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ASD PARENT'S HELPMATE

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Abstract: Autism or Autism Spectrum Disorder is a condition related to brain development that impacts how a person perceives and socializes with other causing problems in social interaction and communication. This disorder also includes limited and repetitive patterns of behaviour. There is no specific medical treatment to diagnose the disorder. Analyzing child's development history and behaviour is the only way to diagnose. We introduce a Android application to identify the disorder and give proper guidance according to the severity of ASD and aims to improve skill development in child. Our system allows the parent to interact with the child in a flexible manner.

Keywords: Behavior prediction, Skill and ability, chat bot

I. INTRODUCTION

Autism spectrum disorder is a condition related to brain development. ASD impacts how a person perceives and socializes with others, causing problems in social interaction and communication. The disorder also includes repetitive patterns of behavior. ASD begins in early childhood and eventually causes problems functioning in society socially, in school and at work. A small number of children appear to develop ASD normally in the first year, and then go through a period of regression between 18 and 24 months of age when they develop autism symptoms. While there is no cure for autism spectrum disorder, but, early treatment can make a big difference in the lives of many children. Because of the unique combination of symptoms in each child, severity can sometimes be difficult to determine. It's generally based on the level of impairments and how they effect the ability to function. Similarly the most common use of technology to help children and adults with autism is to improve communication skills. There are many apps and many built-in features of these devices that can help individuals with autism at all levels. One of them is Augmentative and alternative communication is a specific type of assistive technology that can benefit people with autism of all ages by promoting communication, and increasing social interactions. Studies have examined the use of technology and computer-based interventions to teach people with ASD language and social skills and abilities.

II. THEORY

You Only Look Once

Autism or Autism Spectrum Disorder is a condition related to brain development. We introduce Android application to identify the disorder and give proper guidance according to the severity of ASD and aims to improve skill development in child. Our system allows the parent to interact with the child in a flexible manner. Behavior prediction is used to analyze the behavior pattern of an autistic child. A list of questions are provided for parents which should be answered according to the behavior of child. It needs to be updated for a period of time for accurate prediction. The result shows the chance of occurrence of autism in the child. Skill and ability includes skill identification and skill development. Autistic children develop skill at different rates comparing to normal children so here an interface is provided to identify the specific skills of autistic child and improve it accordingly. In skill identification an assessment is done by the parent through certain tasks and questions for recognizing the skill. Thereafter skill development is done based on it. Chatbot play a major role in making relevant health care information accessible to the parents at the right time. There can be certain critical situations for autistic child which cannot be handled alone by parent. In this scenario, chatbot act as an assistance.

Decision Tree Algorithm

Decision tree is the most powerful tool for classification and prediction. It is a flowchart like tree structure, where each internal node denotes a test on an attribute, each branch represents an outcome of the test, and each leaf node holds a class label. Tree can be “learned” by splitting the source set into subsets based on an attribute value test. This process is repeated at each derived subset in recursive manner called recursive partitioning. The recursion is totally completed when the subset at a node all has the same value of the target variable, or when splitting no longer adds value to the predictions. Decision tree learning or induction of decision trees is one of the predictive modelling approaches used in statistics, data mining and machine learning. It uses a decision tree to go from observation about an item to conclusions about the item's target value. Tree models where the target variable can take a discrete set of values are called classification trees; in these tree structures, leaves represent class labels and branches represent conjunctions of features that lead to those class labels. Decision trees where the target variable can take continuous values are called regression trees. Decision trees are among the most famous machine learning algorithms given their intelligibility and simplicity

III.RELATED WORK

Here we are introducing some paper that are related to our survey.

In this paper^[1], It introduces a infrastructure to record, detect and label the behavioral patterns of children with Autism Spectrum Disorder (ASD).It has different sensor platforms which are wearable and static. Using these platforms the system continuously recognize the activities of an autistic child that exhibit repetitive behaviors. The wearable system works based on accelerometer which detects behavioral patterns of a subject. Static sensors are microphones and cameras which captures the sounds, images and videos of the subjects within a room. The system labels the segment of video data based on detection of the autistic behavior. Time-Frequency methods are used to extract features and Hidden Markov Model (HMM) is used for analyzing the accelerometer signal. It is also used to detect hand/arm motions. This paper helps to achieve 91.5% of classification rate for behavioral patterns. HMM enables to test the proof of concept and currently are exploring further analysis. The number of sensor systems can be extended to other parts of the body such as ankles to detect other repetitive behavioral patterns.

