013. StutterHelp is an application that provides techniques for people to control their speech fluency, slow down the speech rate, and

thus boost confidence for people who stutter or stammer while speaking. This application is a free application and it provides many techniques for stutters to practice speaking. These techniques include Delayed Auditory Feedback (DAF), Metronome, Mirror, Add Words, Finger Tapping and Yoga. Unfortunately, this application does not provide any results where stutterers can know which stage of stuttering they are currently facing after using this application. Users also are unable to keep track of their daily practices. Therefore, user would not be able to know whether they are improving or still in the same stage after using this application. Thus, this application can only be used for their daily practice and is not recommended by Pathologists.

Secondly, another mobile application in the Play Store is known as Delayed Auditory Feedback (DAF) created by Boostlabz.com in 2012. This is a stutterer aid application that uses technique known the Delayed Auditory Feedback (DAF). DAF works by recording a person's speech through the headset. Then, through this technique, it plays delayed audio back to the user. Unfortunately, this application is provides only one specific technique for helping people with stuttering to speak more fluently. Other than that, this application is also reported not user friendly as it does not provide any guidelines on how to use it.

Thirdly, there is also a mobile application known as the Stop Stuttering Free created by Zingy Minds in 2013. This application is focuses more on giving information and guidelines to stutterers concerning stuttering problem. There are a lot of information provided in this application such as what is stuttering, easy techniques to control speech, does speech therapist are needed, does medication help and many more. However, this application does not provide any technical techniques or guide for use as their daily practices at home.

Table 2.1 below summarizes related works that have been done in helping stuttering problems:

Application / Description	StutterHelp	Delayed Auditory Feedback (DAF)	Stop Stuttering Free
Application Focus	provides techniques to control speech fluency, slow down the speech rate, boost confidence level	provides techniques known as Delayed Auditory Feedback	giving information and guidelines to stutterers about stuttering and ways to help them
Techniques Used to aid Stuttering	Delayed Auditory Feedback, Metronome, Mirror, Add Words, Finger Tapping and Yoga	Delayed Auditory Feedback (DAF).	No techniques provided. Only information on how to reduce stuttering

Table 2.1: Summary of related works

2.5 What is mobile application?

Mobile application is software where user can use as a tool to perform task, activities or certain process. Nowadays, many categories of mobile application have been developed by developers since many people are using and have a Smartphone. According to an online article, (Go-Gulf.com, 2012), it was stated that, there are already more than 1.08 billion Smartphone users in the world. Other than that, it was stated the developments of mobile applications are increasing each year. It is expanding at a rapid pace. Based on another online article, it was described that mobile application or mobile apps is an application that run on a Smartphone and a few other mobile devices (Webopedia, n.d.). These mobile applications are installed in Smartphone and people can purchase and download it as long as internet connection is available. Based on the statistics, it shows that mobile applications are heavily used nowadays. People use

mobile apps not only for communication but also for other activities or task such as for their lifestyle, personalization, health and many more. Because of this reasons, the author choose to use mobile application as another alternatives to help stutterer to reduce their stutter problem. Therefore, it is hope that this research project may benefit all walks of life. This is because not only adults use the Smartphone, but all generations including kids often have a Smartphone nowadays.

2.6 Why create Android application?

Android can be considered as the world's most popular mobile platform. Millions of people already use Android because it makes the mobile devise so much powerful and useful. According to an online article, it was described that Android is the largest installed base of any mobile platform and growing fast every day (Android Developers, n.d). Other than that, McCracken (2013) also stated that all companies that produce and make Android phones sell a lot more units than other competitors worldwide.

There are many reasons why Android is better than iOS. One of the reasons is that Android has better features as compared to iOS. This supported by Piltch (2013), who has found that Android can beats iOS for many reasons, including the following:

- By default, iOS shows only one app on the screen at a time; however Android is better than iOS where it allows developers to either create floating apps, which appear in their own windows on top of the primary app, or to split the screen between two different apps.
- Android offers variety of screen sizes as compared to iOS which only offers two choices for new iOS phone: the 3.5 inch iPhone 4S and the 4 inch iPhone 5.
- Android offers many choices of widgets and applications. There are thousands of widgets and applications available from Google Play, giving the users tones of flexibility that iOS cannot match.
- Since Android platform is used by many Smartphone such as Samsung, Sony, Motorola and many more, user can share data with many devices. For iOS, however users are only allowed to share data within Apple devices only.

CHAPTER 3:
METHODOLOGY

3.1 Data Collection Method

There are 3 different methods for data collection that will be use in this project. The methods are:

- Literature Review
- Survey/ Questionnaires
- Interview

3.1.1 Literature Review

The author has done some reading through magazines, case studies, research papers, journal and books that are relevant to the topics of research. The areas of studies include understanding about stutter problem, ways to help and reduce stutter problem, the behavior of stutter people and also mobile application development. Besides that, the author had also collected information from the internet to gain knowledge about existing mobile application in the current market that can help stutter people to reduce stuttering problem.

3.1 .2 Survey/ Questionnaires

The author had used survey and questionnaires to obtain feedback concerning the application and to increase the knowledge about stuttering. Survey questionnaires consist of written set of questions where respondents can record and choose their answer. The author also used the answer from respondent to expand knowledge about the current situation of patients.

3.1.3 Interview

The author conducted several interviews session with pathologist who is specialized in this area. These sessions are conducted to gain more knowledge about stuttering and to get their feedbacks on the methods that will be use in the application. Other than that, the author also interview stutterers to know more about their expectations towards the application. These interviews give a better view about each method; have faster and accurate information to develop this mobile application.

3.2 System Development

In this section, the discussion is focused on the method that will be used to develop this mobile application. The method that will be used is Prototyping Based Model. This model consists of (i) Planning, (ii) Analysis, (iii) Design, (iv) Coding, (v) System Prototype (vi) User Testing, (vii) Implementation and (viii) System Release. Each of these phases has its own role as explained in the following paragraphs.

A prototyping based methodology as shown in Figure 3.1, performs the design and coding phases concurrently, and all two phases are perform repeatedly in a cycle until the system prototype is (mobile application) is completed. The descriptions for the roles of each phase are as follows:

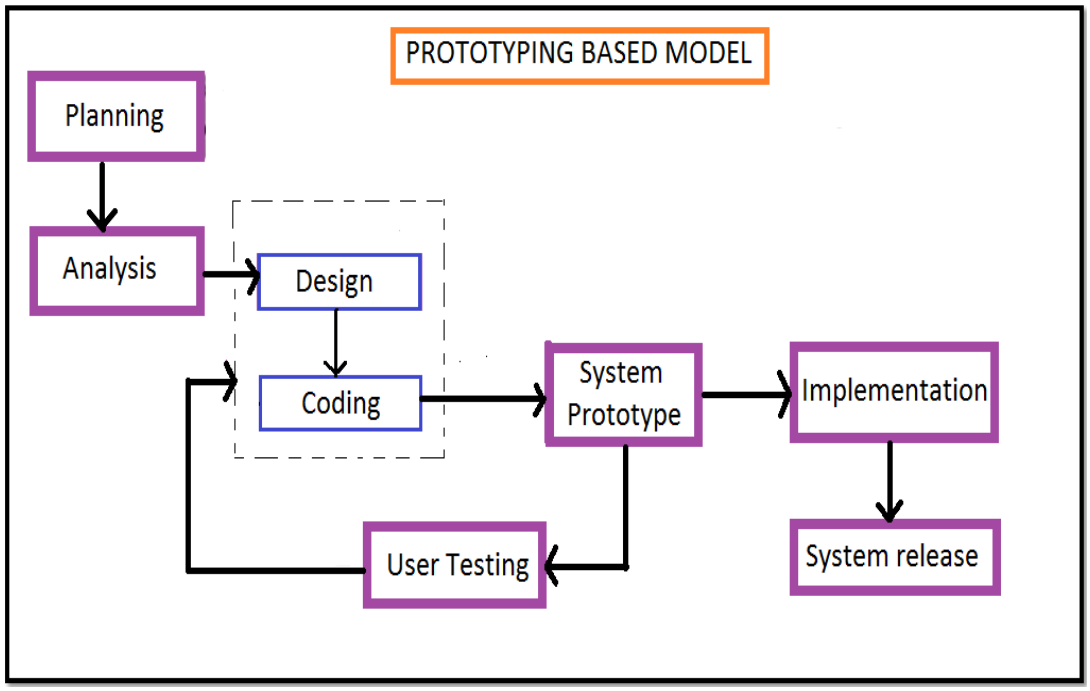

Figure 3.1: Prototyping Based Model

3.2.1 Planning Phase

Planning stage is to identify related stutter problems and also to find possible solutions by conducting several investigations. This phase is also to define and specify the project objectives and scope. Moreover, research and data collection will be conducted and focused on choosing the project title. After going through some discussion with supervisor, developer chooses to develop a mobile application known as Stutterer Aid Mobile Application. Further, during this phase also, the software and the hardware that will be used to develop this application is determined. Other than that, developer uses this planning stage to identify the task for the system development. Author also develops a Gantt chart to display all tasks that will be carried out through the project lifecycle that is represented in **Appendix A.**

3.2.2 Analysis Phase

Following this, analysis phase was performed. This phase was the most important stage in software development. It took some time to do necessary research and get a better understanding on the system requirements. During analysis phase, this is where all the data collections from the research were analyzed including the user requirement for the application.

