

ASSISTING ECHOLALIA (REPETITIVE SPEECH PATTERNS) IN CHILDREN WITH AUTISM USING ANDROID MOBILE APP

Mr. T.A. Mohanaprakash

**Panimalar Institute of Technology,
Assistant Professor (G-I),
Department of CSE,
Chennai, Tamilnadu, India**

Dr. V. Subedha

**Panimalar Institute of Technology,
Professor & Head,
Department of CSE,
Chennai, Tamilnadu, India**

Ms. D. Lakshmi

**Panimalar Institute of Technology,
Assistant Professor,
Department of CSE,
Chennai, Tamilnadu, India**

Abstract— *The general context of work presented in this paper is Android mobile App with long term aim to encourage basic communication and social interaction skills in children with autism. This paper investigates how an Android App can be used as mediator-encouraging children with echolalia autism to break their isolation and importantly to facilitate interaction with other people. The objective of this study is to design a system that will run on the Android platform, a popular platform where a great number of smart phone device applications are run. The application will be designed based on the characteristics of echolalia attacked people with autism.*

Keywords— *Autism Spectrum Disorders, Speech Patterns.*

I. INTRODUCTION

Identified by Leo Kanner in 1942, autism spectrum disorders (ASDs) are the fastest growing neurobiological conditions in the world. Autism is a lifelong developmental disability affecting how a person communicates with, and relates to, other people [1]. Autism is a lifelong developmental disability affecting how a person communicates with, and relates to, other people [2]. Autism Spectrum Disorder (ASD) is a neurological disorder that affects behavior and the ability to communicate and interact socially. It leads to feelings of fear, confusion, and loneliness [3]. Autism is one of five disorders that fall under the umbrella of Pervasive Development Disorders [4]. The three main areas of difficulty people with autism experience are:

- 1) Difficulty with social interaction: People with autism find it hard to recognize and understand other people's feelings and to manage their own, not understanding how to interact with other people can make it hard to form friendships.
- 2) Difficulty with social communication: People with autism struggle to use and understand verbal and non-verbal language, such as gestures, facial expressions and tone of voice.

- 3) Difficulty with social imagination: People with autism find it difficult to understand and predict other people's intentions and behavior, and to imagine situations outside of their own routine[5].

1.1. AUTISM

Autism is a neurological disorder that typically appears by 3 years of age. The symptoms of autism involve three major areas of development and impact a child's abilities to: Engage in reciprocal social interactions with others, Communicate with others in developmentally appropriate ways, Participate in a range of activities and behaviors typical of the child's age and stage of development One of the hallmarks of autism is that the characteristics vary significantly among different children with autism. No two children with autism are the same. Significantly more boys than girls are affected with autism by a ratio of approximately 4:1. Children with autism may have the following social and communication skills and common behaviors:

1.1.1. Social Skills

Child may have problems using social skills to connect with other people. He may seem to be in his own world. It may be hard for him to share a common focus with another person about the same object or event-known as joint attention, play with others and share toys, understand feelings, and make and keep friends.

1.1.2. Communication Skills

There are various trouble faced with communication skills like understanding, talking with others, reading or writing. Sometimes, she might lose words or other skills that she's used before. Child may have problems such as understanding and using gestures, like pointing, waving, or showing objects to others, following directions, understanding and using words, having conversations, learning to read or write. Or she may read early but without understanding the meaning—called hyperlexia.

Child may also

- repeat words just heard or words heard days or weeks earlier-called echolalia (pronounced **ek-o-lay-le-a**);
- talk with little expression or use a sing-song voice;
- Use tantrums to tell you what he does or does not want.

1.1.3. Common Behaviors

A child with autism may have trouble such as changing from one activity to the next, flap hands, rock, spin or stare, get upset by certain sounds, like only a few foods and have limited and unusual interests-for example, talk about only one topic or keep staring at one toy.

1.2. Autism Spectrum Disorder

Autism spectrum disorder (ASD) is characterized by:

- Persistent deficits in social communication and social interaction across multiple contexts;
- Restricted, repetitive patterns of behavior, interests, or activities;
- Symptoms must be present in the early developmental period (typically recognized in the first two years of life); and,
- Symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning.

