

**Communication Learning through Smartphone Application for Autism**

by

**Mohammad Fathi Islam Bin Nor Affandi**

**Dissertation submitted in partial fulfilment of**

**the requirements for the**

**Bachelor of Technology (Hons)**

**(Information and Communication Technology)**

**JANUARY 2012**

**Universiti Teknologi PETRONAS**

**Bandar Seri Iskandar**

**31750 Tronoh**

**Perak Darul Ridzuan**

**CERTIFICATION OF APPROVAL**

**Communication Learning through Smartphone Application for Autism**

by

Mohammad Fathi Islam Bin Nor Affandi

A project dissertation submitted to the

Information and Communication Technology Programme

Universiti Teknologi PETRONAS

in partial fulfilment of the requirement for the

BACHELOR OF TECHNOLOGY (Hons)

(INFORMATION AND COMMUNICATION TECHNOLOGY)

Approved by,



DAYANG ROHAYA AWANG RAMBLI  
Associate Professor  
Computer and Information Sciences  
Universiti Teknologi PETRONAS  
31750 Tronoh,  
Perak Darul Ridzuan, MALAYSIA

(Assoc. Prof Dr Dayang Rohaya bt Awang Rambli)

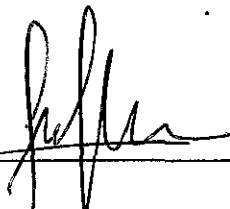
UNIVERSITI TEKNOLOGI PETRONAS

TRONOH, PERAK

January 2012

## **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 acknowledgement, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.



---

MOHAMMAD FATHI ISLAM BIN NOR AFFANDI

## **Abstract**

This project target the kids ( 7 to 12 years old) diagnosed with Classic Autism to help them to improve their development in communication and social skills by using the learning communication software via android smartphone devices. It will make use of a current popular touchscreen technology with attractive features for the kids to use in the learning process. People with classic autism often has problem with communication as they might have delay in developing language and speech, some autism kids also had problem in grasping and using objects such as mouse and keyboards. A touch screen device will allows the people with classic autism to navigate and interact with the devices instead of using mouse and keyboards when they use computers and introduce new actions such as tap and touch the screen.

The software will also emphasize on colors, pictures and sound to guide the autism kids to communicate and at the same time attract them to use it. This project is also aim for the autism kid to improve their learning ability and development of speech and communication by using the picture exchange system that will be used to replaced current method which is verbal teaching and is hope to encourage and instill the autism kids with the vital knowledge that they need to know as they are growing up. Visual memory has been proven easier to remember compared to verbal words, this project will make use of the fact and more entertaining features will be added such as sound and animation to help the autism kids to better understand the words.

## **ACKNOWLEDGEMENTS**

First of all, I would like to send my highest appreciation and million thanks to my Final Year Project Supervisor, Assoc. Prof Dr Dayang Rohaya for always supporting me in completing this project. She was very helpful throughout the project by giving me a lot of encouragements, ideas, suggestions and comments. She was always there to support the development of this project from the beginning until the end. Dr Dayang had been really helpful throughout the project, and she was really a great supervisor.

Other than that, I bid my highest appreciation to both of my parents Mr. Nor Affandi Saad and Ms. Atikah Hassan for always supporting me in whatever I do. They are my key sources of strength in doing whatever I do in my life. I also would like to thank my brothers and sisters for always supporting me.

Nevertheless, I would like to bid my appreciation to all who had involved in this project directly or indirectly. I also would like to send my highest appreciation to all external parties such as Sekolah Kebangsaan Iskandar and last but not least to Universiti Teknologi PETRONAS.

## Table of Contents

<b>CHAPTER 1</b>	<b>INTRODUCTION.....</b>	<b>8-13</b>
1.1	Background .....	8
1.2	Problem Statement .....	10
1.3	Objectives .....	12
1.4	Scope of Study .....	12
<b>CHAPTER 2</b>	<b>LITERATURE REVIEW .....</b>	<b>14-19</b>
2.1	Improvement on current technologies.....	17
<b>CHAPTER 3</b>	<b>METHODOLOGY .....</b>	<b>19-33</b>
3.1	Research methodology .....	20
3.2	Analysis.....	21
3.3	Design .....	21
3.4	Phase 1: Identify Basic Requirement .....	24
3.5	Phase 2: Develop Initial Prototype .....	24
3.6	Phase 3: Review .....	25
3.7	Phase 4: Revise and enhance the prototype .....	25
3.8	What need to be done.....	26
3.9	Suggestion for future enhancement.....	26
3.10	Project Activities.....	27
3.10	Key Milestone .....	30
3.10	Hardware and software .....	32
<b>CHAPTER 4</b>	<b>RESULT AND DISSCUSSION .....</b>	<b>34-45</b>
3.1	User Assesment and analysis .....	34
3.2	Experimentation and Modeling.....	37
3.3	Prototype .....	40

**CHAPTER 5      CONCLUSION .....46**

**REFERENCES .....47**

**LIST OF FIGURES**

Figure 1: Prototyping model ..... 20

Figure 2: Cardboard used by autism kids to communicate ..... 22

Figure 3: New Application interface ..... 23

Figure 4: System flowchart ..... 28

Figure 5: System architecture ..... 29

Figure 6: ..... 29

Figure 7: Android mobile phone ..... 33

Figure 8: Usability Testing ..... 39

Figure 9: Main Menu ..... 40

Figure 10: ..... 41

Figure 11: ..... 42

Figure 12: ..... 42

Figure 13: ..... 43

Figure 14: ..... 44

Figure 15: ..... 45

**LIST OF TABLES**

Table 1: Performance Testing for Different Android Platforms ..... 38

Table 2: Usability Testing ..... 38



# CHAPTER 1

## INTRODUCTION

### 1.1 Background

#### Autism and the Characteristics

Autism is a developmental disorder that appears in the first 3 years of life, affecting the brain development of social and communication skills. The exact cause of the syndrome is still remain unknown [1] but it is mostly believe caused by heritability as it brings the biggest risk of a child to develop the autism syndrome. There are 5 classified types of autism namely Classic autism, Asperger syndrome, Childhood disintegrative disorder, Rett syndrome, and Pervasive developmental disorder (PDD). However this project will be focusing on classic autism as most of a diagnostic autism child falls under the classic autism category. The different types of the autism disorder is categorized by their social skills, communication skills, and limited range of activities and interest. A child with classic autism often has difficulties in social interactions and verbal communication such as they might slowly develop language and might not develop at all. Children with autism also sometime repeat words or memorized passages that they watched through Television commercials [1].With the right therapy, many symptoms of autism can be improved, and many autism people are able to live with their family and community.

#### The emerge of touchscreen technology

Since Ipad has been announced, the use of touch screen technology has spread and emerged to the people all over the world. With the introduce of new technology and features, touch screen technology can be used to help the development of children with classic autism[2]. The kids are able to use the touch function which replaced the used of normal computers that are not best suited for autism kids because of the hardware devices and the difficulty to operate. With some proper software that will be used the

touch screen device will appear interactive and attractive to the autistic children and can be used in order to help their development in learning.

This project also focuses on the learning aspect for the autism kids. The multimedia visual learning that will be offered with touch screen devices will be equipped with interactive pictures and sound that will create an interaction with the children and lead them to touch the panel with their hand whenever they need to answer the question. The touch screen is interactive in the way that it will create two-way communications with the kids and also will involve parents and teachers in the process of learning[4]. Classic Autism kids often had repetitive behavior in their daily routine, and with such device, it can easily attract the attention of the kids to use them in their daily life and at the same time benefits them and improve the development of the classic autism kids.

