M-Learning Application for Autistic Children using Android Platform

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Abstract – One of the bigger challenges that the society faces is ensuring that autistic children get education in a proper way, so that they may develop their skills and consequently, contribute to the society. The objective of this study is to design a system that will help autistic children in their education. The system will be run on the Android platform, a popular platform where a great number of smart phone device applications are run. The system or application will be designed based on studies on the characteristics of children with autism spectrum disorders.

Keywords— Android; Mobile Learning; Autism Spectrum; Smart Phone;

I.   INTRODUCTION

Identified by Leo Kanner in 1942, autism spectrum disorders (ASDs) are the fastest growing neurobiological conditions in the world. Autism is a developmental disability characterized by an impaired development in social interactions and communication [1].

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Children with autism have difficulty in developing appropriate relationships [2], and they exhibit a variety of destructive behaviors, such as repetitive [3] and self-abusive behaviors [4].

It leads to feelings of fear, confusion, and loneliness. Moreover, Noiprawat and Sahachaiseri [5] stated that autism is a disorder of social development, language, and communication. It is also reported that 50% of individuals diagnosed with ASD do not speak but are highly visual-oriented, with the presence of strong visual-spatial skills [6].

In addition, recent statistics show that autism affects up to two children in every thousand, and that it is three times more likely to affect boys than girls [7]. Reeser [8] also referred that tens of millions of children and adults have ASD. Consequently, learning environment is important in promoting the development of autistic children. Environments can attract and stimulate their interest when they participate in skill enhancing activities [9]. Table 1illustrates the autism prevalence among some countries (2000- 2008):

COUNTRY	NUMBER	DATA SOURCE
China	1,100,000	Peking Health Science Center (estimate based on official 2005 rate of 1.1 in 1000 children affected)
India	2,000,000	Action for Autism India (based on an estimated rate of 1 in 250), 2007
United States	1,500,000	U.S. Centers for Disease Control and Prevention ADDME Study 2007 and Autism Society of America, 2007
United Kingdom	650,000	National Autistic Society 2006 (based on rate of 1 in 100)
Mexico	50,000	Based on 2005 estimates by Ministry of Health of 2 to 6 per 1000
Philippines	500,000	Autism Society of Philippines, 2007
Thailand	180,000	Estimate of the Minister of Mental Health, 2006

Table 1: Autism prevalence among some countries (2000-2008) [10].

Additionally, assistive technology is defined as "any item, piece of equipment, or product system, whether acquired commercially, off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of children with disabilities" [11]. In general, assistive technology can be any tool that is used daily to

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improve or increase the functional abilities, be it educational, social, behavioral or physical, of children with disabilities [12]. On other hand, Yee [13] pointed out that mobile devices had gained popularity among the special needs community. Recent advancement in computer technology in mobile devices has opened up immense possibilities for children with ASD. Song and Yusof [14] pointed out that mobile devices serve as an augmentative and alternative communication (AAC) in the pocket and had since gained popularity because of its flexible multimedia content and storage, portability, mobility, and affordability. The touch screen interface makes it appealing and simple to use as well.

According to the aforementioned rationale, this study seeks to help the children with ASD in education by using the new technology (mobile) and Android platform.

II.   PROBLEM STATEMENT

According to Rahman , Naha, Roy, Ahmed, and Samrose [15], one of the bigger challenges is to ensure proper education to the autistic children in a proper way so that they can develop their skills and contribute to the society being within their limitations. In addition, Balaji, Raja and Vivekanandan [16] confirmed that the most challenging and stressful issue faced by schools and parents is to provide appropriate education for autistic children. On other hand, most of the schools provide effective education to normal children, but they fail to do so for autistic children because the two groups of children are different [17]. In this study, the researcher will focus on this particular problem and design an M-Learning application which can help autistic children with their learning and help autistic children respond positively to interaction with technology in general [18].