3.2.3 Design and Coding Phase

In this phase, design phase and coding phase have been done concurrently after one another. These phases were repeated for each requirement that had been analyzed and until the system prototype is completed and functions well. During design phase, the interface of the application was been designed. In order to design the interfaces, developer used storyboard to get a clear view for each interface and function in the application.

Coding phase is a phase to develop the application. This phase involves programming and coding the function and features of the application. It will take a lot of time to develop and configure the working prototype. It will be repeated until the system prototype function well and to ensure the coding work effectively and efficiently. This application was been developed and designed by using Eclipse software.

3.2.4 System Prototype and User Testing Phase

After the analysis and design stage is performed, these stages work immediately with System Prototype, a program that provides a minimal amount of features. The system prototype is not an end product; it will be developed for each requirements being added to make the system fully functional. Usually, the first prototype is the first version of the system. The first prototype which is the interface of this application is developed and been tested and shown to users who then provide comments. These comments are

used to reanalyze, redesign, and implement a second prototype which provides working interfaces and functions as compared to the first prototype.

The purpose of user testing is to test the prototypes to ensure that the prototype function well as required. Other than that, this task is to ensure that all functional requirements are working. This will save times to identify and removes error in the application rather than implementing a full system and identify the errors at a later stage. This process continues in a cycle until users agree and satisfy with the application interface and function in the application.

3.2.5 Implementation and System Release Phase

The implementation phase was including implement the system prototype and system release. By the time the full system is complete, it is expected that the full system can be implemented in Clinic or Hospital which has speech therapist services, pathologist who are specializes in this area and also stutterers. Other than that, this system will be release in the Play Store where user can download it easily in their Smartphone.

3.3 System Architecture

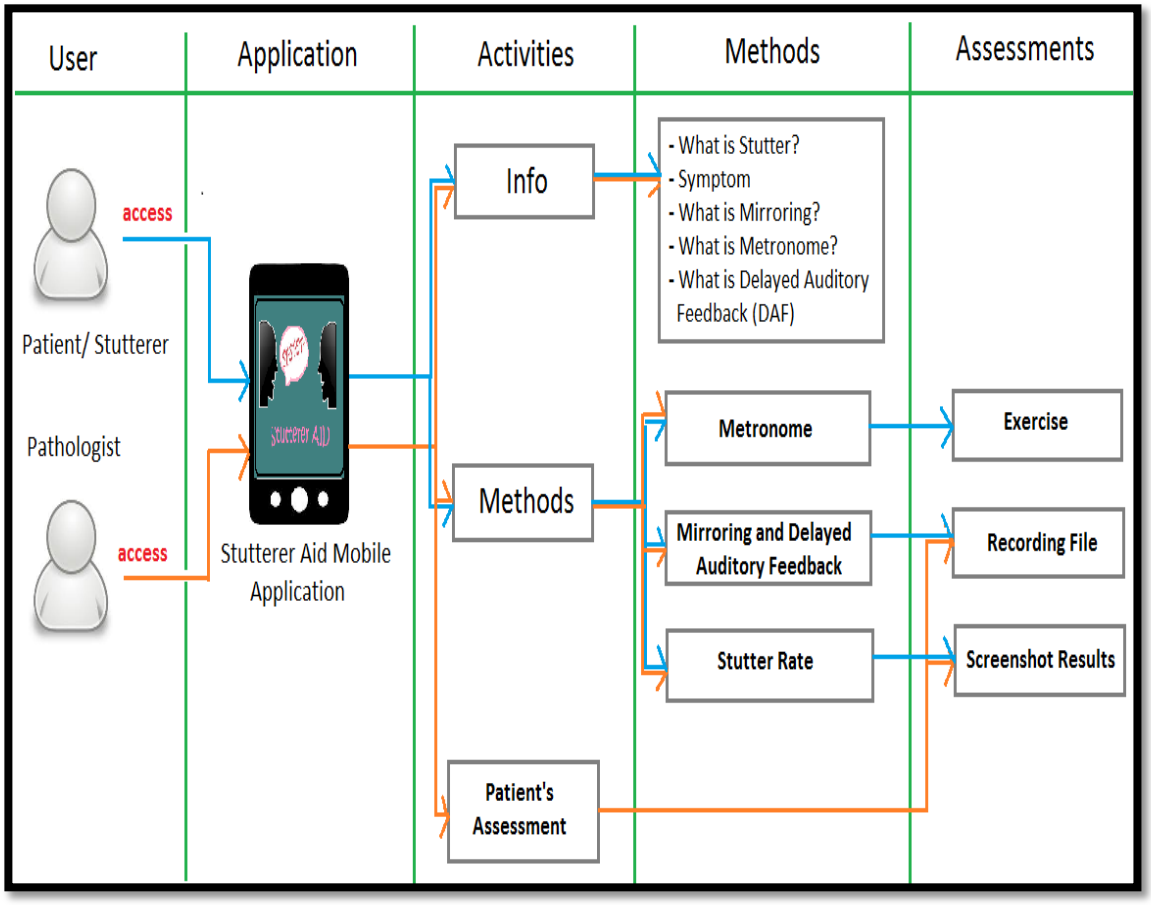

Figure 3.2: System architecture for Stutterer Aid Mobile Application

From the proposed system architecture shown in Figure 3.2, it presents the whole design of the application. The system starts from the user where user will download and install this application in their Smartphone. This application has two different users. For each user has its own view. The first user is for stutterers and the second user is for pathologist.

There are two activities involved in user's view which are info and method. In the 'Info' section, there will be information about what is Stutter, symptom of stutter and also information about each treatment available in this application. The reasons of giving

this information is to give knowledge to stutterer about stuttering problem and give them a clearer view about each methods that they will be going through in this application.

In the 'Methods' section, there are 3 treatments and a devices provided in this application which are Metronome, Mirroring, Delayed Auditory Feedback and Stutter Rate. Metronome has its own assessments while Mirroring and Delayed Auditory Feedback will be combining as one treatment. For Mirroring and Delayed Auditory Feedback, it is a recording method where user will speak while they can see themselves in the mirror and they can listen back their whole conversation by listening to their recording speech. Lastly, Stutter Rate is a device where user can know their speaking rate by knowing the percentage of words per minute and how many they stutter per words in a specific time.

For Pathologists part, pathologist can access directly to the assessment results of their patient where Pathologists can play the recording file to listen back their patient's speech and also can see the results of stutter rate in this assessment results section.