#### Picture exchange system (PECS)

The main feature of this software is the picture exchange system. PECS is basically an exchange of pictures by autism children to the people that they want to communicate with. For example, if the autism kids want to go to the toilet, they will show a picture of toilet to the respective person. It is one of the techniques used nowadays to teach autism kids to manage themselves and learn to communicate with people. But to bring different pictures in the cardboard is not convenient and could confuse the autism kids, that is one of the reasons why this mobile application is developed to make the task for the autism kids easier and at the same time make them more enjoyable to use.

Other features such as sound and animation will be included in the software to aid the picture exchange teaching progress. Autism kids is known to have high interest with colors and moving objects, that is why this software will be developed taking this facts into account and attract the interest autism kids to use it and better understand on the pictures provided. Each pictures will have sound and it will animate based on the pictures characteristics, so that it is easier for them to understand the meaning of each picture.

## **1.2 Problem Statement**

### **Primary school education**

The education provided for disabilities kids especially autism in our country is too generalize as there are not focusing in each of the different disability problems. The education syllabus was made to be taught to all disability kids as they were all mixed in one classroom. As a result, they do not have the required attention from the teachers and often confused with what they learned in the class. There are also not many experience teachers available to teach the autism kids and the infrastructure provided in school is lacking especially in technology to help the autism kids. The autism kids also rely too much on the teacher and as the result it is hard for them to be independent. Such environment that they encounter can hardly encourage them to communicate as they have to rely on the people surrounding them to understand them.

### **Problem with Communication**

Classic autism kids often have problems with communication and social interaction. They cannot start or maintain a social conversation with people. They also often hard to make friends with people and often are withdrawn. There are many learning and therapy method for the autism kids but many of them does not focuses on the latest technology as an aided devices to improve the abilities of the autism kids. Some of the classic

autism kids have problems in concentrating in one thing, as they might easily lose attention and as the result, they are frustrates with it.

### Difficulties in Operating Computer Devices

Most of the autism kids had difficulties in operating computer devices such as mouse and keyboards. These hardware are not best suited with the autism kid as they are more difficult for the kids to operate them. The kids had difficulties in operating computer by itself as it is more of a complex devices to operate. Some of the autism are frustrates with computer as they had a hard time to learn it and sometime because the looks of the computer which has big screen.

### Existing Learning Material is not Virtually Attractive

Most of the learning material that are available for autism kids nowadays are not attractive visually and does not attract them. Most of the material lacks new technology touch which will emphasize more of the interaction between the autism kids by itself. Most of the learning method of material needs teacher to monitor the progress of the kid and this might disturb the kids as the teacher also needs to give attention to other autism kids.

Sometime, Autism kids were not exposed to the use of technology such as computer. Some parents does not believe that autism kids can learn using computer and learn a lot of thing from it. The false perspective about this is wrong as autism kids can learn use computer if they were train to do so. In order to get the autism kids to learn computer easily, a suitable software is needed that focuses only on the learning and development of the autism kids

There are also not many software out there that emphasize on the communication learning for autism kids. Although the technology is getting better, it just goes with

normal people, special needs kids like autism were often left behind in this aspect. That is why it is important to make use of the latest technology to help the autism and let them to be part of the societies.

### **1.3 Objectives**

The objectives of this project are:

- To design an interactive pictorial multimedia application
- To design a good communication platform for the autism kids to use to communicate to people.
- To explore the use of touchscreen technology on smartphone

### **1.4 Scope of Study**

The targeted audience for this project is autism kids from age 7 to 12 years old. The reason why the specific range of age were chosen was because it is easier to teach the kids with the basic of communication as they were growing up learning up new things in their life. Children at this age are much more open to learn and grasp new things and hopefully they can implement what they learn as they are growing up.

There are three main contents in the application vocabulary teaching, sentence building, and picture exchange system (PECS). In the vocabulary teaching, it is aim for the autism kids to learn up new vocabulary and remembers them. Since autism kids have a very limited vocabulary, it become an obstacle and barrier for them to communicate, so that is why vocabulary teaching is important so that they could remember and repeat it every day until they memorizes it.

In the sentence building section, it is the part where autism kids learn to build complete sentence and use it to communicate with people. Previously, they only knows some

vocabulary, but mostly, they do not know how to connect the words, so this section aim to improve their communication by a building a complete sentence in the conversation.

Picture exchange system is the main feature for the applications where as the kids will use the picture in the application to communicate with people. The PECS for this application has been improve whereas rather than a static pictures, there will be sounds and some animations in it to make learning process easier and much more enjoyable.

The research for this project will also involve opinions and suggestions from professional people range from parents, teachers and also the specialist that have direct contact and influence with the autism kids. In order to get the desired result for this project, a neat studies need to be done in order to understand the autism kids and how the use of touch screen devices can be used as the platform to let them to have the best visual learning with better capabilities effectiveness compared to the computer that they used.

The research of this studies also will emphasize on the suitable software that need to be used together with the touch screen device. The software will need to be customized so that it will be effective and suitable for the autism kids to use them. The layout of the content is also important as it is the deterministic factor to attract the autism kids to use them in their learning.

The learning method for the autism kids is also different compared with normal kids. A neat studies need to be done in understanding the method that is used to teach the autism kids and ant the same time try to improve the method, using the approach of touch screen technology.

Facts and researches from journals will be used as proven data to help with the research. With the knowledge and information that had been gained before, it will be crucial for this projects to achieve it's goal and purposes.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### Classic autism characteristics

Classic Autism is second leading childhood developmental disorder and considered as the most severe type of autism[11]. Children that are diagnosed with classic autism often had difficulty in developing speech and that differs from Asperger's Syndrome where the kids usually does not have problem in developing speech. The causes of the autism is still unknown till nowadays and researchers suggest that autism may be caused by neurological problem that came from genetic parents.

Autism kids often need special care in class where the teachers need to pay a lot of attention to the autism kids because they are more sensitive than normal kids and they also need proper training in order for them to understand the instruction. For example, in order for the autism kids to understand bathroom, a visual picture might help them to understand it better because they can imagine and visualize bathroom better, rather than just telling them what and where the bathroom is. Studies has shown that autism kids can have better understanding in visual concept learning, where it is much easier for them to understand from the picture rather than the words.

The common communicational nature of education makes learning process much more challenging because of the limited verbal language of autism kids. Therefore, in order support education and learning for individuals with speech and communication disabilities often include visual artifacts that demonstrate language. Visual supports are “those things we see that enhance the communication process” [9] and can be an incredible aid for children learning about the world around them.

### Autism Birth Rate Ratio

In the recent time, the Centers for Disease Control (CDC) in the United States responded to the growing rates of autism birth where in 2007 studies from 2000 to 2002 indicated that an average of 1 in 150 children affected by an ASD were born [5, 6]. A recent report by this body using data from 2006, however, indicated a rise in prevalence to 1 in 110 children: 1 in 70 boys and 1 in 310 girls [7]. The numbers and chances of kids born with autism syndrome has grown over the past few years, and from the data shown, chances of a boy born with autism are 5 times higher than a girl.

### Latest technology Approach

There have been many approaches using latest technology nowadays as a method intended to improve the development of autism kids from communication skills to the social skills. Computer has been widely been used as the platform for the autism kids to learn. But most of the software were design based on the classic approach of teaching using picture cards and videos. Children with autism tend to process visual information easier than any auditory information. Especially pictorial information has been shown to be highly effective. Hence, most low-tech approaches have a simple paper or cardboard-based form.[13].