Furthermore, Buzzi, Buzzi, Gazzé, Senette and Tesconi [19] pointed out that mobile devices are one of the best kinds of devices that are used for teaching subjects to students with learning and development disabilities, such as autistic children, and that the necessity for ensuring equal opportunity for the autistic children in every sphere of life should be approached by technology. Nowadays, mobile devices are prevalent in our lives. Their numerous potentials make them educational friendly [20]. As aforementioned, this study will use the Android platform to design an application that will help autistic children - get the appropriate education they need.

III.   LITERATURE REVIEW

There are various teaching systems for autistic children that have been used. The first basic technique is the use of picture cards. Each picture card has a corresponding word written on it. As their picture memory is fairly well-developed, autistic children find it easier to understand and memorize the words. Children learn words by hearing the sound that they hear while the teacher speaks. Hence, proper pronunciations should be made by teachers to help the autistic child learn. A child may jumble up with words that are close to each other. For example, it may be difficult for a child to differentiate between consonants. Interventions to support children with autism often include the use of visual supports, which are cognitive tools to enable learning and the production of language [21].

Although visual supports are effective in helping to diminish many of the challenges of autism, they are difficult and time-consuming to create, distribute, and use, which gives the results of a qualitative study focused on uncovering design guidelines for interactive visual supports that would address the many challenges inherent to current tools and practices. The table below shows the previous studies on the use of information technology to help children with ASD.

AUTHER(S)	YEAR	OBJECTIVE(S)	RESULTS
Balaji, Raja,Kanaga Suba and Vivekanandan	2012	Implementation of best practices for children with autism and normal children in rural area using manet	Design a web based teaching system which can provide with a customized platform for every autistic child listening to the class.
Buzzi Claudia, Buzzi Marina, Gazzé Davide, Senette Caterina and Tesconi Maurizio	2012	Teaching low-functioning autistic children	Implementing basic ABA programs. Compared to previous work based on AAC and DTT, the novel aspect is related to the distributed web-based architecture that enables the use of the SW anywhere, anytime and on different devices.
Dimitrova Maya, Vegt Niko and Barakova	2012	Using robots to reward and stimulate children doing tasks	Designing a System of Interactive Robots for

Emilia		together can be helpful in improving their social skills.	Training Collaborative Skills to Autistic Children
Balaji and Khanaa	2012	Education for autistic children	A Novel Web-Based Teaching System for Autistic Children in Rural Area using MANET
De Urturi Zelai Sáenz, Zorrilla Amaia Méndez and Zapirain Begoña García	2011	Education: what to do in certain situations, basic knowledge about healthcare medical specialties	Designing and implementing a multimedia application within the framework of Serious Games
Helena Song Sook Yee	2012	Communication solutions for autistic persons in relating to their families and others in the community.	The Major Trends and Issues from Mobile Technology for Children with Autism Spectrum Disorder
Rahman, Shujon Naha, Proteek C. Roy, Ishrat Ahmed, Samiha Samrose and Rahman Ahmed	2011	Takes care of the diversity of tastes among the autistic children of a classroom and helps the teacher to teach in a class participated by both autistic and neurotypical children.	Designing and implementing an intelligent classroom software

There are few studies that use smartphones that run on Android platform to design applications that will help improve the kind of education provided for children with ASD. Therefore, this study seeks to design an application that will provide a better education to children with ASD.

IV. ANDROID ARCHITECTURE

Android is a Linux-based operating system for mobile devices like smartphones and tablet computers. It has been developed by the Open Handset Alliance and managed by Google [22]. The unveiling of the Android distribution in 2007 was announced with the founding of the Open Handset

Alliance, a consortium of 86 hardware, software, and telecommunication companies devoted to advancing open standards for mobile devices [23]. At the beginning of year 2012, there were more than 450,000 applications available for Android, and the estimated number of applications downloaded from the Android Market on December 2011 exceeded 10 billion [24 – 25].

