Improving the Life of Children Affected by Autism Spectrum Disorder with the Help of IOT

Ms. Gayathri.E[#1] Ms.Saranya.A[#2] Ms. Yashini.S[#3] Mrs.B.Monica Jenefer[#4]

#1,#2,#3-UG Students, #4-Head of the Department, Department of Computer Science & Engineering Meenakshi Sundararajan Engineering College, Chennai, Tamil Nadu, India

Abstract

This paper explicate an innovative IOT system which supports the children with autism spectrum disorder (ASD) and also acts as a guide system of their health. The main aim is to sense their EEG (Electroencephalographic) waves and to keep a track on it using Smartphone. EEG probes present in the cap helps in sensing their brain waves. The recorded brain signals are dispatched to the cloud by making use of the antenna present in the IOT module with GSM. The cloud acts as storage system and those signals are viewed by the application developed. The Therapists and the Guardian make use of this system to follow their children and can understand the complexity of the behaviour. Each autistic children has a marked set of talents and strengths. By making use of this application their skills can be improved to a certain level. This application also strives for improving their vocabulary skills and helps them in communicating.

Keywords – *Autism spectrum disorder (ASD), EEG probes, IOT module with GSM*

I. INTRODUCTION

Autism spectrum disorder (ASD) is a neurological disorder that develops in a children within the age of 2 or 3 years. This disorder affects the communication and behaviour of a person. The autistic children have difficulty with communication, difficulty with social interactions, obsessive interests and repetitive behaviours. They also face mental health challenges such as anxiety, depression and attention issues. According to the CDC the number of autistic children have been increased from 1 in 92 in the 2016 report to 1 in 71 in the 2018 report. There are no cures for ASD but therapies and other treatment conisderations can help people feel better and can ease their sysmptoms. Behavioral theraphy, play theraphy, occupational theraphy, physical theraphy, speech theraphy aree some of the treatment methods. This paper makes use of the EEG sensors to sense their brain signals which comes under the IOT domain.IOT is a collection of reticulated computing devices, digital and mechanical machines, objects, animals or people that are provided with unique identifiers (UIDs) and capability to transfer data over a network without requiring human-to-human or human-to-computer interaction. The IOT has countless applications in promoting the health of the patients, from remote monitoring to smart sensors and medical device integration. It has the potential to keep patients safe and hale. Healthcare IoT can also boost patient engagement and satisfaction by allowing patients to spend more time interacting with their doctors.The application developed will certainly promote the lifestyle of the autistic children.This application will not only improve the lifestyle of the autistic children but also help the parents to keep an eye on the child and can monitor their behaviour .It also help the therapist so that the treatment can be varied according to the mental health level.

II. RELATED WORKS

Facial, Visual and hand movement response data were used to identify the behaviour of the children in different situations and it was also used to detect their moods. Brisking facial muscle, eye-contacts, and hand movement yielded a variety of nonverbal expressions intended for communication and social engagement. It conveyed about 80% of the cues in social communications. Spontaneous facial expression in children with ASD were measured by making use of the EMG (Electromyography) sensors. It also measured the subtle facial movements which were indiscernable to human eyes. The electrophysiological sensors were placed on their fingers,chest,shoulders to record their movements. Placing of number of sensors on their sensors disturbed their mental health and the ASD children were more nervous and at an high peak of anxiety. Facial action coding system (FACS) illustrated the different emotional and non-emotional phases of the face. For example: Dimple in the facial was considered to be a sign of depression, lips apart represented a surprised emotions. The children were taught with functional life skills by making use of smart box devices.