3.4 Key Milestones

Key Milestones	Week
Project title proposal	Week 3
Extended Proposal	Week 6
Viva Proposal Defense	Week 10
Interim Report	Week 13
User Testing	Week 20 (FYP 2)
Pre-Sedex	Week 26 (FYP 2)
User Testing with target user	Week 26 (FYP 2)
Submission of Draft report	Week 27 (FYP 2)
System Release	Week 28 (FYP 2)
Submission of Dissertation (soft bound)	Week 28 (FYP 2)
Submission of technical paper	Week 28 (FYP 2)
Oral Presentation	Week 29 (FYP 2)
Submission of Dissertation (Hard Bound)	Week 30 (FYP 2)

Table 3.1: Key Milestones during development of application

3.5 Proposed Storyboard

Diagram below is the proposed storyboard for Stutterer Aid Mobile Application

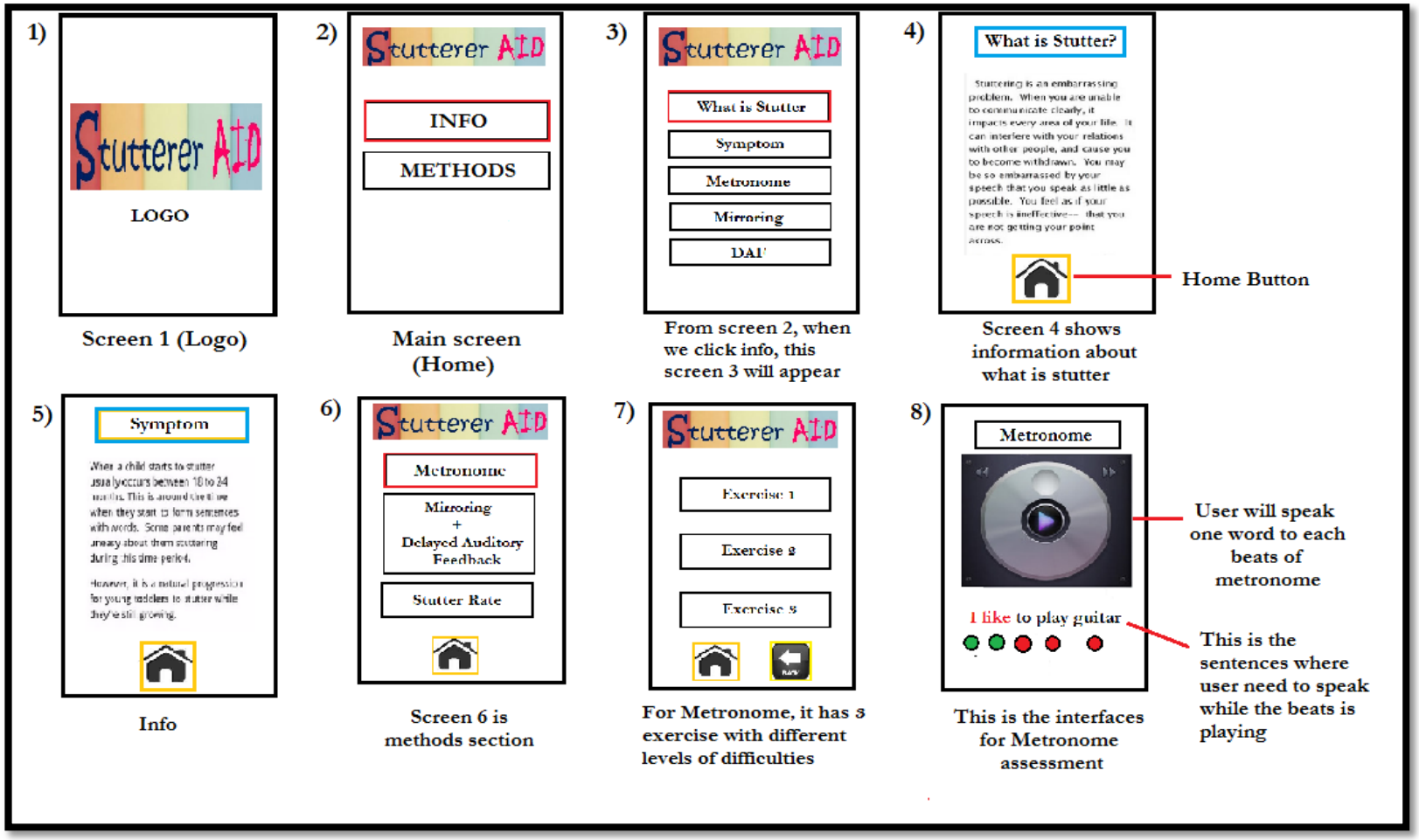

Figure 3.3: Storyboard 1

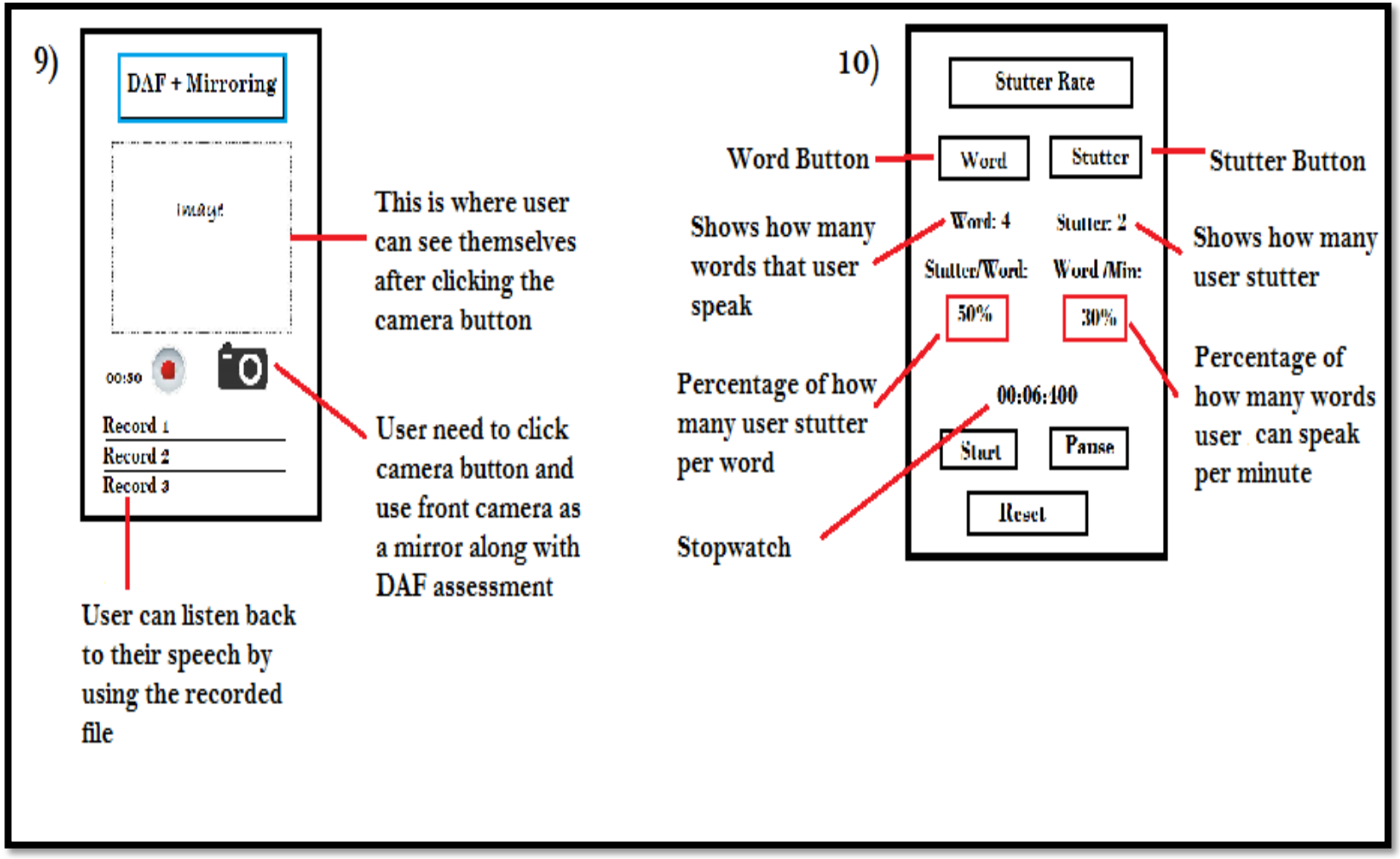

Figure 3.4: Storyboard 2

3.6 Tools Required

The tools required to develop this mobile application are:

- Eclipse – Software to develop the mobile application

Stutterer Aid Mobile Application was developed using Eclipse IDE software. Eclipse IDE is an Android development tools that is designed to give a powerful, integrated environment in which to build Android Application. Below are the interfaces of the Eclipse IDE software:

Figure 3.5: Eclipse software

Figure 3.5 below is the image of the Eclipse's mobile device emulator. Emulator is a virtual mobile device that runs in the computer. It lets author to develop and test Android application without using a physical device.

Figure 3.6 Eclipse's Emulator

- Microsoft Excel – To build the Gantt chart and display the activities of the project.
- Smartphone – To install and display the mobile application.
- Google Docs Spread sheet – To create the online survey

CHAPTER 4:
RESULTS AND DISCUSSION

This chapter explains about the current project implementation. Sections 4.1, present the results of the interviews conducted with Pathologists. Next, in Section 4.2, present the results of user testing with target users. Then, Section 4.3 explains about the system design and architecture. Finally in Section 4.4, the system interface is shown and explained.