In this paper^[2], It introduces an automated study of gaze patterns as an investigating tool to distinguish autism spectrum disorder from typical development. The response to different stimuli such as pictures of human faces, geometries, animations, human voices, had been used to measure the degree of impairment, differences in theory of mind and executive functions and hence to estimate the severity of ASD. Gaze abnormality can be used to study the model of the world perceived by people with autism which is quite different from normal people. This system is a screening tool for gaze pattern analysis of ASD. In this automated analysis of reading gaze patterns, density method is used to read and quantify the data..This paper shows that the density plots for autistic subjects were found to be more concentrated to few AOIs having less gaze points in total, signifying poor interaction level and seldom eye contact.

According to this paper^[3], an overall description of autism, its classes, signs and diagnosing protocols are included.This system ease the process of detecting and recognizing autism spectrum disorder. Here deep investigation of computer vision-based protocols in cooperation with machine learning technologies are discussed to propose autism diagnosing solution. Computer vision-based approach go through three phases, extraction of autistic child body from input video, pose estimation and skeleton representation, and recognition of repetitive behaviour and state whether it is autistic symptom or not. As several poses are expected to be found with various viewpoints, deep learning models are used to produce satisfying outcomes in extracting autistic child's body. Computer vision based approaches allow capturing behavioural patterns in a non-intrusive and continuous way over time and has low implementation costs.

In this paper^[4], a network platform for the implementation of the development of children which enhances the efficiency of evaluation of autistic children is developed. The Development Assessment of Children with Autism Evaluation Form analyzes and converts the evaluation results so that the majority of children with autism rehabilitation professionals can free from difficult manual operation. This paper provides a systematic, scientific and comprehensive assessment for children with autism. Here the autism children should be evaluated for four times. For the first stage of assessment, diagnostic assessment of rehabilitation training will be made. In second, third and fourth time, periodic assessment of the effect of rehabilitation training will be made. The experts concerned with ASD can also use this platform to guide the rehabilitation of children with autism.

The main aim of this paper^[5] EI records are used to evaluate classification techniques to identify suspected ASD cases.Performance of machine learning techniques are improved and used to developing and applying a unified ASD ontology to identify the most relevant features from EI records. ASD identification is regarded as a text classification problem with positive and negative ASD as two classes. A classification model for categorizing the EI records is first developed is used to predict the classification of records labeled as “speech and language impairment” or “unspecified developmental delay”. This paper compares the effectiveness of three popular machine learning methods - Naïve Bayes, Bayesian Logistic Regression, and Support Vector Machine and trained by features with three representations - Boolean, term frequency, and term frequency. Therefor the results indicate that by using Support Vector Machine (SVM) with ontology-based unigrams as features get the best performance.This shows that developing automatic approaches for quickly and effectively detecting suspected cases of ASD from non-standardized EI records earlier than most ASD cases are typically detected is promising.

According to the paper^[6],A skin conductance device capable of measuring the galvanic skin conductance is developed and help diagnosing autistic children from the first weeks after their born. As skin conductance is directly affected by the emotional arousal. With the development of cloud services it is important that advances in technology help physicians in diagnosing autistic people.A screening device is developed and (a bluno board) will continuously measure the GSR and display it to the physician to help diagnose the child as ASD, ADHD, or balanced. The physician can use his smartphone as the display. A wireless Bluetooth communication is established between the device and the smartphone. The physician will use an android

application to monitor and control the system. Developed device is capable of measuring the GSR of children and stream then wirelessly to the Smartphone of the physician. According to the levels of the GSR, diagnosis and treatment can be established.

This paper ^[7] the classification method for ASD diagnosis is used in children aged 4-11 years. The Linear Discriminant Analysis (LDA) and The K-Nearest Neighbor (KNN) algorithms are used here for the classification. To test these algorithms, 30 percent of the data set is selected as test data and 70 percent as training data. As a result of this work, In LDA algorithm, the accuracy is 90.8%, and the accuracy of the KNN algorithm is 88.5%. In LDA algorithm, sensitivity and specificity values are calculated as 0.9524 and .08667, respectively. In KNN algorithm, this values are calculated as 0.9762 and 0.80. This study, was to find out whether children have ASD by using classification methods. As a result of the classification, there are two classes of cases in which the child is ASD or not ASD. As a result of the work done, 90.8% accuracy is obtained as a result of the LDA algorithm and 88.5% accuracy is obtained from the KNN algorithm.

