Emotion based Media Play Back System for Autism Disorder

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Abstract- Children with autism have trouble interacting communally and are more likely to isolate individuals. Many autistic children struggle to learn but basically interested in music activities and respond to that. The proposed research work implements emotion detection in children's with autism spectrum disorders (ASD) using physiological signals, CNN, and music that match their mood. Here we capture real-time images using a webcam, and by using a convolution neural network, the facial emotion can be predicted, and concurrently, a GSR sensor is directly connected to the user for measuring their sweat gland activity. If both the predicted facial emotion and the GSR sensor are happy, then it will play some interesting audio to them using an AT mega microcontroller and mini-player, which will keep them relaxed and help them to learn interactively.

Keywords - Autism spectrum disorder (ASD), Galvanic Skin Response sensor, Facial Expression Recognition (FER), Arduino.

1. INTRODUCTION

For a long time, neurobehavioral disorder symptoms recognized as ASD induced cognitive deficits in communication and social interactions as well as constrained and stereotypical behaviors [1] [2]. Asperger syndrome, autistic disorder, and pervasive developmental disorder not otherwise specified (PDD-NOS) will all be referred to as ASD (PDD-NOS) [3]. ASD prevalence estimates have been estimated to be around 1%, but they are rising quickly. Wider ASD diagnostic criteria, a younger age at diagnosis, rising public consciousness, and external conditions have all been linked to this rise in ASD prevalence [4]. This should limit our understanding to how this disorder affects children's functioning without allowing other confounding factors, like intelligence, to affect this relationship [5].

For kids with autism, music can be a great way to connect and keep people calm. Exploring educational and communication skills via music are fun, secure, and none threatening [6] [7]. Language and speech advancement are aided by music, which can also be used to communicate with others. Emotion detection is the most recent technique that we used to detect facial emotions using various methods such as image processing, physiological signals, and so on [8] [9]. Detecting these emotions is a challenging factor; a small difference in expression may result in different emotions [10]. However, while focusing on specific areas of the face such as the brows and changes in the mouth and face may result in perfect emotions, the

question of how to extract all of these facial gestures remains [11] [12]. Studies on machine learning algorithms show that they are very helpful in classifying and recognising patterns, so they can be used to detect emotions [13] [14].

Here we used to interface emotion recognition with music as the therapy for ASD disorder children's Real time emotions can be classified by CNN and GSR sensor which is used to find emotions with difference in sweat glands and comparing both data the music will played according to the emotion with their preferences [15] [16]. Estes and Munson have described how children with autism spectrum disorder behave and how early intervention and correction are not always effective [17] [18]. Children with autism will not pay attention to the emotional expressions and behavior of other people from an early age [19] [20].

2. MATERIALS AND METHODOLOGY

Utilizing facial image study, emotion detection can identify various body languages. Yahia Said and Mohammad Barr claim that a face-sensitive CNN can be used to identify face images throughout multiple images, and that it can then analyze facial landmarks to forecast expressions for emotion recognition. Ekman and Friesen were the first to perform facial recognition; they divided human feelings into 6 groups: joy, afraid, despair, loathing, shock, and frustration. Differences in the cheeks, nasolabial folds, eyebrow, and mouth are made available by motion of the facial muscles [21] [22]. These movements lead to the expression of various emotions on the face. Here, pre-trained dataset feelings detection karas trained model was used to identify the facial expressions [23] [24].

The functionality of one system was tested using Python 3.5 and Anaconda software, along with the face detection algorithms Viola-Jones and Haar cascade. Similar to this, the performance measures were validated using face recognition and classification using the KDEF (Karolinska Directed Emotional Faces) dataset and the VGG (Visual Geometry Group) 16 model, which was created with an accuracy of 88% [25] [26]. The results, however, demonstrated that the network architecture was more sophisticated than the algorithms in use today. Another system used Python 2.7, the Open-Source Computer Vision Library (OpenCV), the Cohn-Kanade and Extended Cohn-Kanade databases, and provided accuracy of about 83%. Researchers who are looking to prototype and benchmark systems for automatic facial expression detection have described the Extended Cohn-Kanade (CK+) database. Figure 1 shows the main block diagram for image processing and IoT monitoring.

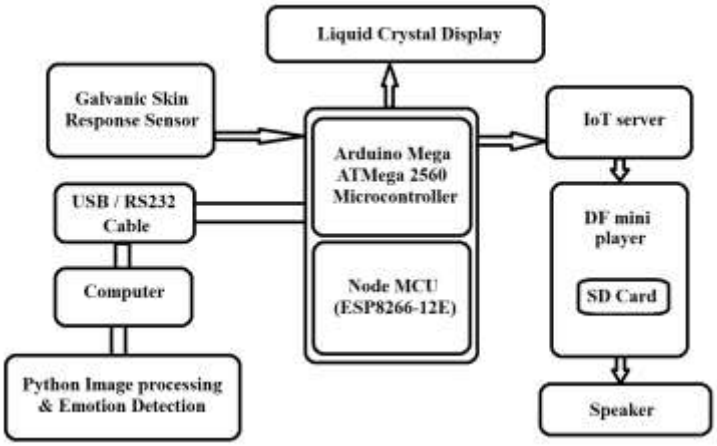

Figure .1 Block diagram of Reaction Image Processing Hardware and Software

The initial Cohn-Kanade dataset is regarded as a very valuable addition to the current corpus due to its prominence and ease of access. A completely automated process requires too much data in order to be reliable for all expressions in a variety of realistic situations, as was also acknowledged. Large, consistently coded datasets across a wide range of visual variations would be required for all of this, as well as joint research from various institutions (at least 5 to 10k examples for each action). Here, we used three software tools: the Arduino IDE, the Python IDE, and Things speak. Arduino IDE is written in C++ and is used for writing and uploading Arduino-compatible applications. Here, we used this for writing and uploading code.