4.1 Interview Results

The author has conducted a phone call interview with two Pathologists who are experts in this area. The reason that these interviews are conducted is to gather data on what are the most effective methods that can be applied in the application in order to treat stutterer's stuttering problems. Other than that, the author also needs to get verification from pathologists on what are the important features that can aid and guide patients (stutterers).

Based on the interview session with Pathologists, there are some successful methods that were recommended by the Pathologists for. The methods were:

1) Metronome
2) Mirroring
3) Listening to music
4) Word Repetition
5) Delayed Auditory Feedback (DAF)

All of this methods were been used by many speech Pathologist during therapy session with patients.

The methods are rates by the pathologist through their observations and experience. From the interview session, below are the rates that been give by Pathologist for each method:

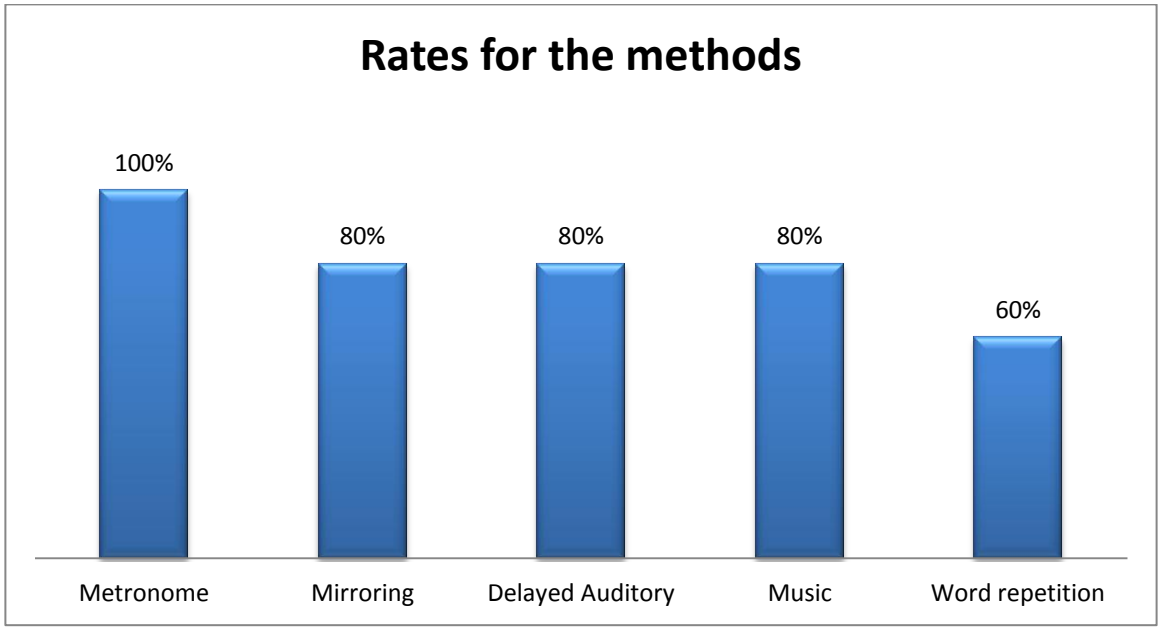

Figure 4.1: Rate for methods that can aid stuttering

Figure 4.1 states the rating of each method based on interview session with two pathologists. Both pathologists agree with metronome to be the most appropriate methods in curing stuttering. Mirroring, Delayed Auditory Feedback and Music ranked as second to be most appropriate methods that can aid stuttering problem. Lastly, word repetition method to be the less rate among these methods.

From the result, we can see that Metronome has the highest rates because based on pathologist's experience, Metronome method is the most efficient method that can control the speech pattern of stutterers as well as control their breathing while pronouncing syllables by syllables per each beat.

For Mirroring, Delayed Auditory Feedback and Music method, we can see that pathologist agrees with 80% of usefulness of these methods because these methods also can help stutterer in fluency their speech pattern and can boost their confidence level. Lastly for Word repetition method, pathologist rate this method with less rate because the method also can aid stuttering but with slow impact to stutterers.

Based on the result above, Stutterer Aid mobile application is implementing three from five methods that are mentioned above which are Metronome, Mirroring and Delayed Auditory Feedback.

4.2 User Testing Results

Refer to **Appendix B** for the User Testing Feedback Form. User Testing is divided into two categories which are for developers and for users. Testing for users also divided into two parts which the first part is for Pathologist and the second part is for target user (children's stutterers).

4.2.1 User Testing Results from respondents

User Testing was conducted with 14 respondents consists of speech pathologist, doctors, parents and children's stutterers. After the testing took place, the feedback towards the project is evaluated. The feedback results from respondents as per below:

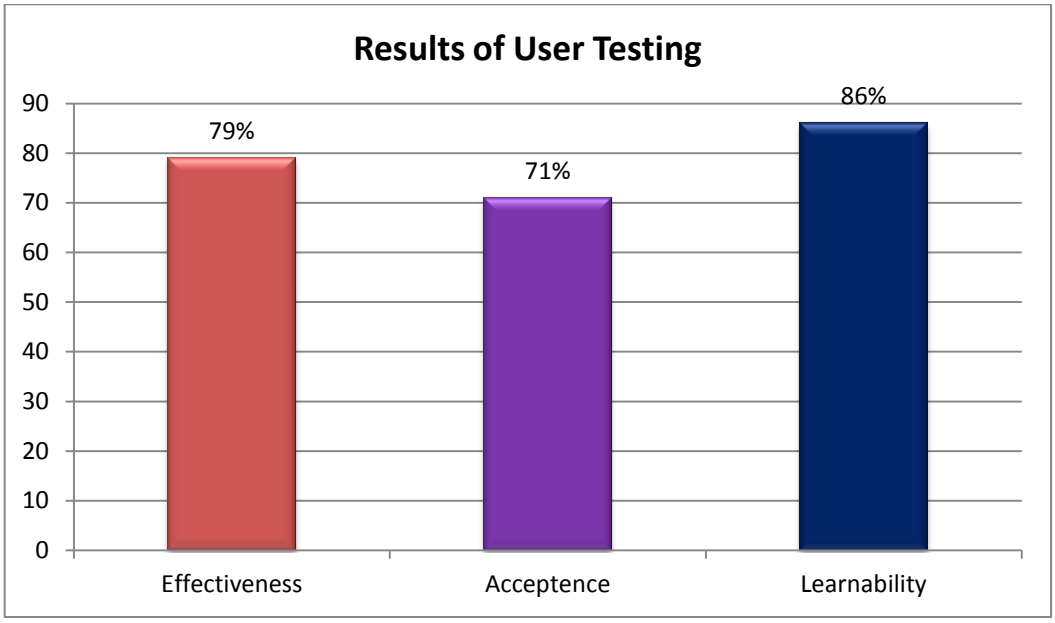

Figure 4.2: Testing results for Pathologist, doctors, parents and children's stutterers

The results above show that 86% of respondents agree that Stutterer Aid Mobile Application is easy to learn and understandable. Learnability bars define that users are able to use without any instructions. Moreover, 71% of respondents agree that this application is acceptable. Acceptance bars define that they are agree that this application are acceptable as alternatives way for stutterers having personal speech exercise and suitable for their patients. Lastly, for effectiveness, 79% of respondents agree that this application is effective and methods in this application can be used to aid stuttering and can help them improve their confidence level.