III. PROPOSED WORK

About 1 percent of world population are affected by Autism Spectrum Disorder. After a tedious experiment researchers and scientists have proved that

autism is a life long condition (i.e.) autistic children become autistic adults. This paper brings out a one-sided solution to the affected children. Even though this system doesn't give a complete cure to the autistic children it works as a guidance and control the level of autism in children. Both the system process and the medical treatments should go one on one to get complete results. This system consist of EEG sensors – to sense the brain waves , microcontroller- to convert the analog signals to decimal values , an IOT cloud - to store the reading that are sensed from the brain and an application – to view the readings and to control the affected child. It keeps a track of the brain signals and gets stored so that the physician of the respective child can keep a note of it and in case of any emergency the physician can directly contact the guardian and notify them about his/her

changes in the health. The daily tracking system creates comfort zone so that there is no need of any hard copies of the medical report that has to be carried, the readings are stored in the cloud with the help of this they can access and check the previous record of action that happened in the specific course of time .The working starts with the EEG sensors , the EEG probes that are attached to the children senses the brain waves which are in analog format. The output from the EEG sensors are sent as input to the microcontroller . It converts the analog waves to readable decimal format. An amplifier is used to amplify the signals – the signals are in micro volts it is amplified to volts.
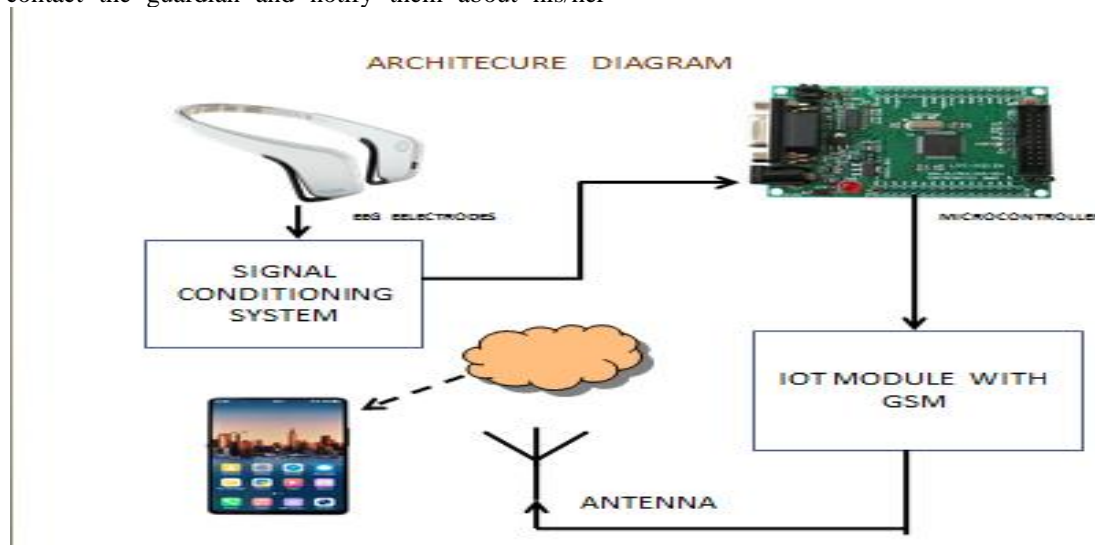

Figure :1

These readings are stored in the cloud and are monitored by the application developed. When the readings cross the threshold value a Peer to Peer communication will be developed between the guardian, physician and the children. . In addition to P2P communication a song of his/her favourite will be played at that course of time (when the signal level goes above the specified threshold) so that their eccentric activity can be controlled and pacify the child. This system develops a connection between the child, physician and the guardian and helps to monitor the convalescence regularly.

IV.ARCHITECTURE DIAGRAM

The architecture diagram proposed for this system is as shown in figure 1. It consists of an EEG SENSOR, Amplifier, micro controller, IOT module with a GSM and an application. EEG sensor will sense the brain signals of the children. It will be usually in the

micro volt format which can't be processed so it is given to the signal conditioning system which is the amplifier.From the amplifier it will be sent to the micro controller for converting it into decimal values.From there it will be sent to the cloud with the help of antenna present in the IOT module with GSM. The application will display the processed values.

V.MODULES

A. Signals Sensing Module

The EEG sensors consist of three probes that are differentiated using three colors – red , yellow and black. Red is kept to right side of the forehead , Yellow is kept to the left side of the forehead and Black to right behind to right ear. Black is for ground which nullifies the electric power so that it doesn't create any kind of discomfort to the children . These probes are made to sense the brain waves and record it. These brain waves are in micro volt format and in the wave format. The

---

neurons are the basic cell structure which are composed to form the nervous system so the wave readings are in microvolt format.