The term “spectrum” refers to the wide range of symptoms, skills, and levels of impairment or disability that children with ASD can have. Some children are mildly impaired by their symptoms, while others are severely disabled. The latest edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) no longer includes Asperger’s syndrome; the characteristics of Asperger’s syndrome are included within the broader category of ASD.

Information on ASD can also be found on the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development website and the Centers for Disease Control and Prevention

1.3. ECHOLALIA

A child that uses echolalia repeats messages or words that he/she hears other people say. Because of this, echolalia is often called “parroting” or “echoing.” Echolalia is actually how most children learn language. It is a part of normal language development. Most children “grow out of” echolalia by 30 months of age. Children with autism spectrum disorders and other disorders may not “grow out of” this stage.

A child demonstrating echolalia may repeat conversations, videos, book read-aloud, songs, etc. When repeating these things, the child will often use the exact rhythm and tone of the original message. Echolalia, after 30 months of age, can be a characteristic of Tourette’s syndrome, and some forms of autism spectrum disorders. When a child uses echolalic language, he/she processes chunks of information rather than individual words. Although the child may be using sophisticated language with lengthy sentences, higher level vocabulary, and advanced grammatical forms, the child often doesn’t understand the meaning of what he/she is repeating.

People with autism may also experience over or under-sensitivity to sounds, touch, tastes, smells, light or colours. Because of these impairments, children with autism have great difficulty in forming and maintaining social relationships. It is difficult for them to engage in social play, much less in collaborative play, and they will typically play by themselves with their own toys. Play is an essential activity during childhood. During play children can learn about themselves and their environments as well as develop cognitive, social and may lead to general impairment of children’s cognitive development, learning potential and may result in isolation from the social environment [6-8].

Different approaches have tried to define the anatomical and functional correlates of emotional processing and theory of mind. Abnormalities have been consistently reported in individuals with autism. About 1 in 68 children has been identified with autism spectrum disorder (ASD) according to estimates from Autism and Developmental Disabilities Monitoring (ADDM) Network. ASD is almost 5 times more common among boys (1 in 42) than among girls (1 in 189). Research has shown that a diagnosis of autism at age 2 can be reliable, valid, and stable. On average, children identified with ASD were not diagnosed until after age 4, even though children can be diagnosed as early as age 2. When looking at age of first diagnosis by subtype, on average, those children were diagnosed with Autistic Disorder at age 4, Pervasive Developmental Disorder-Not Otherwise Specified at age 4 years and 2 months, and Asperger Disorder at age 6 years and 2 months [9].

To date, a number of advanced technologies have targeted the training of social competence of children with ASD [10] including video modeling [11] virtual reality [12] and socially assistive robots [13]. Recent studies have shown that individuals can learn to cope with common social situations if they are made to enact possible scenarios they may encounter in real life. Literature

suggests that people with autism feel comfortable in predictable environments, and enjoy interacting with computers [14].

A few projects world-wide seek to include robots as part of the therapeutic regimen for individuals with autism. The great hope of this investigation is the development of a "social crutch," a robot that motivates and engages children, teaches them social skills incrementally, and assists in the transfer of this knowledge to interactions with humans. Since the behavior of a robot can be decomposed arbitrarily, turning off some behaviors while leaving others intact, we can selectively construct complex social abilities through layers of social responses [15-18].

On other hand, Yee [19] 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 [20] 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. In this paper, Section III discusses literature survey made on this topic and in Section IV Tabulation shows the methods that are used to help children with ASD to improve their social interaction skills.

II. THE EXISTING STUDY

In the existing system, presents a novel design, implementation, and first evaluation of a triadic, collaborative game involving the humanoid robot KASPAR playing games with pairs of children with autism. Children with autism have impaired social communication and social interaction skills which make it difficult for them to participate in many different forms of social and collaborative play. Our proof-of-concept 10-week, long term study demonstrates how a humanoid robot can be used to foster and support collaborative play among children with autism. In this work KASPAR operates fully autonomously, and uses information on the state of the game and behavior of the children to engage, motivate, encourage and advise pairs of children playing an imitation game.