Android architecture is composed in layers. These are the application layer, application framework layer, Android runtime, and system libraries [26]. Applications are composed of one or more different components. There are four types of components, namely, activities, services, broadcast receivers, and content providers [27]. Activities include a visible interface of the application. Service components are used for background processing which does not require a visible interface. The broadcast receiver component receives and responds to messages broadcast by application code. Finally, content providers enable the creation of a custom interface for storing and retrieving Data in different types of data stores, such as file systems or SQLite databases. The application framework layer enables the use or reuse of different low-level components. Android also includes a set of system libraries, which are used by different components of Android. The Android runtime includes Apache Harmony [28] class libraries that provide the functionality of core libraries for Java language.
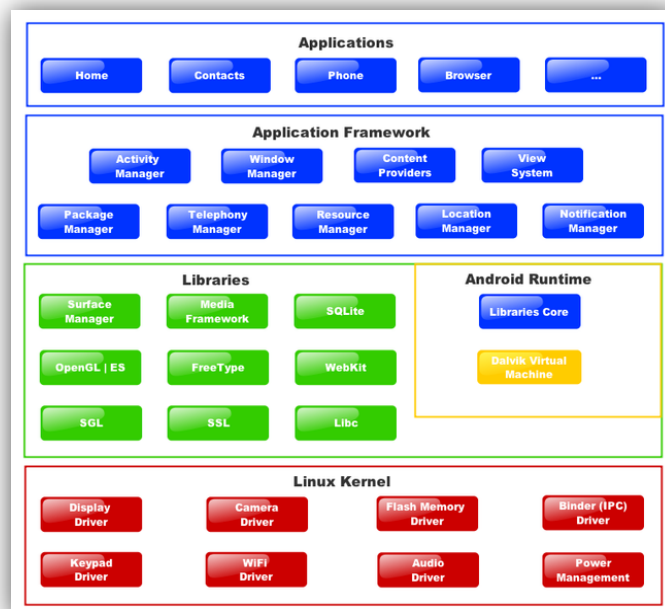

Fig1: Android Architecture

V.   APPLICATION FOR AUTISTIC CHILDREN

Mobile devices are getting increasingly popular and have been widely used in recent years. Therefore, this application can be installed on any smartphone that runs on the Android.

The process of this application is very easy. The child runs the application, then a list of alphabets will be displayed. After that, the child will choose any letter he/she wants. The system will then display words that begin with the same letter that the child has choses. The process of the application is shown in *Fig2*:
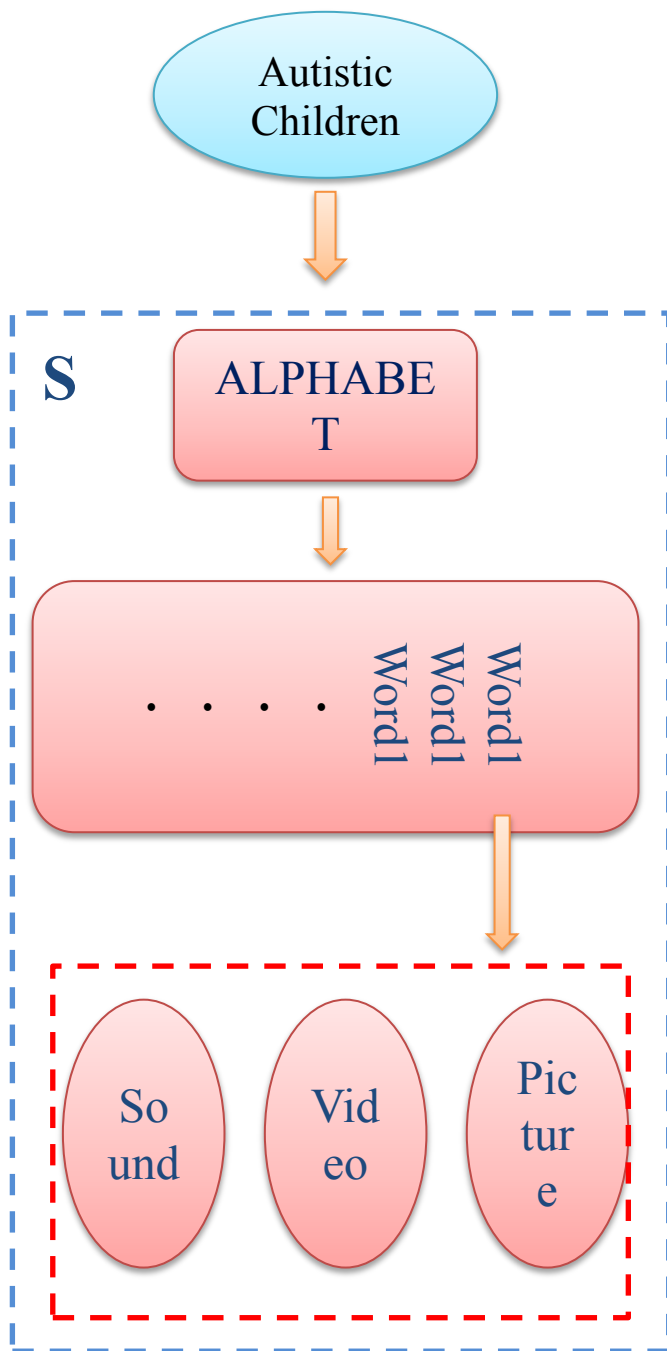
Fig 2. Process of the Application