According to paper ^[8] it applies a hierarchical clustering model suited to dealing with datasets of mixed data types to stratify children with ASD into more homogeneous subgroups in line with the Diagnostic and Statistical Manual of Mental Disorders (DSM)-5 model. The outcome of this cluster analysis provided a better understanding the complex issue of ASD phenotypic heterogeneity and identify subgroups which is useful for further ASD genetic studies. The main goal is to provide insight into viable phenotypic and genotypic markers that would guide cluster analysis of ASD genetic data. As a result, analyzing the clusters in a hierarchical structure is a well-suited and meaningful model to unravel the complex heterogeneity of this disorder. Data mining techniques are applied to seek discovery of phenotypic features that are relatively discrete, quantifiable and pathophysiologically relevant. Key strength of the hierarchical model is able to further divide and analyze each predominant subgroups to unravel more homogenous and clinically meaningful groups as we go down the tree structure.

In this paper ^[9] an ensemble model for analyzing ASD phenotypes using several machine learning techniques and a k-dimensional subspace clustering algorithm is presented. The ensemble also incorporates statistical methods at several stages in this analysis. This model is applied to a sample of 208 probands drawn from the Simon Simplex Collection Missouri Site patients. From this, results are useful evidence that is helpful in elucidating the phenotype complexity within ASD. The model can be extended upto other disorders that exhibit a diverse range of heterogeneity. This ensemble statistical and clustering model is an efficient solution that can be applied to analysis the features from any complex biomedical dataset which is characterized by high dimensionality with unknown underlying subgroupings. It is also applicable to other disorders that exhibit a diverse range of heterogeneity.

In this paper ^[10] presents preliminary evaluation of interaction techniques and designs for individuals with ASD to be used in a highly immersive virtual reality vocational training system [VR4VR]. It includes motion tracking cameras, a head mounted display, real time tracked objects, and several interaction tools such as touch screen and haptic device. Tangible object manipulation, haptic device interaction, touch and snap technique and touchscreen interaction are implemented in this system for object selection and manipulation. Real walking and walk in place techniques were implemented for locomotion and user study was performed with five individuals with ASD which has no prior VR experience. The first testing results and observations that show the preference of the users with ASD on the implemented interaction techniques are shown here with the aim of contributing to the future studies that utilize VR for individuals with ASD. In VR4VR system, individuals with ASD are trained on six vocational skills in highly immersive virtual environments. These skills include cleaning, shelving, environmental awareness, loading the back of a truck, money management and social skills. These techniques are the ones that is most resemblance to everyday real life interaction.

In this paper ^[11] an integrated cloud based framework is developed for autism screening and confirmation with integrated screening tool targeting different age group to speed up the process. For this, screening tools are developed for children of different age group. Social behavior, culture, customs and traditions varies from country to country so depending on these factors, screening tools are based on local context. Automatic screening and confirmation is necessary to streamline autism detection and intervention for earliest detection. This framework involves an approach to solve problems regarding autism finding or different age category in same platform. Local screening tools are added in this framework to make it an effective and culturally sensitive system. The 3 layer assessment process will screen and confirm autism effectively. The cloud manager monitors and manages the entire system centrally to store information for future reference and assist people.

In this paper ^[12], it introduces the things regarding how to predict participants' RJA performance in HRI based on their head pose patterns in HRI, under a semi-supervised machine learning. As a three-class classification problem, here achieved a micro-averaged accuracy of 73.5%, which indicates the potential effectiveness of the proposed method. In this paper they find out that hard histogram worked in general better than soft histogram. This is a practical difference which depends on the specific problem and its data distribution. The 186 HRI sessions from two longitudinal user studies are used as 186 data points in the machine learning framework. This paper helps to predict human-human social communication performance of children with ASD based on their skill observed in HRI and this approach will lead to the assessment and generalization of HRI based intervention of children with ASD.

According to paper ^[13], at the early research a socially assistive robots are provided for improved communication and social interaction in young aged children with ASD (Autism spectrum disorder). In this paper, a low-cost toy like robot is presenting with all safety feature which are snap-off head and snap-off arms, also hand detection, face detection with camera and session recording, two autonomous games and teleoperated mode. This new proposal resulted in social interaction, development in communication and speech among autistic child. Here salutation will be automated by track movement of previously implemented hand and face detection to track movement for response. Then to identify which accessory is being placed on its head it uses RFID tags that can be added to robot's hand and hand which allows and helps to respond appropriately.