Results are presented from a first evaluation study which examined whether having pairs of children with autism play an imitative, collaborative game with a humanoid robot affected the way these children would play the same game without the robot. Our initial evaluation involved six children with autism who each participated

in 23 controlled play sessions both with and without the robot, using a specially designed imitation-based collaborative game. In total 78 play sessions were run. Detailed observational analyses of the children's behaviors indicated that different pairs of children with autism showed improved social behaviors in playing with each other after they played as pairs with the robot KASPAR compared to before they did so. These results are encouraging and provide a proof-of-concept of using an autonomously operating robot to encourage collaborative skills among children with autism.

III. PROPOSED WORK

In our existing system, KASPAR technique finds only the error of the children while playing game. This KASPAR does not make the children to participate effectively in the social interactions. The different states collected from the game played with KASPAR helps to determine the behavior of the autism children. The system proposed in this work overcomes these problems with the help of mechanical robot called Android. This system solves the difficulties of the Autism (Echolalia) attacked peoples. Due to massive increase in the usage of Mobile phones and handheld devices such as Smartphone's and Tablets, there is an exponential growth in usage of Mobile applications.

Normally the mobile applications are widely used for entertainment (games), education (dictionaries) and for social networks (face book).The intention of creating the mobile applications is to teach, to help and to create a social awareness of the autism people. Autism people needs an intermediary either a human or a mechanical robot to socially interact with other people. To convey something to the autism people, the intermediary have to repeat as many times to the child until the child gets and delivers to other. It is difficult to ensure that a human or a mechanical robot always to be associated with them. Repeating as many times to the autism people is not always possible for the human intermediary. Hence the mobile application reduces the time and solves the mentally challenged people's problem. This mobile application helps them

- 1) To drive their life as like a normal person in the world.
- 2) To face the problems in public and other areas.

Considering one of the problems of the autism people (social interaction) and make them to answer for the question regarding their personal details to the person, this mobile application is created.

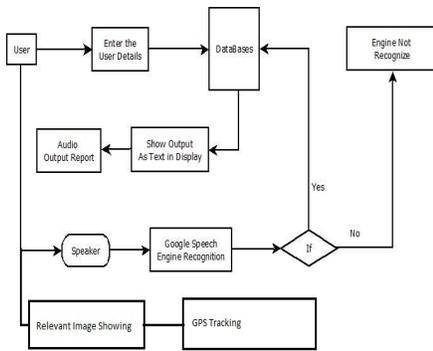


Fig 1 : Working of mobile application

Our mobile application involves with:

1. Registering the details of the person.
2. Conversion of speech to text by Google Speech Recognition Engine (GSE).
3. Based on the question retrieves answer from the database (text).
4. Then the text is converted into speech by using Text to Speech (TTS) engine and answer is repeated to the autism affected child.
5. Finally the relevant images and tracking the location of the person are added.

The mobile application consist of four modules

- Register with Database
- Speech and Text Conversion
- Retrieve and iterate the Details
- Relevant Image and Tracking the Person's Location.

3.1. Register with Database:

Once the application is installed in the mobile, the guardian of that autism people should enter the details of the autism impeded peoples such as Name, Father Name, Mother name, Contact number, Address, Doctor Phone number and some personal details of that person. The details once entered remains permanent in the database. Since the database remains static, it is not possible by the intruders to misuse the apps and hence prevents the autism people from misguiding them.



Fig 2 : Speech and Text Conversion

Speech conversion: When a person ask question to the autism child, voice is captured by mobile application and it is recognized

by Google speech recognition engine (GSE). Voice commands are recognized by microphone, speech is converted to text using appropriate GOOGLE VOICE API and searching is done based on the text in the SQLITE database.