There are also technologies like Voice Output Communication Aids (VOCAs) that rely on auditory skills to teach the autism kids to describe the items and help them to understand it. These technology has proven to be effective but they are separated devices with different functions. In this project, I want to combine some proven effective methods into a learning applications that will be used via touchscreen devices. The use of the visual aids has proven to reduce the symptoms of classic autism such as cognitive, communication, and social disabilities [8]. These visual supports are used frequently to encourage communication and learning in children. In these cases, visual supports are used to encourage communication, in much the same way that sign language can be a



visual representation of language for someone with a hearing impairment. High-tech devices like touchscreen can also help children with special needs build language skills over time and reduce the symptoms associated with autism[9]

The most important thing to develop a learning applications for autism kids is the affectivity of the system that need to be able to attract the attentions of the autism kids. With proper visual and auditory element, it can make the learning process for the autism kids much more interactive and easier for them to understand. As Autism kid often had difficulty in understanding words instructions, a set of visual pictures can explain them of the real situations that they need to understand. The autism kids also can understand the emotions of human by learning on the visual pictures that will explain on the emotional behavior of the person. By using that way, they might can understand the emotions of human when they smile and sad.

#### Computer as a tool to aid autism

An increasing number of studies show that computer technology used in teaching and therapy is well accepted by individuals with autism spectrum disorder[11]. Some reports also suggest that the use of computers with autistic children in a teaching environment led to increases in focused attention, attention span, in-seat behavior, fine motor skills, generalization skills, etc[14].(Hilman, 1996) also states that computers are appealing to children with autism due to their predictability and consistency, their controllability by the child and their lack of confusing social messages[15]. (Pleinis & Romanczyk, 1985) provide supporting evidence that, although computer-based instruction does not necessarily increase the learning performance, it significantly reduces disruptive behaviors and increases compliance with instructions. This section surveys some of the more traditional uses of computer technology related to autism, especially with regard to instruction.[16]

## **2.1 Improvement of Current Technologies**

Picture Exchanged Communication System (PECS) is one of the most popular and successful approach as described by (Bondy & Frost, 2001) [19]. Basically the kids are using the cards with instruction or set of commands in it to interact with people. For the autism kids that has difficulty in communicating, this system really helps them in their daily life and has become crucial to them. This system is proven to be successful but lack of new technology touch to make them more attractive and effective. I wish to develop the system that improved the PECS and add new technology touch such as interactive multimedia visual through the touchscreen device. There will be sound and animated pictures added as a method to improve the current PECS. By improving the the available system, I hope that it will have greater effect in developing the motorskill of autism kids. Pictures example will be provided of the PECS and I will also provide the example of the layout I designed to improve the current system.

At the moment, autism kids using picture's card to convey on what they want, it is inconvenient for the kids and might bring difficulties to them. I want to design a software that portrays all these pictures inside the touchscreen device so that the autism can select the pictures from the device rather than carrying all the cards with them. It will be very convenient for them as they can carry the device around and everything will be inside the device. The picture exchange for non verbal communication is proved to be helpful for the autism kids because some of them have difficulties in communicating, and only the pictures are the method for them to convey what they are feeling and what they want[17]. Hopefully by using the picture as a medium of communicating, the autism kids could interact with people later on and help them to improve their communication skills.

In a daily routine day of autism kids, they had difficulties in communicating with people and a lot of people misunderstood of autism kids labeling them as sometime aggressive, hyperactive and many more, but in reality, most of the autism kids are living on their

own dreamland where all matters for them is in their surroundings. It is hard to approach them as some of them are quite sensitive to many aspects such as noises, crowd people and they also hardly could understand people or join people.

Picture exchanged might one of the only way for the autism kids to communicate with people but to carry all different sets of cards is not convenience for them and that is why this application is developed to that have all these instructional cards under one touchscreen device. By having the device, autism kids would eliminate another barrier for them to communicate with people and can use them to show what they want to do so that people could understand them rather than misunderstand them. What they need to do is just a slight touch on the touchscreen device and it will be very easy for them rather than carrying all those cards. The instructional cards might have pictures along with voices that explain of the situation for example like “ I want to go to toilet”, “ Im hungry”, Im sleepy” and many more. With the advancement of the technology, autism kids should not be left behind and I believe such application could encourage the autism kids to engage with people in their family and community.

The touchscreen device also will have features for educational purposes. To interact with people, emotions plays an important role to show what are people feeling at the time. The autism kids might not understand of these emotions so I would like to add these features into the application. After they understood the emotional behavior, the autism kids could also learn to use and apply them to show how are they feeling whether happy, sad, or angry [20]. It is better than they crying and start to acting up. By learning the emotional behavior, I believe the autism could adapt and mingle well in the family and the community. Sets of pictures showing human emotions will be designed with explanations on each of those emotions.

After gathering information from parents and people involved with autism kids, I planned to design the application that could help the autism kids in communication and at the same time make the application enjoyable to use. With this application, I hope that

it could change the perception of people towards autism people. This application could strengthen the relationship of autism kid with others. With this application also, the autism kids can easily learn the basic action that we do everyday in our life. Although all the sample of actions were made in form of picture, but with proper and frequent practice, it can help them to improve in communication and social skills.

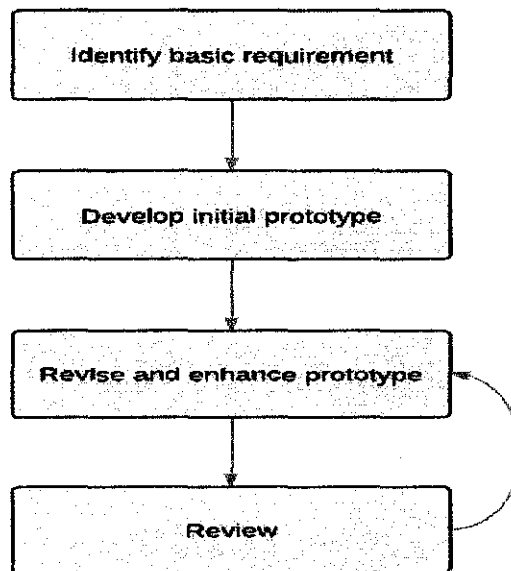
## CHAPTER 3

### METHODOLOGY

#### 3.1 Research Methodology

This project will use prototyping model in the system development life cycle and the process of the project is segmented into 4 different phases. Phase 1 mainly involves research work. Phase 2, 3 and 4 make up the main development stage.

Software prototype is a method in software development that will be created based on basic interfaces and functionality to test the software and improve them based on feedback from the users. It is an incomplete version and may be changed from time to time in order to enhance the capability of the application. The purpose of the prototype is to allow user to evaluate the developer's product and for this project is to maximize the interactive design of the learning system for autism kids.



**Figure 1 : Prototyping model**

### **3.2 Analysis**

After I had received feedback from parents of autism kids that I had interviewed on, I Come out with the layout design for my application and what to have inside the application. Many methods are available in teaching the autism kids but not many of them were interactive enough to attract their attention. As I have mentioned in problem statement, one of the major problems for autism kids in learning are their short attention span, That is why I choose to design an application that has interactive multimedia visual inside it.

There also not many teaching method that encourage autism kid to communicate with people. It makes them left behind and hard to mingle around with people. My application mainly focused on encouraging autism kids to engage to communicate with people through picture exchange system.

### **3.3 Design**

Figure 2 below show the example of picture exchange for non verbal autism kids. It shows the current method that autism kids use for communicating with people. Basically autism kids used sample of cards like shown in figure 1. Each card representing different element whether set of instruction or just a simple picture of item. The application that I will develop will combine all these picture and the autism kids can easily choose any picture that they want to use depend on the circumstances. In figure 3, It is the example of the layout I will create that will replace the old method that was used in figure 2.

Before :

This pictures were made from cardboards and it is currently what autism used to communicate with people.