In this paper ^[14] ASD is a mental disorder which has characteristics of decrease in creativity, social interaction, communication and imagination etc. In most of the cases characteristics of Autistic person will continue for the rest of his or her life. Nowadays children and teenager are usually have a high interest in digital games. So in this paper, it proposes design and evolution of games design that helps in developing CT skills in person with autism. Other than it helps to understand other scientific areas and by digital artifacts their skills may be developed. TEACCH (Treatment and education of Autistic and related communication handicapped children) which provides principle that is followed by workshop design. TEACCH aims to help autistic child to grow maximum at adult age.

In this paper^[15], an euro developmental disorder which is involved difficulties in social communication. This paper filtered a variety of prosodic, acoustic, and conversational features from speech recordings of the Hebrew speaking children are completed in Autism Diagnostic Observation Schedule. Using this feature, built several Deep Neural Network (DNN) algorithms are estimate ADOS scores and compared their performance which Linear Regression and Support Vector Regression (SVR) models. This feature can be utilized the a CNN model to yield remarkably accurate forecast of ADOS scores when applying utilizes the architecture that are multiple vocalization samples from each child . This paper suggest that speech analysis algorithm may have clinical usefulness in assessing early ASD risk and measure of novel outcome for quantifying ASD severity changes time and following treatments.

In this paper^[16] it is focused on social communication deficitsimproving inpopulations of ASD, less emphasis outdated loyal toimproving the skills relevant for adult independenting the living, such as driving. The paper explains the novel virtual reality (VR)-basedon driving system liketask are different difficulty levels is presented the train and driving skills are improved for teenagers with ASD.multiple machine learning methods are compared and the ability of these methods to accurately measure cognitive load are validated. This paper is used as The VR-based driving system and the experiment protocol described. Eye gaze feature extraction and analysis are presented. The results are designed the train and improve the driving skills of ASD child.

This paper^[17] attempts to apply unsupervised Machine Learning to discover clusters in ASD. The main aim is to learn cluster based on visual representation of eye-tracking scan paths. The clustering model is trained using compressed representations learned by a deep autoencoder.This study includes eye-tracking meeting point and Machine Learning (ML) in the ASD context.This paper shows briefly the translation of eye-tracking recordings into a visual representation and can illustrate the gaze movement of scan path using unsupervised Machine Learning (ML).The clusters are analysed to provide interesting insights into the characteristics of the gaze behavior involved in autism.The objective of this paper is to discover potential connections between the dynamics of gaze behavior and autism.

In this paper^[18], an approach to estimate the probability variation of generating ASD in children, which is not observable condition before birth is discussed. According to the statistical nature of ASD heritability and recurrence data available in literature, HMMs seemed to be the most straight forward and transparent strategy to start this investigation. Adequacy is due to the HMMs generative approach, which is based on prior probabilities of each state,which allows to infer a distribution probability over the possible values of the hidden states.This paper^[19] aims to examine longitudinal associations between diagnosis, joint attention, play and imitation abilities and language outcome in infants with autism and pervasive developmental disorder. Experimental measures of joint attention, play and imitation were conducted with some of infants with autism spectrum disorder at age 20 months. Language outcome was assessed at age 42 months. Here it is demonstrated that early social-communication skills can be measured in infants with autism spectrum disorder.

In this paper^[20], discuss about Collaborative puzzle games in interactive activities that can be played to faster the verbal-communication skills and collaboration of children with ASD.The clever agent as also able to measureautomatically in the performance of children's taskand verbal-communication behaviors through game play. Two preliminary studies are children are conducted with ASD to evaluate the feasibility and performance of the intelligent agent.The potential to calculatecollaborationand communication skills of the participants . The system generate accurately verbal-communication features as indicated by the low error rates of these features.

IV.METHODOLOGY

The main objective of our project is to predict the chance of autism spectrum disorder in children's using a checklist provided in the behavior prediction phase. For this we implement decision tree algorithm. The user have to answer the questions provided in the checklist and finally predict the chance of autism. Skill identification and development process is done using the information stored in the database. An AI based chatbot is also provided which interpret the words given by a person and provide a pre set answer.