Fig 3 illustrates the first page of the application, which is the list of alphabets. The child can touch it, and then the system will display the next page.
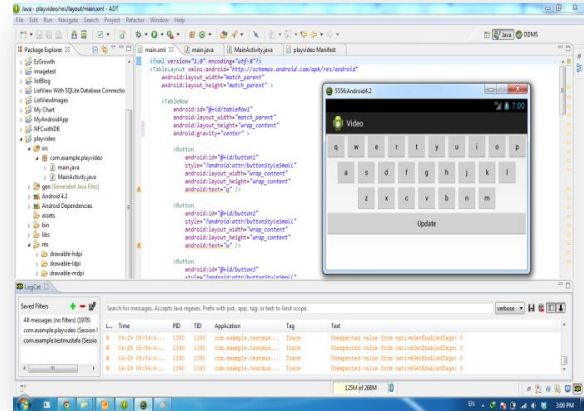

Fig 3. First page for Autism Application

The child can choose any word, and the new page will show him/her what he/she wants to run, whether it is play a Video or Sound or open Pictures, as shown in *Fig 4*.
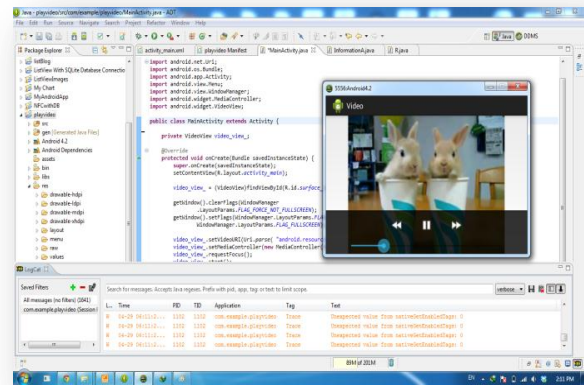

Fig 4. Open Video from Autism Application

VI.   CONCLUSION

This paper seeks to solve the education problem for children with ASD. The world of autism is still a mystery to the sciences. While medical therapies are being devised with medicine and physical exercises, the necessity for ensuring equal opportunity for the autistic children in every sphere of life should be approached by technology. The mobile learning application is a big step toward developing an equal educational environment for autistic children. Consequently, this application seeks to lead toward devising more technological support for the autistic population that

will help them acquire equal opportunities in every sphere of their lives.

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