B. Signal Conditioning Module

The signals are in micro volt format which creates difficulty in reading the values. So in order to make it a ease the signal conditioning system is done. For this process amplifier is used. With the help of the amplifier the analog signals from the EEG sensors is conditioned and amplified from micro volt to milli volts. Now the signals are converted to micro volts.

C. Displaying Eeg Signal Values Module

The conditioned signals from the amplifier are sent to microcontroller. The microcontroller used here is PIC16LF1526 – this helps in converting the analog signals to decimal values. The amplified signals which is the output from the amplifier is sent as input to the microcontroller. The analog wave forms are converted into readable format (i.e.) 0,1,2,..... numerical format(decimal). To view the values Liquid Crystal Display is used(LCD). The readings are made to display in the LCD so that the corresponding values are made note.

D. Transmitting Signals To The Cloud

The values are stored in the IOT cloud. Here the cloud acts as a storage system. The readings that are processed into decimals values are sent to cloud using the GSM module . The GSM module consist of a SIM card to create a connection to the cloud using the data packet available in the sim. The recorded and processed signal values are sent to cloud and it is stored in the cloud and accessed in the due course of time when in need. While storing the values if the reading goes above the threshold value it creates a P2P communication with the child , physician and guardian. An application is developed in the smartphone when the reading is above the threshold a song will be played .

VI. RESULTS AND DISCUSSION

Any kind of eccentric behavior and autism spectrum disorder cane be resolved. A set of 10 children suffering from Autism spectrum disorder are tested with this system for the working basis. It answered for 8 people, when the sensors were attached to their head the signal values were stored in the cloud and is viewed using the application as soon as the value goes above the threshold the song from the application started to play and it brought changes in the child behavior after the listening to the song. They were able to become habitual and felt comfortable with the system. They didn't find any kind of awkward feel with the sensors on their head and it wasn't issue for them.

Day	Child ID									
	1	2	3	4	5	6	7	8	9	10
1	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
2	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
3	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes
4	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
5	No	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes
6	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes
7	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
8	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes

Above table shows the response of 10 child monitored in various days.

VII. CONCLUSION

A support system which helps in promoting the lives of autistic children or adults suffering from autism. This is development is a milestone for the children suffering from autism. It doesn't create any issues with the surroundings and for the children using it. It creates a comfort zone for the guardian to keep a record and track their children even in their absence. This system helps in giving a recognition to the children and to make them be socially comfortable. It also strives in improving the vocabulary skills of the children. Rather than creating a social bond it acts as a helping hand and give them confidence to face the society with courage.

REFERENCES

[1] Manar D. Samad, Norou Diawara, Jonna L. Bobzien, John W. Harrington,Megan A. Witherow, and Khan M. Iftekharuddin , Senior Member, IEEE,"A Feasibility Study of Autism Behavioral Markers in Spontaneous Facial, Visual, and Hand Movement Response Data" on IEEE(Vol.26,NO.2,February-2018)

[2] Lal Bozgeyikli , Student Member, IEEE, Andrew Raij, Member, IEEE,Srinivas Katkoori , Member, IEEE, and Redwan Alqasemi, Member, IEEE, "A Survey on Virtual Reality for Individuals with Autism Spectrum Disorder Design Considerations" in IEEE Transactions On Learning Technologies (Vol. 11, No. 2, April-june 2018)

[3] YanShi,SaptarshiDas,SarahDouglas,SubirBiswas,"An experimental wearable IoT for data-driven management of autism" in IEEE Transactions On Learning Technologies,(2017)

[4] Helena Song Sook Yee,Multimedia University,Selangor, Malaysia,"Mobile Technology for Children with Autism Spectrum Disorder: Major Trends and Issues"(2016)

[5] James M. Rehg, Agata Rozga, and Gregory D. Abowd,Georgia Institute of Technology Matthew S. Goodwin, Northeastern University,"Behavioral Imaging and Autism"on IEEE CS,(2014)

[6] Esther Ben-Itzchak, School of Education, Bar-Ilan University and Ditza A. Zachor, School of Medicine, Tel Aviv University, "The effects of intellectual functioning and autism severity on outcome of early behavioral intervention for children with autism" in ELSEVIER Research in Developmental Disabilities 28 (2007)