4.1System Model

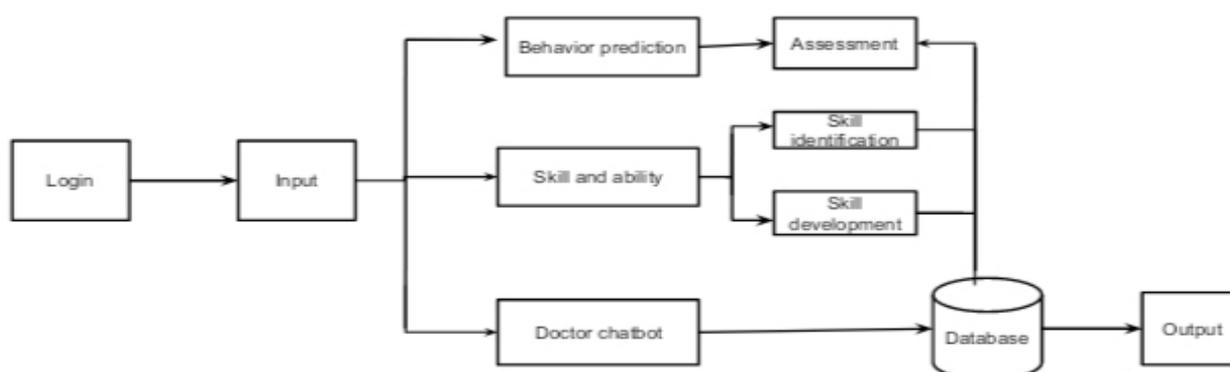


Fig 4.1 system model of proposed system

The main objective of our project is to recognize the chance of autism spectrum disorder in a child .Above diagram shows the system model of our application .Initially we can see the login module. The user can register their children’s details and login to the profile. If already registered the user can sign in after the authentication process. User can then provide the input. In behavior prediction module it predicts the behavior of autistic child. Several questions are provided in this module. They have to completely fill the questions and finalize the behavior of child. For this we provide a checklist which works based on decision tree algorithm In skill identification it includes detection of skills according to the behavior of child by providing various activities. In skill development module from the activities in the above module, several tasks are related to it and skills are developed. Through the chatbot module, assistance to the parents are given to handle critical situations regarding their children,

V. RESULTS AND DISCUSSION

Here we are developing an application to detect the chance of autism. A decision tree algorithm is used for the prediction Below show the output of our application:

The screenshot displays the ASD HelpMate application interface. On the left, under the heading "ANALYSIS OF YOUR CHILD", there are three dropdown menus: "Please Select Your Child's Age" (set to "4-6 months"), "How Many Words Can your Child Speak" (set to "No Words but laughing & coo.."), and "Please Select Your Child's Speech Level" (set to "Verbal"). To the right of these menus is a checklist titled "ASD HelpMate" with the following questions and "Yes" responses:

- Has Your Child ever been evaluated by a therapist: Yes
- Developmental Issues: ADHD
- Can Your child play with toys with buttons and moving parts: Yes
- Does Your child play with puzzles that has more than 3 or 4 pieces: Yes
- Can Your Child Draw a Circle by looking: Yes

Below the checklist, two behavior prediction outcomes are shown. The left outcome, "Your Child Have Chances For Autism Disorder", is accompanied by an illustration of a doctor talking to a child. The right outcome, "Currently No Chances For Autism Disorder", is accompanied by an illustration of a doctor talking to a child sitting on a bench.