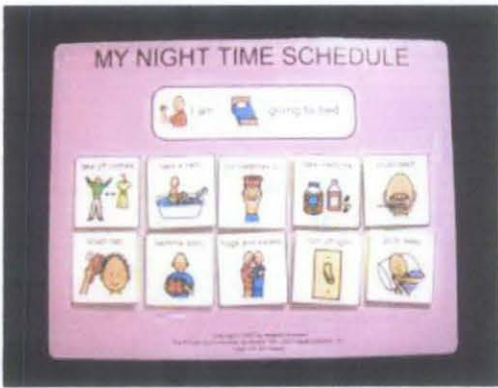
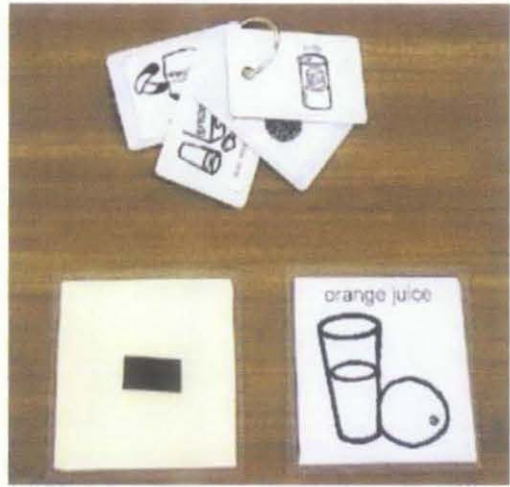
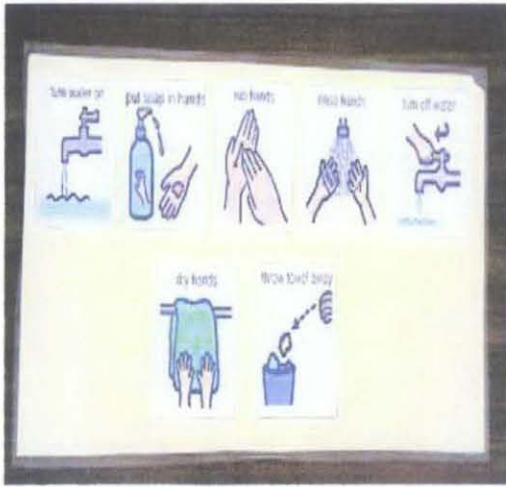


Figure 2 : Cardboards used by autism to communicate

After :

This is the main layout for the software. The student will pick based on the categories before proceed to the next step.

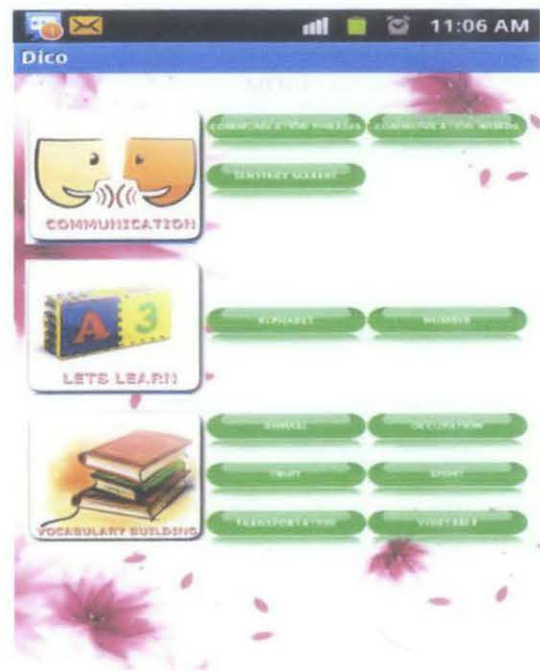
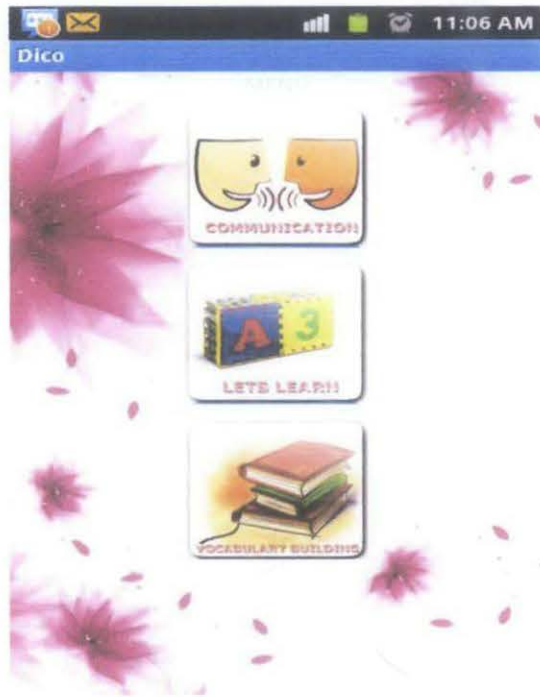


Figure 3 : New application interface



### **3.4 Phase 1: Identify the basic requirements**

This project will have a thorough research of the classic autism syndrome that happened to the kids below 12 years old and the suitable learning application that can be used for the autism kids to improve their social and communicational skills. The research will cover about the syndrome itself, to the effectiveness of the learning method and how the current technology aids the autism kids. The project will be also covering in touchscreen devices that will be used as the medium if the learning application software.

Through the information and data gathered from parents and people involve with autism kids, the application will be design to suit the autism kids based on the data received. The information is a form of opinion and experience of these group of people in dealing with autism kids. To ensure that this application is worthwhile, it needs to be planned effectively based on the available data.

After the basic requirement had been identified, the application can be designed and later tested to ensure it meets the targeted requirements.

### **3.5 Phase 2: Develop initial prototype**

The basic user interface and the material of the learning applications will be designed to represent the real application and it's function. All the previous research data about the requirement of the projects will be used to develop the prototype so that it can represent the real product.

After the interface had been develop, it will be tested on the touchscreen mobile to ensure it works fine on its platform. Modification might needed to ensure it run smoothly on its platform.

### **3.6 Phase 3 :Review**

This is when users can evaluate the product based the prototype that had been made and changes will be made to accommodate the suitability of the user's preferences. Changes will be happened based on the feedback from time to time until the final product is decided and finalized.

The application will be tested and referred back to the objective and specific of design to see whether it achieve the target or not. The end product must pass all the specific objectives to ensure it's capability in the future. The application need to be developed so that the autism kids do not have hard time in operating the touchscreen mobile and at the same time they could enjoy the application.

### **3.7 Phase 4: Revise and enhance the prototype**

The product will be revised based on the changes that will be made and the functionality of the application. It will be referred to phase 3 and from the collected data, The final conclusion will be drawn the application will be improved and will be tested for the functionality and effectiveness. The final enhancement of the prototype be made based on initial test result.

If the end product did not satisfy the early objectives of this project it will go back to third phase and will be reviewed to find the problems and fix it. This way, the application can run smoothly and did not give problem to the user.

### **3.8 What need to done**

The next phase in this project is to use to design the multimedia content and have them tested in the platform which the touchscreen mobile. I will also need to make programming to ensure that the touching features works with the visual content that I have. And after completed this phase, The product will be tested for bugs and errors and later on gives to autism kid to try on the application and to study their reaction and based on the result, make the modification on the application if necessary.

### **3.9 Suggestion for future work for expansion and continuation**

I would like to suggest that this application could be enhanced in the current aspects and new application that could be inserted to this application. For example this application could have a chat features when autism kids can be connected to internet and have a proper conversation with the therapist or teacher. This way, the people involve can monitor on time basis to see the improvement of the autism kids.

Additional features like teaching material could be add such as English, mathematics, science and many more. The proper learning material could be made interactive using touchscreen mobile phone and could have the potential of giving the autism kids a better learning material that is much easier to understand.

Games that designed specially for autism kids could also be added into the the touchscreen mobile phone to give autism kids entertainment and could release their stress. Games that uses only tip of finger is easier and entertaining rather than using mouse and keyboards that might be difficult for autism to operate.