4.2.2 Evaluation Analysis of level of satisfaction

After the testing takes place, then the satisfaction of respondents which consists of pathologist, doctors, parents and also children's stutterer toward the application will be evaluated. The evaluation of satisfaction will be analyzed using graph below:

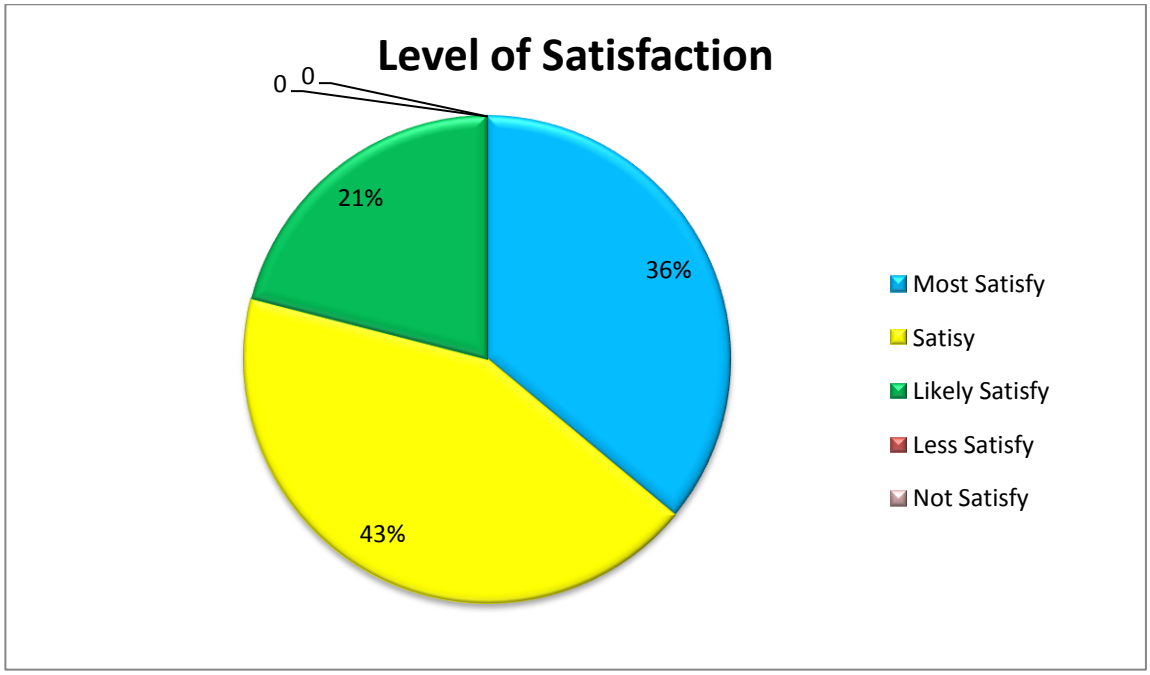

Figure 4.3: Evaluation Analysis of level of satisfaction

From the result above, we could say that the group of respondents is mostly satisfied with the performance of the application. So, from the table above, we could say that only 36% of respondents are most satisfied with the application which they think that this application has met the overall objectives. Moreover, 43% of respondents are satisfied with this application which means that there are still have weaknesses in the system or the application need to be upgrade. Lastly, 21% of respondents are likely satisfied with the application which they think that this application is good and should include more features.

Therefore, from the Figure 4.3, we could see the result of efficiency of this application. The application had satisfied the user but it need to be improved more in term of the user interface design and provide more exercise and features for stutterers in this application.

4.3 System Design

4.3.1 Process Flow

In detailed system design, system models and conceptual design is important in designing the system. A system model gives detail guideline of the system developed. A system model is an abstraction of the system being studied rather than alternative representation of the system. So the basic flow of this application is being shown in Figure 4.4 below:

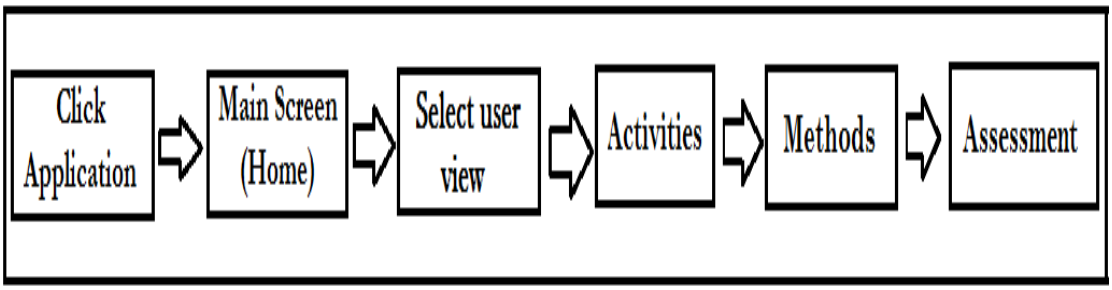

Figure 4.4: Basic flow of application

Figure 4.4 is the basic flow diagram of how this application works beginning when user enters the application until goes through all assessments.

Below is a system flow chart of Stutterer Aid Mobile Application

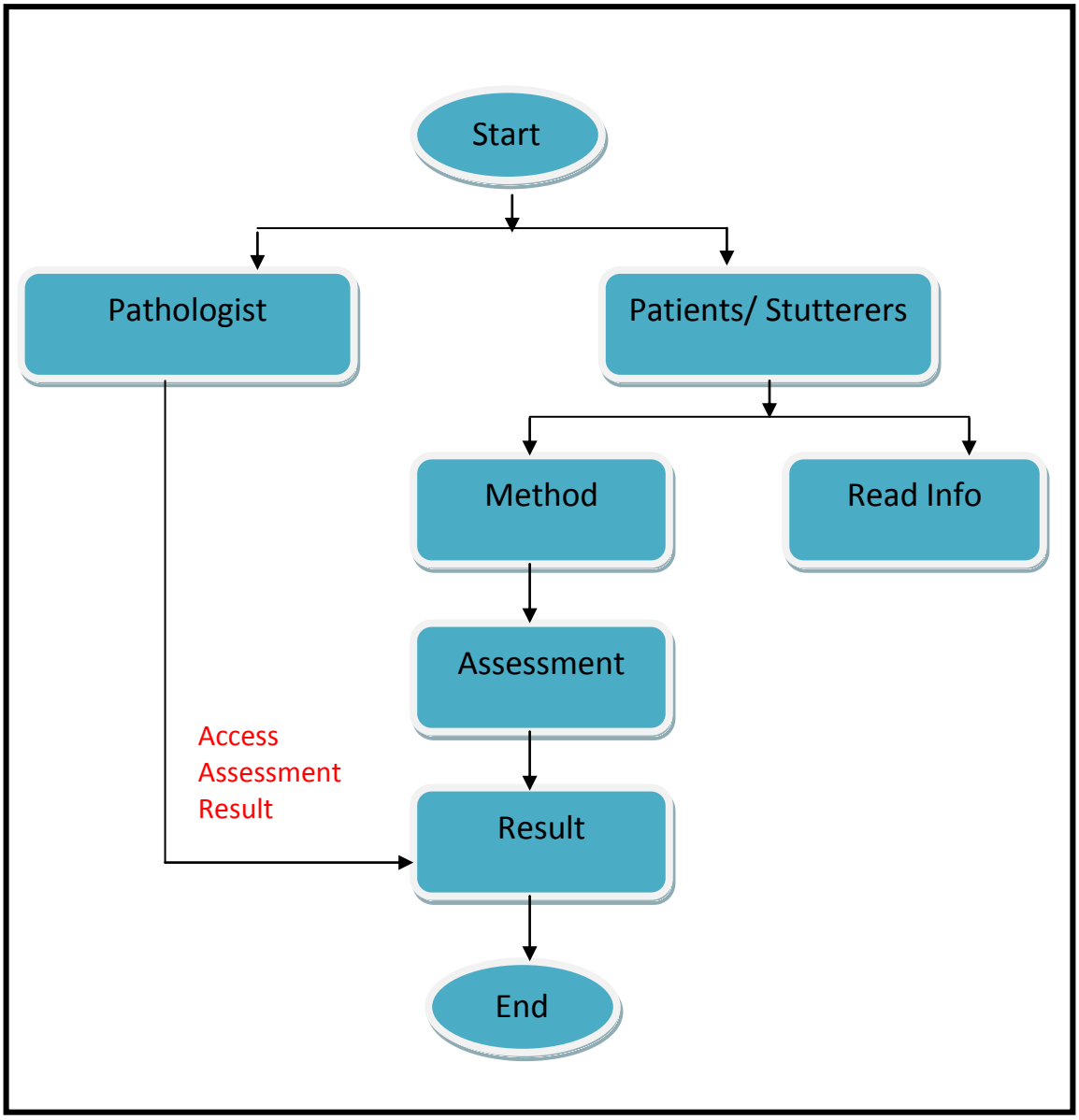

Figure 4.5: System Flow chart for Patients/ Stutterers

Referring to Figure 4.5, the flow chart is the process flow for Stutterer Aid Mobile Application. The first process is where the users choose to enters patient's categories or pathologist categories. Then, in the patient's part, there are two activities provided which are Info and Methods. Before stutterers start the activities in the methods section, they need to read the guideline of every method in this application. Next process is when the patients enter 'Method' section, there are three methods provided in this application which are Metronome, Mirroring and Delayed Auditory Feedback and Stutter Rate. After patients completed Stutter Rate and Mirroring and Delayed Auditory Feedback activity, the results produced are been saved in their phone. These results are for pathologist reference. Thus, pathologist can access directly to the assessment result by entering pathologist categories.