Fig 5.1 Checklist

Fig 5.2 Behaviour prediction

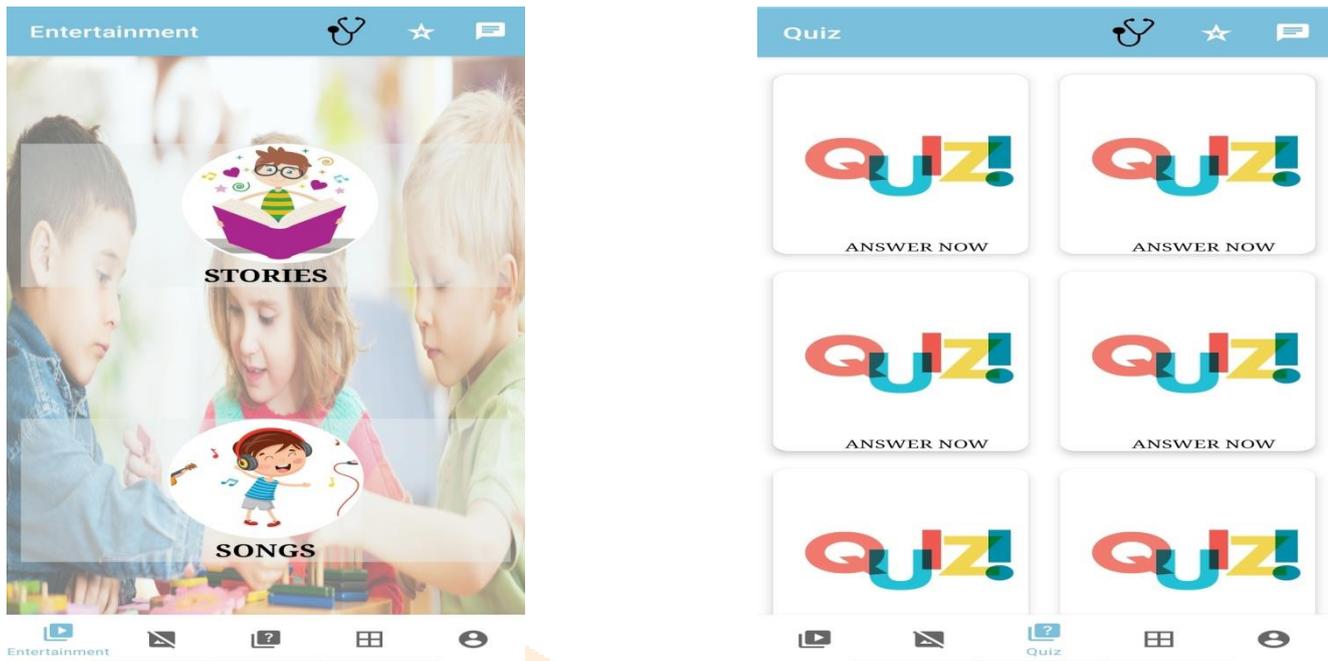


Fig 5.3 Skill Identification and Development

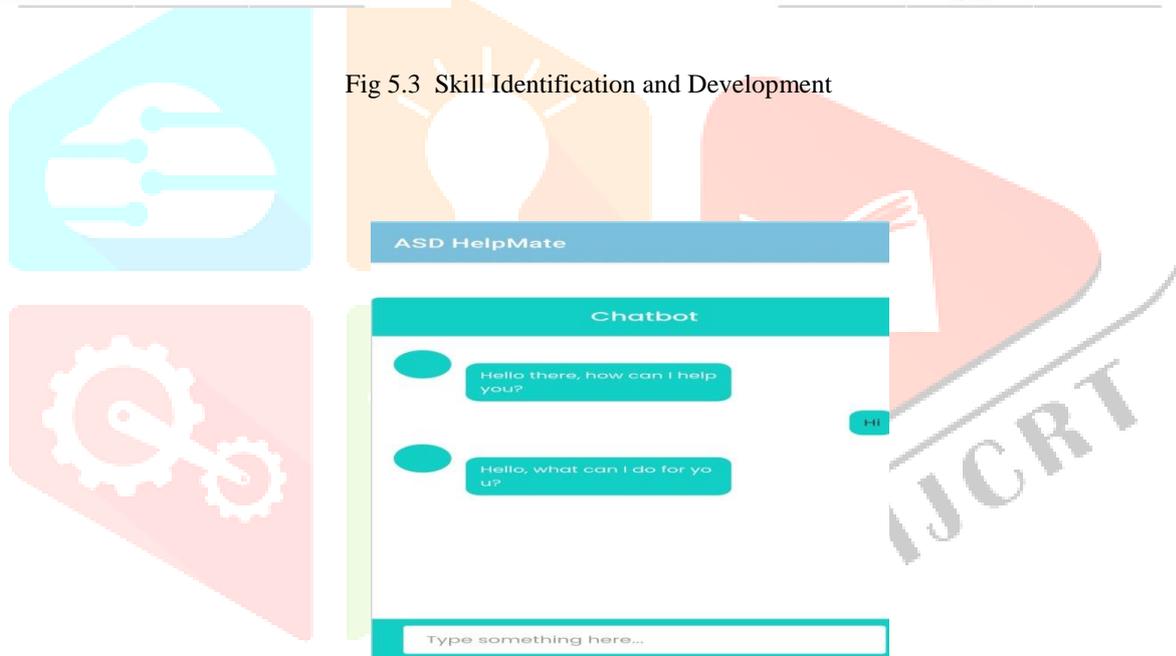


Fig 5.4 Chatbot

The above figures shows the our application. In fig 5.1 here the checklist for the prediction is shown .User can input the answers . In Fig 5.2 The output is displayed . Fig 5.3 depicts skill identification and development .Fig 5.4.Chatbot is shown that provides assistance to the user.

So this application will be an asset in future.By this way we can identify autism spectrum disorder at early stage and thereby decrease the severity of the disease.

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