### **3.10 Project Activities**

The activities done for this project mostly includes meetings and interviews with the supervisors and the people that have relation with autism. It is basically to get ideas and suggestions for this project to moves on involving the flow of the system, operation of the system and the interface for the system. The supervisor for this project, Dr Dayang monitor the development of this project as well as giving ideas and input to add on to the system.

Other activities done for this project mainly involve on the research part for this project from journals and from survey conducted to the people involved. The data received is used to ensure that the system that being develop, is on track with the targeted user, this includes choosing the right input to use in the system.

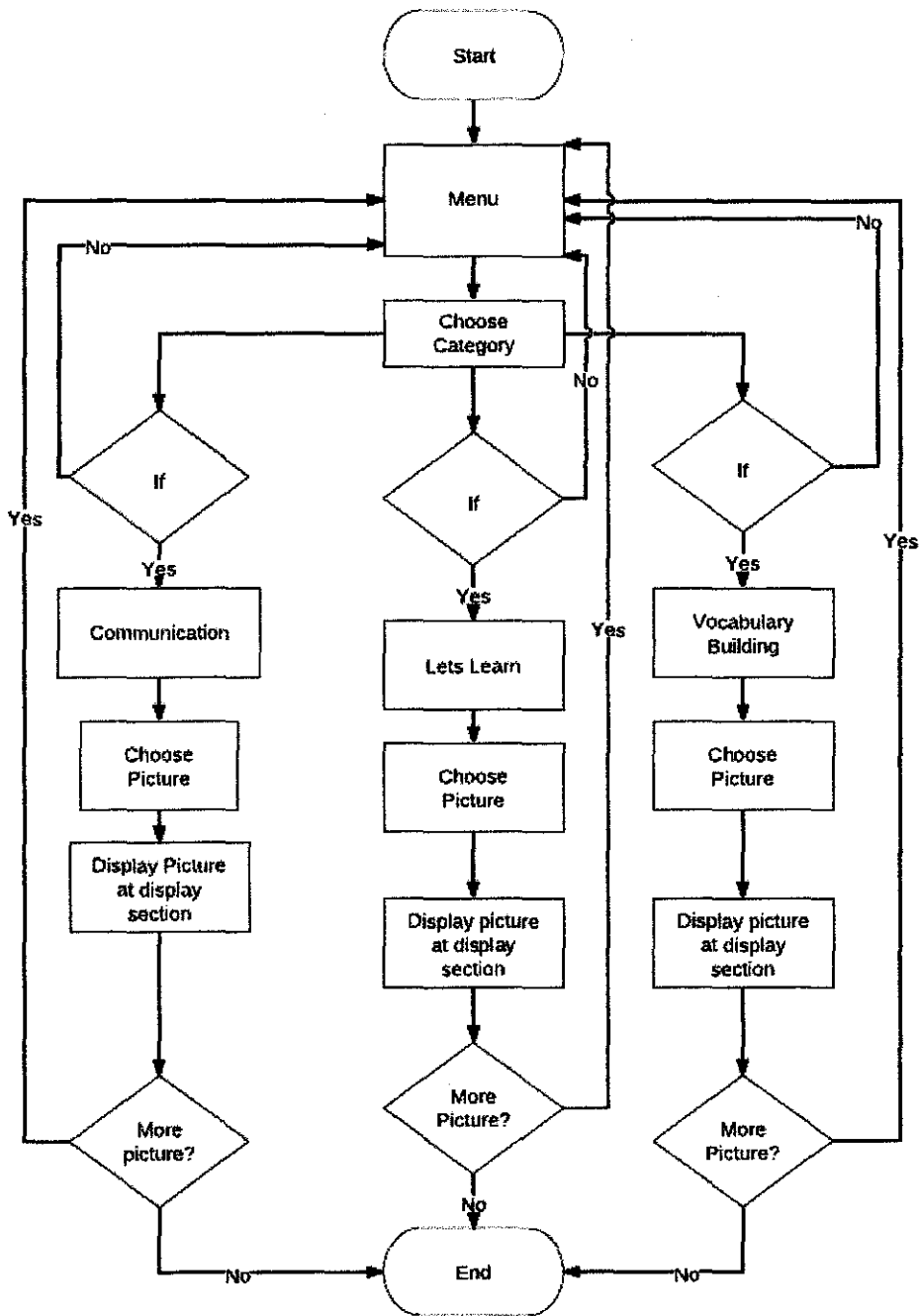
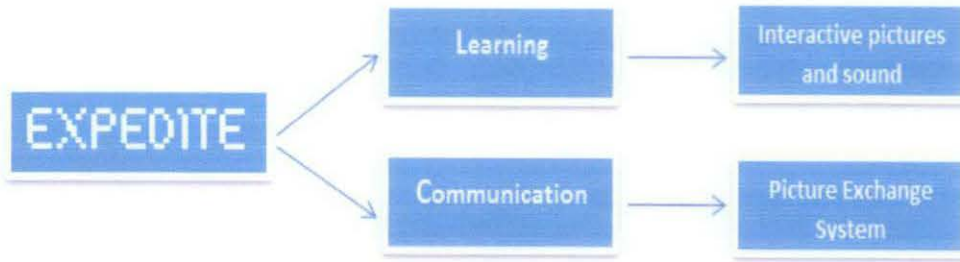


Figure 4 : System Flow chart



**Figure 5 : System architecture**



**Figure 6**

### **3.11 Key Milestone**

There are few important dates that were taken into high attention. The important dates are amongst other:

- Submission of Progress Report – Week 7 (November 7, 2011)
- Pre- Engineering Design Exhibition (EDX) – Week 10 (November 30, 2011)
- Dissertation – Week 11 (December 7, 2011)
- Viva Presentation – Week 13 (December 21, 2011)
- Final Dissertation and Technical Report Submission – Week 15 (January 6, 2012)

The project submission and project milestone is based according to FYP2 Timeline provided by the course coordinator. Provided below is the Gantt chart for the project

No	Activities	Sept		October				November				December			
		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
1	Progress Report							■							
2	Programming and Prototyping							■	■	■	■	■	■	■	
3	Pre-EDX											■			
4	Dissertation												■		
5	Viva Presentation													■	
6	Final Dissertation														■
7	Submit Technical Report														
	Done	■													
	Progressing		■												
	To be done			■											



### **3.12 Hardware / Software**

Current technologies such as computer also were used in teaching the autism kids. But computer has its own complexity in handling it especially for autism kids. With hardware tools like mouse and keyboard, it is difficult for autism kid to navigate them. That is also one of the reasons why I came out with the idea to develop touchscreen application for autism kids so that it could ease off the difficulty in operating a computer. Autism kids could start with touchscreen device first before proceeding to the computer. With the function of touchscreen, there is no need for mouse and keyboard because it was replaced by the use of finger gesture. Touchscreen device also gives mobility advantage to autism kids because they could bring it with them anywhere they go and use them. Compared to the use of computer, I believe touchscreen device is more suitable for autism kids to handle.

For the final year project, I planned to use android mobile touchscreen. The reason I chose mobile because it is in compact size and easy to carry around. It gives mobility advantage to the autism kids. Other devices such as tablet PC might not be suitable because of its size and also the price which is more expensive. Mobile touchscreen is cheaper and affordable for most of people. Preferably Sony Ericsson Xperia X10 Mini using Android OS. Android OS has proved to be very popular lately because it is open source software and easy to customize. With the rise of android mobile nowadays, many applications were developed and one day, android OS could surpass Apple IOS. That is why android is a right platform to be used to develop this software.



**Figure 7 : Android mobile phone**

On the software side, I will use softwares such as Adobe Flash to develop the multimedia content for the application because many touchscreen phone support flash so it is flexible to be used. I will also use Eclipse and Android SDK to develop the android application using JAVA language. I will also use Adobe Photoshop and GIMP to design buttons for the application.