4.4 System Interfaces

Below are the interfaces of Stutterer Aid Mobile Application:

Figure 4.6: Screen Logo

Screen 1:Logo

Logo of Stutterer Aid Mobile Application.

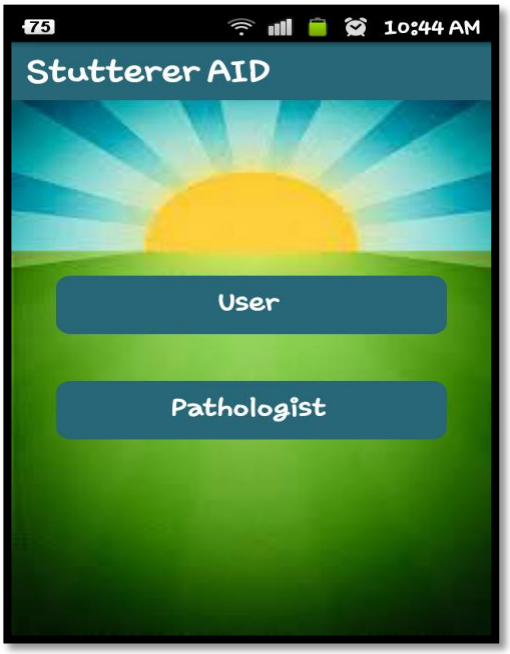

Figure 4.7: Screen 2

Screen 2

There are 2 users' categories in this application which are for Patients and Pathologist

Figure 4.8 Screen 3

Screen 3: Patient's Section

- There are 2 activities in patient's part which are Info and Method section.

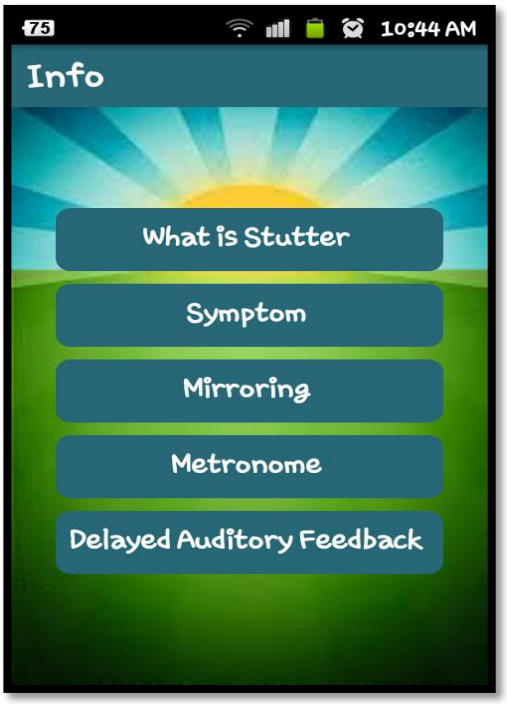

Figure 4.9: Screen 4

Screen 4:Info

- After user click button Info in screen 2, this screen will appear.
- This is the info section where user can read and have a clear view about what is stutter and the symptom of stutter
- Other than that, user also can read on how Mirroring, Metronome and DAF work in this application.

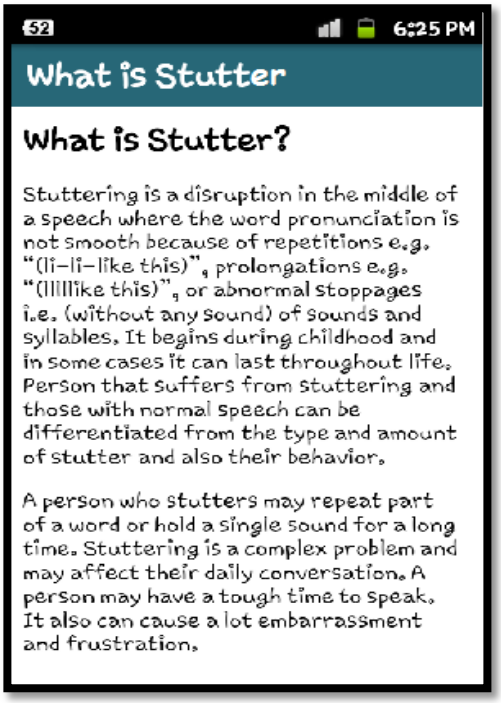

Figure 4.10: Screen 5

Screen 5:

Screen 5 is the info about what is stutter

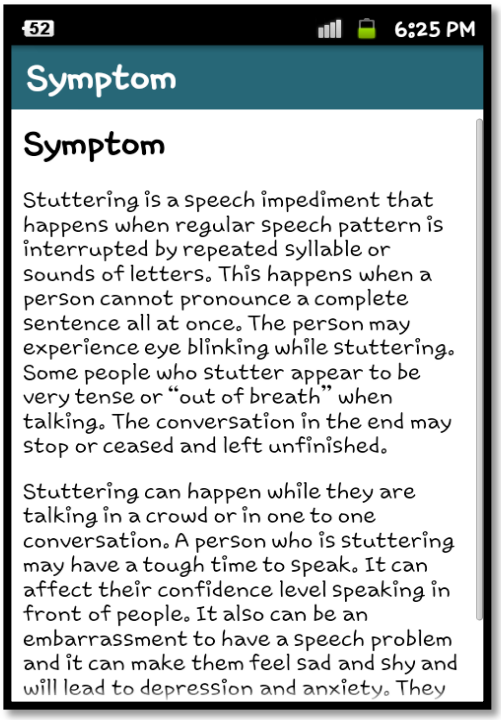

Figure 4.11: Screen 6

Screen 6: Symptom

Screen 6 is the info about symptom of stutter

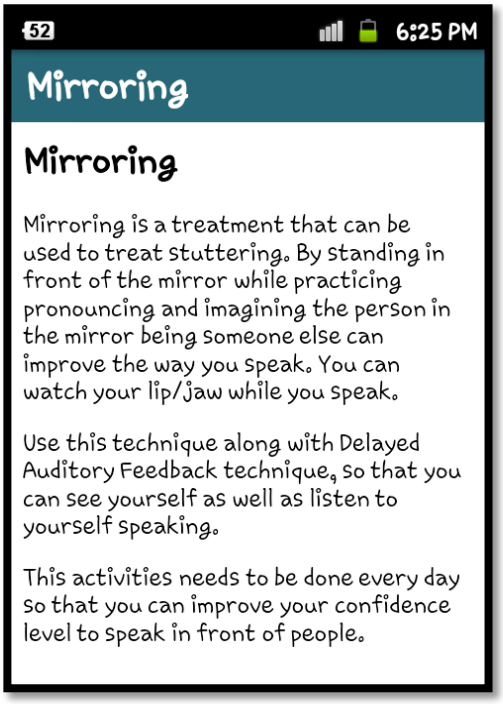

Figure 4.12: Screen 7

Screen 7: Mirroring Method

Screen 7 is the info about what is Mirroring method.

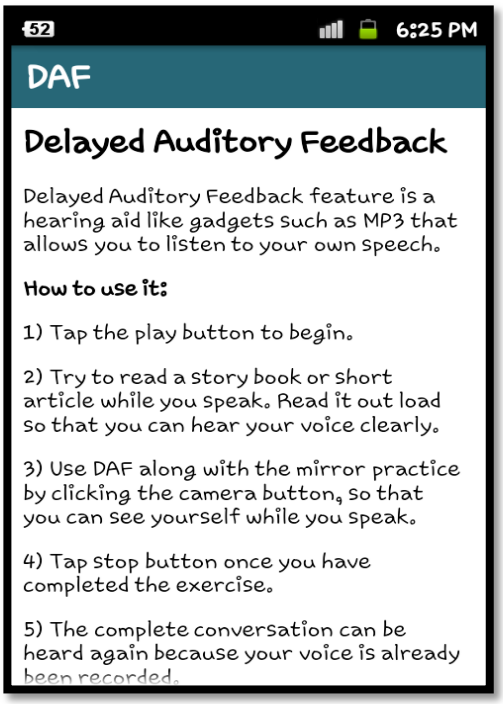

Figure 4.13: Screen 8

Screen 8:

Screen 8 is the info about what is Delayed Auditory Feedback and how does it works.