Fig 3 : Text conversion

Appropriate Database details (text) are converted into speech using text-to-speech engine. Sounds of each language are recorded in series of text which contains all possible sounds. These recordings are segmented based on syllables, words, phrases etc. To reproduce sound, initially linguistic analyzes is made for the input text and produces the phonetic text. Then the grammar, syntactic analysis, prosody is performed to determine how to produce each word with intonation and rhythm. Finally, the system produces information association phonetic writing with tone and required length of pronunciation. Then sound generated by selecting best units in database.

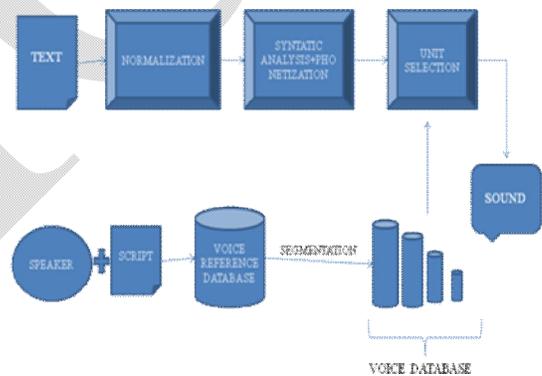


Fig 4 : Retrieve and iterate the Details:

Google speech engine recognizes the question and retrieves answer from the database in text format and the corresponding sound is produced by text to speech engine. Then the answer is **repeated** as many times to the person which is preset. The person with echolalia attacked hears this and replies to the question asked to them by the people.

3.2. Relevant Image and Tracking the Person's Location:

Retrieve the relevant images for the query from the database and display it on the screen. For example, when someone asking his/her father name, mother name it will display their corresponding images on the screen. The GPS system is added to track the location of the child in case of missing.

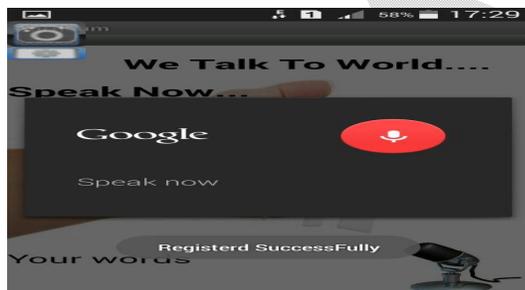


Fig 5 : Details registered successfully

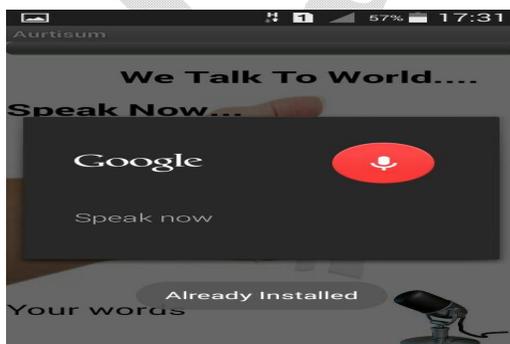


Fig 6. Voice recognition



Fig 7.Retrires the details

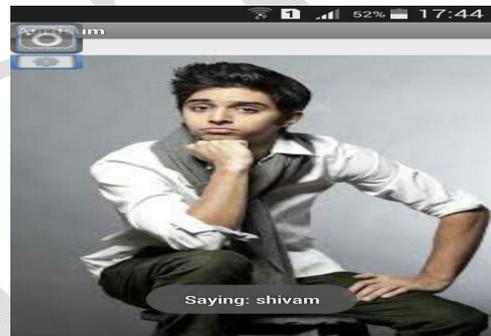


Fig 8. Repeats and displays the details

IV. CONCLUSION AND FUTURE WORK

The world of autism is still a mystery to the science. 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 application is a big step toward developing an equal 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.

We have created a mobile application named autism which helps the autism child to answer for the question raised from the third person. This mobile application has a lot of advantages .Since the mobile phones are portable; it can be accessed anywhere and anytime. A human mediator does not need to speak many times to the child, since the mobile application being an intermediary. Mobile Application stores the user database permanently. The mobile application is created only for one language (English).Hence the mobile application with other languages and for learning purpose of the child can be enhanced for the future.