## **CHAPTER 4**

### **RESULT AND DISCUSSION**

#### **4.1 User Assessment and Analysis**

The user needs assessment process was carried out through interviews with the parties which has direct involvement with the autism kids. Among the parties that had been interviewed are:

Ms Rogayah Hashim (Disability Class Teacher, Sekolah Kebangsaan Iskandar)

Dr Katy Salisbury (Parent/lecturer, University College Plymouth St Mark & John)

Ms Nadhirah Ismail (Student, Institut pendidikan Guru, Kota Bharu)

Mr Fakhri Affandi (Parent)

The reason why these people were interviewed was because they have high knowledge on the topics and most of them have direct involvement with autism kids and had experience in dealing with them.

The interview conducted with Ms Rogayah is the main analysis of this project because among all interviewees, she had the most experience in teaching the autism kids. The Below is the data and conclusion that I gathered from the interview.

#### Lack of Experience Teachers

Based on the research of the local schools that offers education class for autism in Malaysia, autism kids mainly rely on the experiences of the teacher to handle the autism. With many of the schools have shortages on the experience teacher and also lack of infrastructure to help the autism kids, a new approach need to be developed to aid the teaching of the autism kids. Mostly in schools, the autism kids were put in a class combined with other special kids such as down syndrome and ADHD. The teacher

cannot give attention to one particular student as the same syllabus will be taught to all the students. So basically the education was made general to these students as there are no specific syllabus we taught based on the problems that the kids have.

### High Interest in Computer

Based on the interview, Ms Rogayah, she admits that autism kids have a high interest in the technology gadget such as computers because there are many colors and it appears very attractive to them. Most of the autism kids at the schools enjoy using computer at the labs, but the education does not really emphasize on the technology parts as it still heavily rely on the teacher's guidance.

### Strict Rule by the School

The local school only accepted autism kids who can manage their basic needs like going to toilet and etc. So an early education from parents is very important in order to help the autism kids manage themselves. A smartphone communicative software could be the answer to both parents and teachers to help the autism kids to handle themselves. As communication is very essential, and with only few of the autism kids know how to communicate, such software could improve and build a two way communication that is very much needed by the autism kids.

The teachers also mention on how autism kids know a few basic language to communicate, and they cannot build a complete sentence to complete the conversation. For example, if the students want to go to toilet, they say the word "toilet" instead of making a full sentence of "I want to go to toilet". It is up to the teacher to correct the sentences to the student, and once again it relies heavily on the teachers, if it is at home, the parents are the one responsible to correct it for them. They have no medium to learn it by themselves and they rely heavily on the people surrounding them, and again, that is for the students who have already know to manage themselves and therefore accepted by

the schools, for those who are still unable to communicate, they can only rely on their parents to understand them. That is also why, with the introduce of android software, the autism can learn to do by themselves and rather than relying on the people surrounding them. With frequent practice and a good support from families, autism kids are able to be independent on their own. With one of the symptoms of the autism who like to repeat the same thing and do the same routine everyday, they will learn to pick up the words and one day make a full sentence of the words.

### Autism Kids Social Life

Autism kids are very unsocial, which means it is hard for them to make friends and to mingle with the society. It takes years for the autism kids to actually make friend with the classmates and sure enough, communication is the biggest barriers that proves to be very challenging for the autism kids. With the communication learning software developed using smartphone as the platform, it could be the bridge to connect the autism kids with people and actually be the answer on how to close the gap of autism with the people surrounding them. With the attractive pictures, colors, and sounds, it is just what autism kids needs to start learning on improving their communication skills. Autism kids has known to grow a deep attachment towards the colors and pictures, so it will easily attract them and again with their normal habit of repeating, it is a hope that one day they will memorize the words and use them in their communication. It is proven by the normal education in class, but it takes too long for them to remembers it, because they can only learn it when the teachers mentioned it in the class and other than that time, they are clueless. That is why such a software that are available to them anytime, they could frequently used it whenever and wherever they are as it is very convenience and knowledgeable from them.

The teacher mentioned of one of her previous student who is diagnosed with autism and has emotional problems as she always try to hurt herself by cutting her hand, biting them and so on. The parent and the teacher were unable to understand what is actually causing

her to do that as she cannot communicate properly, the problem continues until she moves with her parents to oversea. There, with the western education gives high attention on disability kids education, the syllabus is different than one in our country where as they have class special for autism kids and really focuses on helping them. There are also teacher assistant that will monitor the student while the teacher is teaching them in the class. With the education that focuses on the autism kids, she no longer hurts herself and start to act better towards herself. That is why attention is very important to the autism kids, and the most important thing is communication, with an effective two way communication, we can actually knows how and why the autism kids behaving that way. Western education also focuses on pictures exchange between autism kids as such education were not made here in our country because the education is made general for all disability kids with no special classes were made for different type of disabilities. Hence, the software could be a really good source for the autism kids to learn communicating and hopefully they will be able to communicate with people surrounding them so that people can understand their actions and problems and can think a solution for it.

#### **4.2 Experimentation and Modeling**

After developing the system, tests were carried out to check whether they system work on different hardware and how it effects the system performance. There will be also survey to check on the system interface to see if there the effectiveness of the system and improvement need to be carry on.

The first test done is to test whether the system works well in different type of phone that is using Android operating system. This test is basically focusing on the performances of the system.

Phone Model	Android Platform	Remarks
Samsung Galaxy S	Android 2.2	Installation successful.
HTC Desire	Android 2.2.3	Installation successful

**Table 1: Performance Testing for Different Android Platforms**

The second test that will be done is the user satisfaction test that includes system interfaces, systems problems and defects. The test was conducted on 20 IT students who had expertise and knowledge in the human computer interaction.

Elements	Rating	Remarks
Application installation	5	The installation is easy.
Interfaces	4	The interfaces can be improved.
Functionality	4	Could add more features
Time to run	5	Short time to run
Choices of color	4	Could add more colors
Icons used	4	More icons and pictures

**Table 2: Usability Testing**

- 1 = Very dissatisfied
- 2 = Somewhat dissatisfied
- 3 = Neither satisfied nor dissatisfied
- 4 = Somewhat satisfied
- 5 = Very satisfied