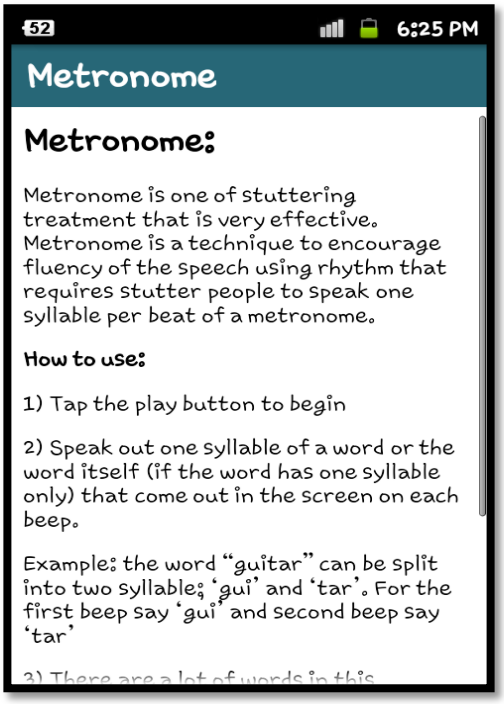

Figure 4.14: Screen 9

Screen 9:

Screen 9 is the info about what is Metronome and how does it works.

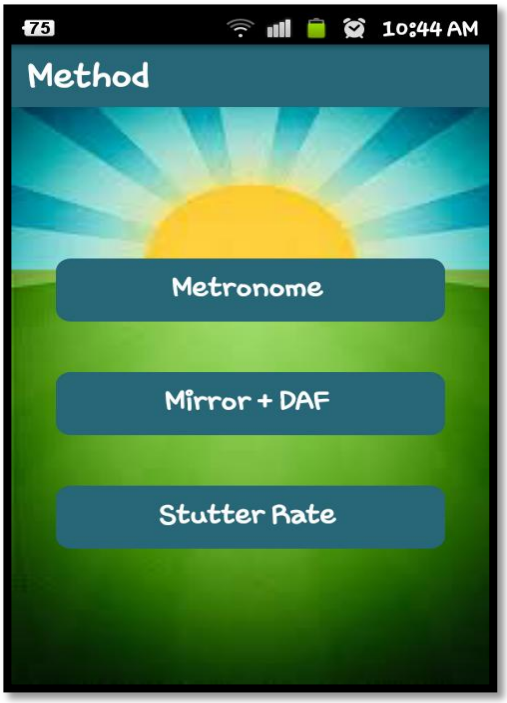

Figure 4.15: Screen 10

Screen 10: Methods

Screen 10 is the method section which contain Metronome, Mirroring and Delayed Auditory Feedback and Stutter Rate

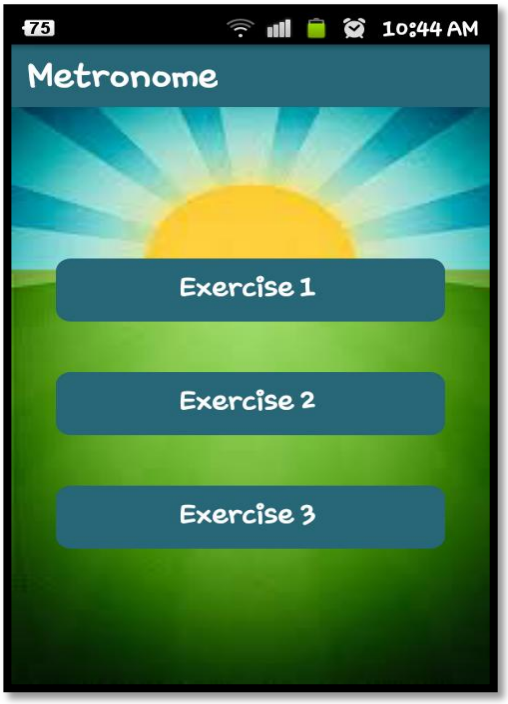

Figure 4.16: Screen 11

Screen 11:

- Inside Metronome, it has 3 exercises
- Each exercise has different length of time between each beats

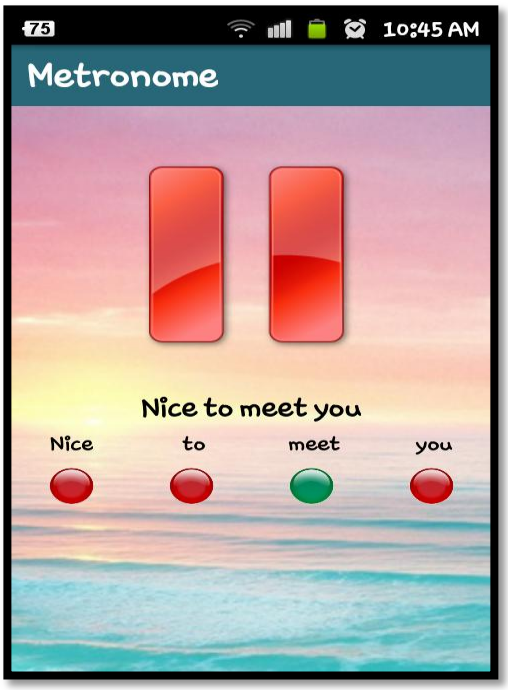

Figure 4.17: Screen 12

Screen 12:

This is the interfaces of how Metronome exercise looks like. User will click they play button and the beeps sound will come out for each syllable.

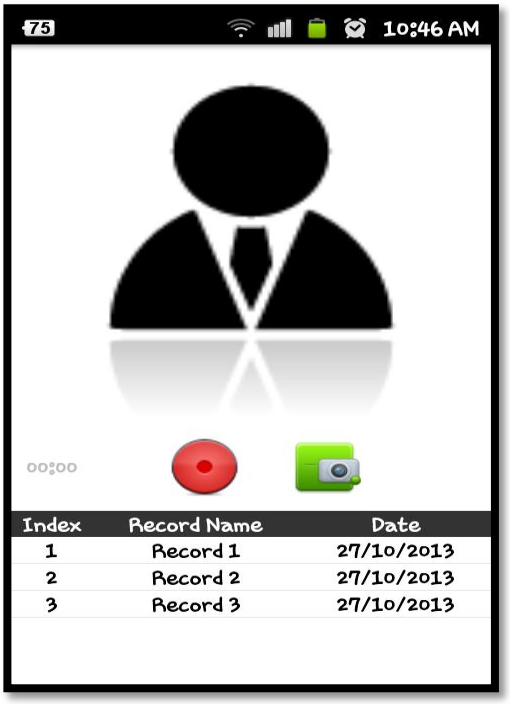

Figure 4.18: Screen 13

Screen 13:

- This is the interfaces of how Mirroring and DAF method looks like.
- User can record their voice after clicking the red button
- The camera button is for user seeing themselves while talking.
- User image/ face will appear in the user icon box above
- User also can playback the recording file by clicking the list of record name

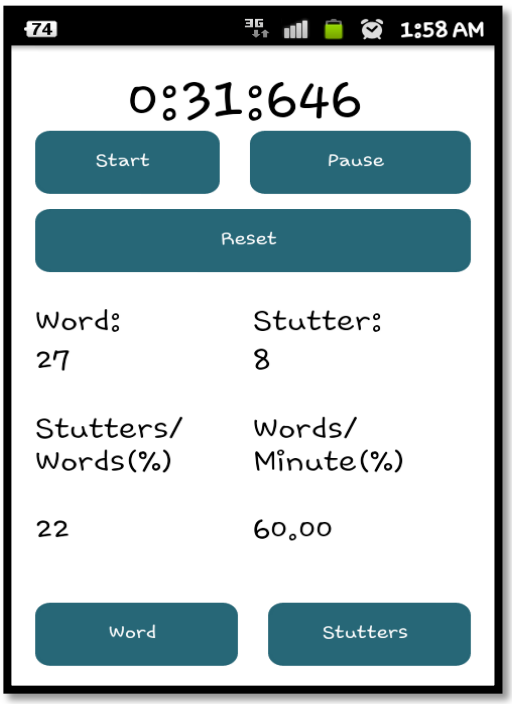

Figure 4.19 Screen 14

Screen 14: Stutter Rate

- This is the interface of Stutter Rate
- This methods is a manual method
- Each time user speak the word, they need to click the button word and when they stutter in the middle of speech, they will click stutter button.
- This method will calculate the speaking rate of the patients

Figure 4.20 : Screen 15

Screen 15: Pathologist's Section

- For Pathologists, they can go directly to the patient's assessment result
- In this section, there are two buttons that connect to the assessment which are Stutter Rate and Mirroring and Delayed Auditory Feedback methods.
- For Stutter Rate, Pathologist can see the screenshot Result of Stutter Rate
- For Mirroring and Delayed Auditory Feedback methods, Pathologist can playback the

CHAPTER 5:
CONCLUSION

5.1 Relevancy to the Objectives

Referring to Chapter 1, in Section 1.3, it was stated that this project has 3 unique objectives. It can be concluded that, as stated below:

For objectives number 1:

- To identify the appropriate methods that can treat stutterer's stuttering problem

  Based on the literature review (refer to Chapter 2), there are a lot of methods that can treat stutterer's stuttering problem. The methods are, Metronome, Mirroring, listening to music, breathing exercise and Delayed Auditory Feedback. Other than that, stutterers need to attend speech therapy in order for them to get more extensive practices in term of speech pattern and boost their confidence level. Moreover, based on the interview sessions with Pathologists, they mentioned that, the most appropriate methods for helping stutterers are Metronome, Mirror and Delayed Auditory Feedback. Therefore, from data gathered, all of these three methods (i.e. Metronome, Mirroring, and Delayed Auditory Feedback) was applied and implemented in the Stutterer Aid Mobile Application.