References

- [1] B. Quinn and A. Malone, *Pervasive Developmental Disorder: An Altered Perspective*: Jessica Kingsley Publication, 2000
- [2] Jordan R, *Autistic spectrum disorders—an introductory handbook for practitioners*. David Fulton Publishers, London, 1999.
- [3] N. Noiprawat and N. Sahachaiseri, The model of environments enhancing autistic children's development, *Procedia-Social and Behavioral Sciences*, Vol. 5, pp. 1257-1261, 2010.
- [4] R.M. Yogeswara, Siva Kumar, J. Santosh and S. Anand, *Virtual Technologies in Intervention Programs for Autistic Children*, *International Journal on Emerging Technologies* 4(1), pp. 39-43, 2013.
- [5] Elizabeth S. Kim, Lauren D. Berkovits, Emily P. Bernier, Dan Leyzberg, Frederick Shic, Rhea Paul, Brian Scassellati, *Social Robots as Embedded Reinforcers of Social Behavior in Children with Autism*, *Journal of autism and development disorder*, Vol. 43, pp. 1038-1049, 2013.
- [6] Vygotsky LS, *Interaction between learning and development. From: Mind and society*, pp. 79-91, Cambridge, 1978.
- [7] Piaget JP, *Play, dreams and imitation in childhood*, New York: w. w. Norton, 1962.
- [8] Winnicott DW, *Playing and reality*, Penguin Books Ltd, Middlesex, 1971.
- [9] American Psychiatric Association. *Diagnostic and statistical manual of mental disorders*. 5th ed. Arlington, VA: American Psychiatric Association, 2013.
- [10] Grynszpan, O., Simonin, J., **Martin, J.C.**, **Nadel**, *Designing Educational Software Dedicated to People with Autism*, Vol 34, pp. 101-107, 2005.
- [11] Nikopoulos, C.K., & Keenan. *Effects of video modeling on training and generalisation of social initiation and reciprocal play by children with autism*. *European Journal of Behavior Analysis*, Vol 5, pp.1-13, 2004.
- [12] Sarah Parsons^{a*} & Sue Cobb^b, *State-of-the-art of Virtual Reality technologies for children on the autism spectrum*. *European Journal of Special Needs Education*. In press, Vol 26, pp. 355-366, 2011.
- [13] Dautenhahn, K. And Werry, I. *Towards interactive robots in autism therapy: background, motivation and challenges*. *Pragmatics and Cognition*, Vol. 12, pp. 1-35, 2004.
- [14] Moore D.J. *Computers and People with Autism/ Asperger Syndrome; Communication*, summer, pp. 20-21, 1998.
- [15] Werry, I.P., Dautenhahn, K., *Applying Mobile Robot Technology to the Rehabilitation of Autistic Children*, *Proceedings of SIRS '99, Symposium on Intelligent Robotics Systems*, pp. 20-23, July 1999.
- [16] Michaud, F., Théberge-Turmel, *Mobile robotic toys and autism*, *Socially Intelligent Agents -Creating Relationships with Computers and Robots*, Kerstin Dautenhahn, Alan Bond, Lola Canamero, Bruce Edmonds (editors), Kluwer Academic Publishers, pp. 125-132, 2002.
- [17] Dautenhahn, K., *Design Issues on Interactive Environments for Children with Autism*, *Proceedings International Conference on Disability, Virtual Reality and Associated Technologies (ICDVRAT)*, pp. 153-161, 2000.
- [18] Kozima, H., Nakagawa, C., and Yano, *Designing a Robot for Spatio-Temporal Contingency-Detection Game*, *International Workshop on Robotic and Virtual Agents in Autism Therapy*, 2002.
- [19] H. S. S. Yee, *Mobile technology for children with Autism Spectrum Disorder: Major trends and on Socially Assistive Robots*, Vol. 24, pp. 147-157, 2008.
- [20] .H. Song and A. M. Yusof, *A Current Review of the Use of Mobile Technology to Enhance Learning and Communication Among Children with Developmental Disabilities*, *EDULEARN 10 Proceedings*, pp. 5985-5990, 2010.