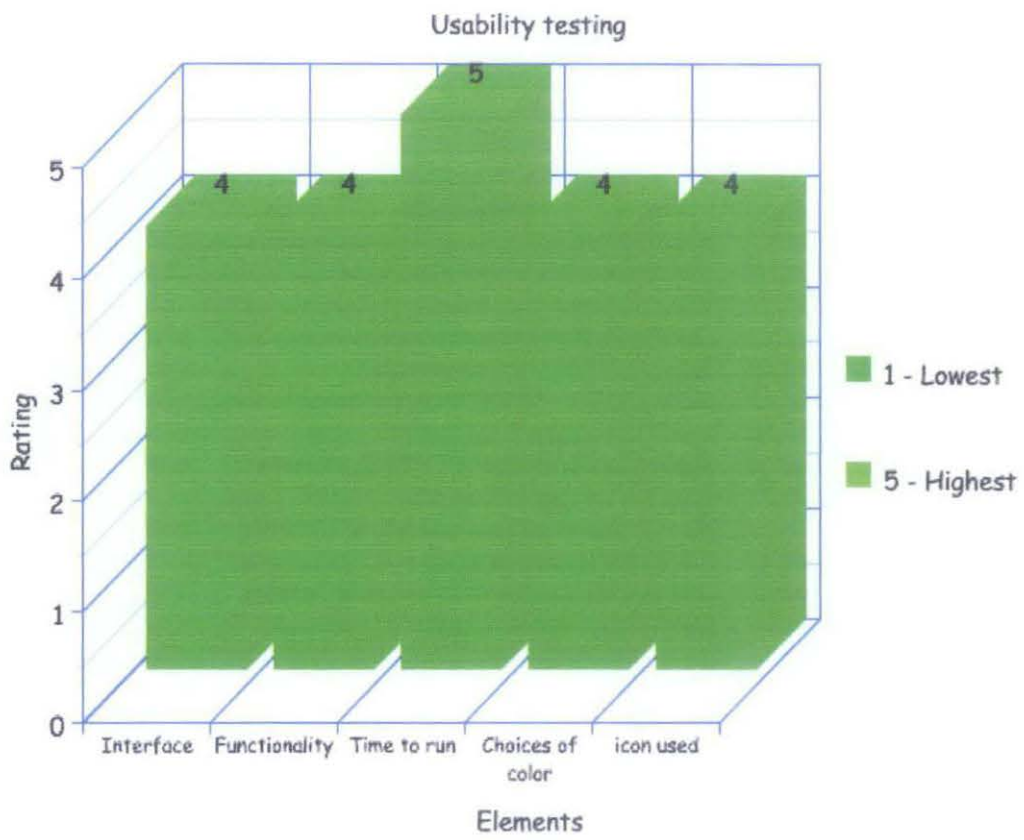


Figure 8 : Usability testing bar chart



## 4.3 PROTOTYPE

### 4.3.1 INTERFACES

This is the interfaces for this project taken from Samsung Galaxy S. The interfaces consist of the 3 main menus that users need to choose in order to proceed. 'Communication' menu is when the user want to interact with people using the Picture Exchange Communication System (PECS). Under the communication menu, there are 3 sub menus which are 'communication phrases', 'communication word' and 'sentence maker'. There will also sound in these applications. Each picture has a sound pronouncing the words.

'Lets Learn' menu is for the user to learn the alphabet and numerical numbers. 'Vocabulary Building' menu is for the user to learn up new vocabularies. It consist of varieties of sub menu based on the respective topics.

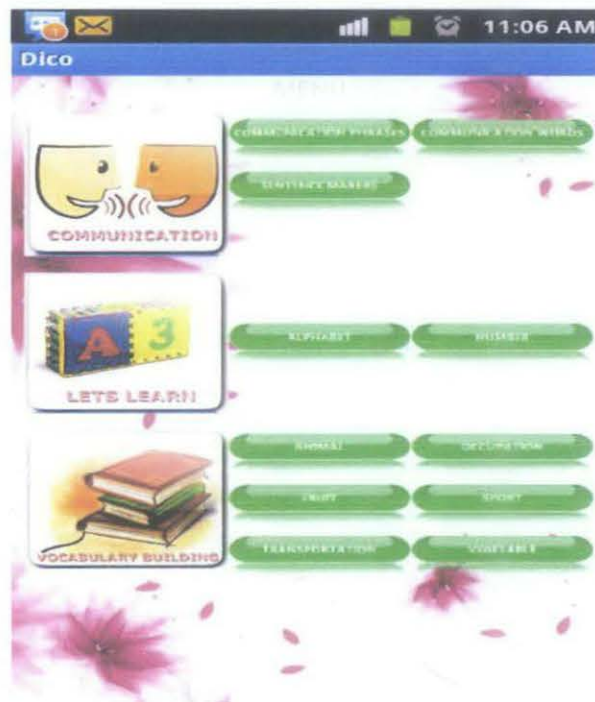


Figure 9 : Main menu

'Communication phrases' is used to make a daily basic communication for the autism. It consist of a complete sentence that the autism used daily. Refer to figure 10



Figure 10

After choosing the picture, once the user rotate the phone horizontally, the picture will be enlarge an make a full screen. This is when the user show to other people what they want to say, in other words communicate with them. A sound will accompany this picture saying " I am very happy". It aim to help the autism kid to pronounce the word correctly and learn to use them. Refer figure 11 and 12.

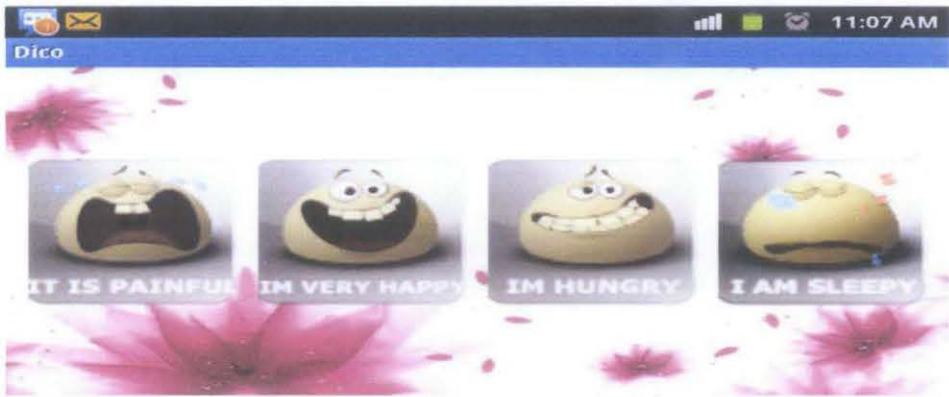


Figure 11

In communication words, a picture of basic communication word used daily were put in this section.



Figure 12

In “sentence maker”, a picture of basic word to make up a sentence is put here. It is aim for the autism kids to make up their own sentences and use them to communicate with people. Refer figure 13



Figure 13

In 'Lets Learn' section, there will be 2 main topics inside it which is alphabet and numerical. This sections aim for the autism kids who has not grasp the basic of communication and this is the section for them to get started.

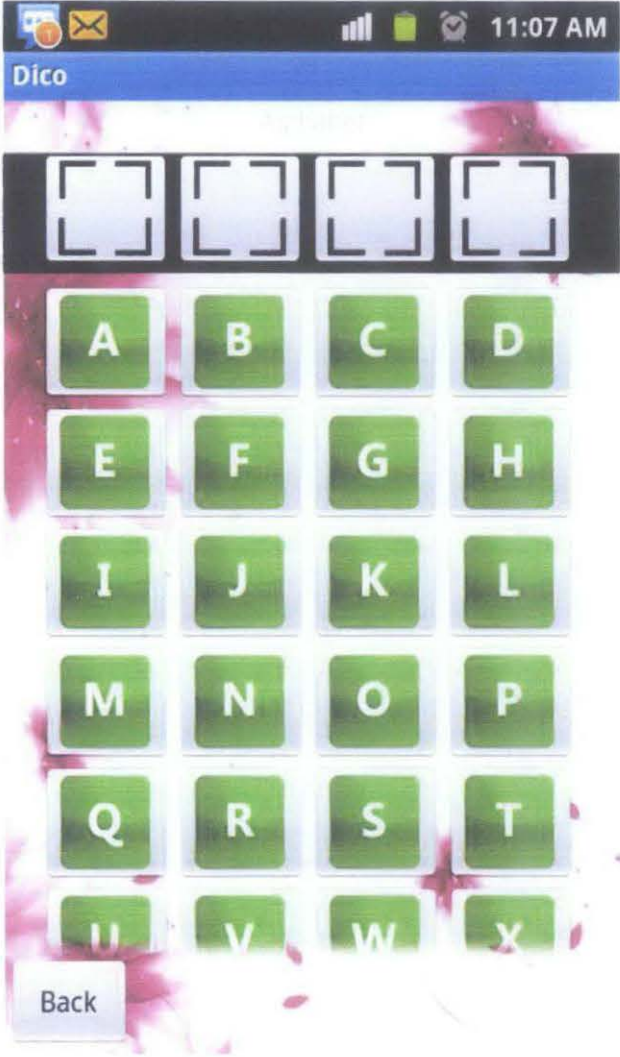


Figure 14



In “vocabulary learning”, autism kids will be exposed with a new vocabulary and they can learn to pronounce it by referring to the respective picture based on the categories. Refer figure 15 and 16.