For objectives number 2:

- To develop mobile application as alternative way for stutterers to have personal practice in order to reduce their stuttering problem

  By developing the personal practice session for stutterers through mobile application, it is the fast and effective ways for someone to learn and have personal time for practice speaking. They can use this application anywhere they want and at anytime. Referring to the System design and implementation (refer to chapter 5), this project was developed by using Eclipse IDE software. Eclipse IDE is software that is design to develop an integrated environment and powerful android application.

For objectives number 3:

- To assess the effectiveness of the Stutterer Aid Mobile Application.

  The application was been tested with patients (stutterers), parents, speech pathologist and doctors. There were 14 respondents testing the Stutterer Aid Mobile Application. Results from the test are important and has been used to modify and improve the function and features of the application. Other than that, Stutterer Aid also had been modified based on user's comments and feedback. This is to ensure that the Stutterer Aid Mobile Application is accepted by users and Pathologists.

5.2 Suggested Future Works for Continuation

For future project work, the author would like to suggest that the research area and the system's features to be expended. The research areas should includes the numbers or the statistics of stutterers especially in Malaysia in order to support the relevancy of this project. Other recommendation is to upgrade the system's features by providing other methods that can aid stuttering and improve the effectiveness of this application.

For the applications to be reliable for the patients to used, the applications can be upgraded. For examples the sentences in the Metronome method will be added and also to develop assessment tests that have different level of difficulties where stutterers need to past the test to go to the next level. By using this way, user can practice a lot and can see the result so that they can know whether they improve it or not.

The author also suggests that the interface of this application should maintain a user friendly and attractive environment for children. Therefore, it is hope that this application can be accepted by all stutterers and Pathologists in Malaysia and may get an official collaboration with Pathologist in many hospitals in Malaysia.

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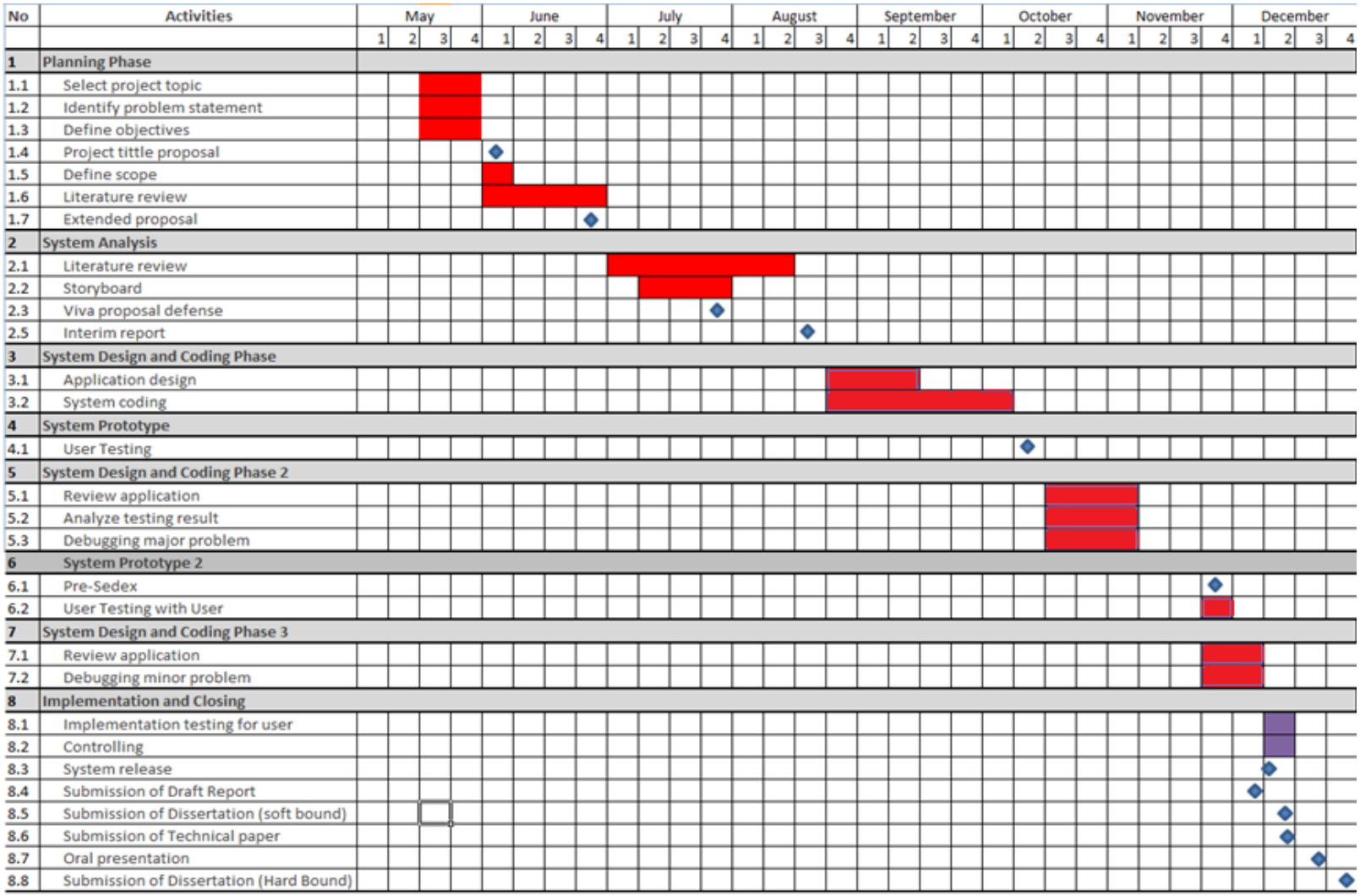
APPENDICES

Appendix A: Gantt chart

Appendix B: User Testing Questionnaire

APPENDIX A - Gantt chart



Apendix B- Questionnaire

STUTTERER AID MOBILE APPLICATION: USER TESTING FEEDBACK FORM

The objectives of this feedback form is to record the feedback from stutterers and Pathologist in order to improve the functions and effectiveness of this application.

Your opinions are very important for this project and thank you for your time to share your view for this project.				
Please rate 1-4 for question below	Strongly Agree	Agree	Di-sagree	Strongly Disagree
Learnability				
1. The application has user-friendly Graphical User Interface (GUI).	4	3	2	1
2. It is easy to use and understand how the method in this application works	4	3	2	1
3. The information provided is simple and easy to understand.	4	3	2	1
Effectiveness				
1. The application will help stutterer fluent their speech and improve their confidence level	4	3	2	1
2. The methods in this application works well and suitable for stutterer	4	3	2	1
3. Stutter Rate methods can helps Pathologist and stutterers know the speaking rate	4	3	2	1
4. The sentence been used in Metronome method is suitable for children's stutterers and can help them improve the flow of the speech	4	3	2	1
5. Mirroring and Delayed Auditory Feedback methods can help children improve their confidence level and control their speech pattern	4	3	2	1
Acceptance				
1. You are interested to use this application.	4	3	2	1
2. I will recommend this application to be use by stutterers and pathologist	4	3	2	1

Level of Satisfaction towards Stutterer Aid Mobile Application

Level of Satisfaction	Most Satisfy	Satisfy	Likely Satisfy	Less Satisfy	Not Satisfy
Rate	**5**	**4**	**3**	**2**	**1**