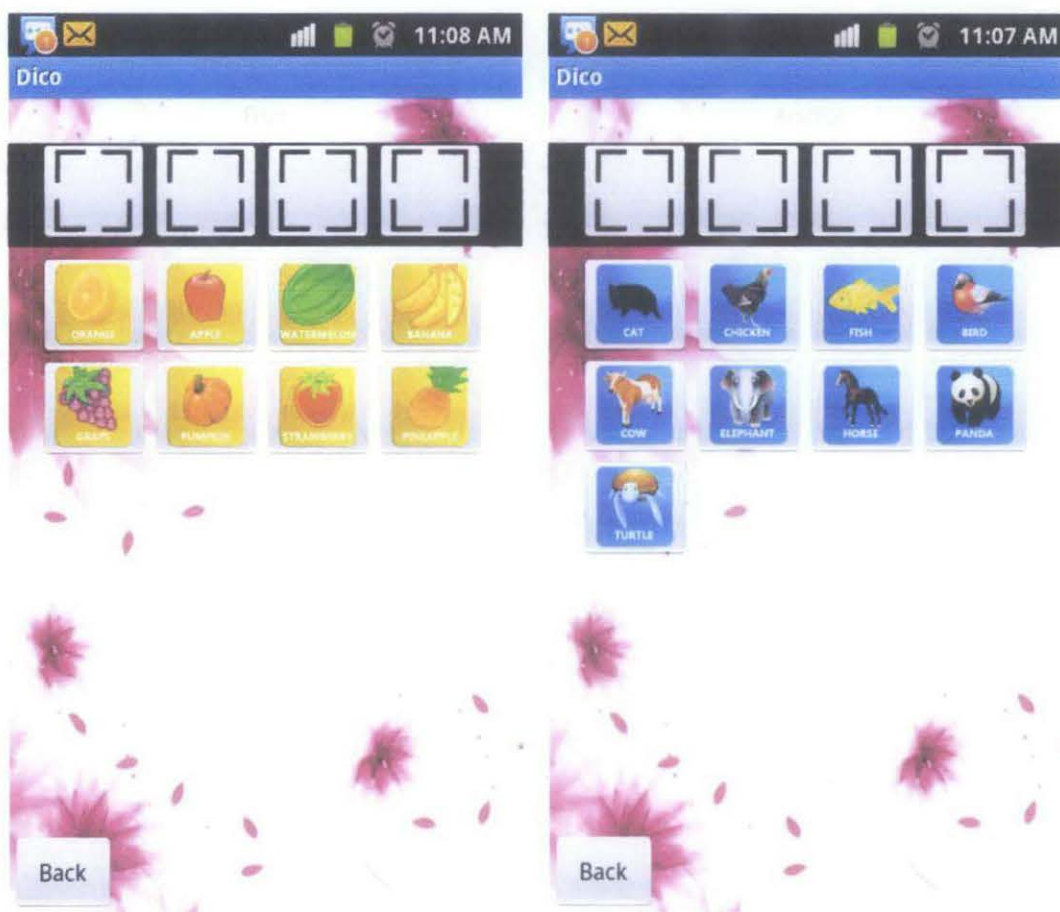


Figure 15

## **CHAPTER 5**

### **CONCLUSION**

This project highlights on the visual autism interactive communication learning application via android touchscreen device that aims for classic autism kids below 12 years old. The autism interactive learning application will encourage the autism kids to understand the environment around them and at the same time improve their communication skills. Multimedia visual will be used as a main material in learning to attract the attention of the autism kids. Features such as sound and pictures will be used to make the learning process more entertaining and understandable. Interactive visual will encourage the interaction of the autism kids by having them to understand the people and also the emotion. Through the set of emotions picture, it is also hoped that autism kids could apply them in their daily routine life and eliminate the barrier of communicating with people and can have a good social life in the community. This project could help the autism kid to eliminate the barrier of their social life.

## References

- [1] PubMed Health, 2010. Retrieved March 1, 2011 from PubMed Health website, <<http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002494/>>
- [2] The Co-Viewing Connection, 2010. Retrieved March 1, 2011 from Co-Viewing website <<http://coviewingconnection.com/2010/09/20/asd-children-and-touchscreen-technology-finally-some-real-research/>>
- [3] The News Blaze, 2009. Retrieved March 1, 2011 from News Blaze website, <<http://newsblaze.com/story/2009050705071200002.bw/topstory.html>>
- [4] Autism Coach . Retrieved March 1, 2011 from Autism Coach website, <<http://www.autismcoach.com/Assistsive%20Technology%20Overview.htm>>
- [5] Centers for Disease Control and Prevention (CDC) (2007) Prevalence of autism spectrum disorders—Autism and Developmental Disabilities Monitoring Network, Six Sites, United States, 2000. *MMWR Surveill Summ* 2007, 56(No.SS-1)
- [6] Centers for Disease Control and Prevention (CDC) (2007) Prevalence of autism spectrum disorders—Autism and Developmental Disabilities Monitoring Network, 14 Sites, United States, 2002. *MMWR Surveill Summ* 2007, 56(No.SS-1)
- [7] Centers for Disease Control and Prevention (CDC) (2009) Prevalence of autism spectrum disorders—Autism and Developmental Disabilities Monitoring Network, United States, 2006. *MMWR Surveill Summ* 2009, 58(SS-10)
- [8] Cohen MJ, Sloan DL (2007) *Visual supports for people with autism: a guide for parents and professionals*. Woodbine House, USA
- [9] Hodges S, Williams L, Berry E, Izadi S, Srinivasan J, Butler A, Smyth G, Kapur N, Wood K (2006) SenseCam: a retrospective memory aid. In: *Proceedings of the UbiComp 2006*. Springer, pp77–193



- [10] Ciaranello, R.D. "Brain Development: Pervasive Developmental Disorders and Infantile Autism". Neurobiological Disorders in Children and Adolescents. Jossey-Bass Publications, San Francisco. 1992 (9-17).
- [11] Moore, D., McGrath, P., & Thorpe, J. (2000). Computer-aided learning for people with autism—a framework for research and development. *Innovations in Education and Training International*, 37(3), 218–228.
- [12] Ezine Article. Retrieved March 2, 2011 from Ezine Article website, <http://ezinearticles.com/?There-Are-5-Different-Types-of-Autism-Disorders&id=1592117>
- [13] Pierce, K., & Schreibman, L. (1994). Teaching daily living skills to children with autism in unsupervised settings through pictorial self-management. *J Appl Behav Anal*, 27(3), 471–481.
- [14] Jordan, R. (1995). Computer assisted education for individuals with autism. In *Proceedings of the autisme france 3rd international conference*. Nice.
- [15] Hileman, C. (1996). Computer technology with autistic children. In *Proceedings of the autism society of america national conference*. Milwaukee, WI.
- [16] Pleinis, A., & Romanczyk, R. (1985). Analyses of performance, behavior, and predictors for severely disturbed children: A comparison of adult vs. computer instruction. *Analysis & Intervention in Developmental Disabilities*, 5, 345–356.
- [17] Gray, C. (1993). *The social story kit and sample social stories*. Future Horizons.
- [18] Blischak, D., & Schlosser, R. (2003). Use of technology to support independent spelling by students with autism. *Topics in Language Disorders*, 23(4), 293-304
- [19] Bondy, A., & Frost, L. (2001). The picture exchange communication system. *Behavior Modification*, 25(5), 725–74
- [20] Bernard-Opitz, V., Sriram, N. and Nakhoda-Sapuan, S. Enhancing Social Problem

Solving in Children with Autism and Normal Children Through Computer Assisted Instruction. *Journal of Autism and Developmental Disorders* 31 (4), (2001), 377-384.