The ATmega2560 serves as the foundation for the microcontroller board known as the Arduino Mega 2560. The Arduino board, which includes a sensor and other components, has 54 digital input/output pins, 16 digital inputs, and 14 PWM outputs. To implement cutting-edge technologies, we used Python, an open source and cross-platform programming language. The main programming language used in this case was Python. It uses Tensor Flow as its Python backend on top of a Keras-powered convolution neural network (CNN).

Figure .2 Emotions from different Autism children

The above figure shows that different emotions which detected from the Autism children. Here, we detect live emotions from six Autism children and songs have been played according to their mood.

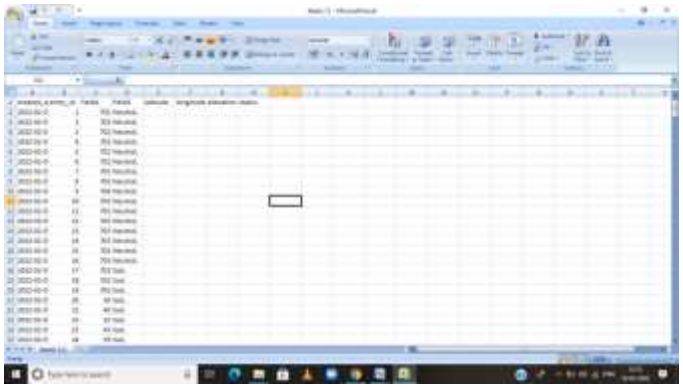

Figure:9 Data downloaded in Excel sheet

The graphical output at the Thing Speak cloud is seen in Fig 5.4 and can be used only after logging in to the Thing Speak website with username and password, and the data can be downloaded as the excel form which seen in fig 9. To measure the emotions in real time we used both image processing and physiological signal. For image processing the real time image got captured by webcam and face detection can be done followed by that facial expression can be predicted. Here, we used hear cascade for human face detection and Convolution neural network (CNN) for easy emotion prediction and pretrained dataset have been used for better result. We tested this system for six Autism children in Rejoice School for Autism and the Developmentally Delayed which located in Kanyakumari and predicted their real time emotions and music has played according to their emotions.

3. RESULTS AND DISCUSSION

Here, we tested for Autism children because the facial emotions will be differ from normal people and autism children. We got better accuracy in Neutral and Happy while in sad it tend to be different. Here the children pretend to be that emotion so we get some variation in that predicted emotions.

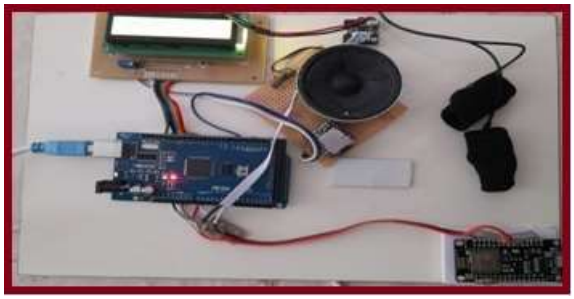

Figure .3 Proposed Hardware Model

The suggested concept's entire hardware is depicted in Figure 6. The hardware consists of the Arduino microcontroller, to which the GSR detector is connected, and the live image detection data that is transferred to the Arduino board at each moment. An LCD is connected to the sensor to view its immediate output. Through the Node MCU-ESP8266 module, data from the Arduino board is sent to the ThingSpeak platform.

Figure .3 Outputs on LCD

In Figure 3, the GSR value and emotion detected from the webcam will be displayed as "happy" or "sad." Here, the maximum emotion detected from the webcam will be displayed. Hence, both the emotions get compared, and if both get the same emotion, music will be played according to that emotion with their respective preferences. Figure 4 shows the GSR plot through the IoT platform Thingspeak.

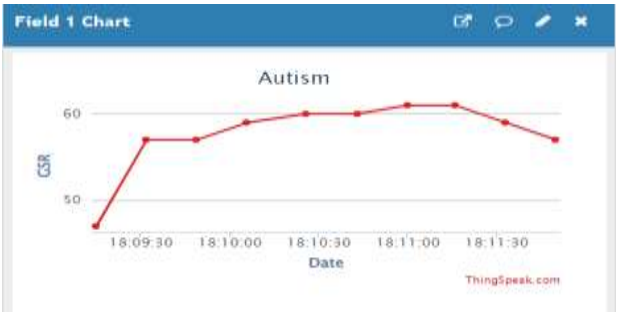

Figure .4 Output obtained on Thing speak

4. CONCLUSION

Autism children find it difficult to communicate their emotions to others, which is why they isolate themselves and are uninterested in learning. This research looked into the possibility of embedding traditional therapy modules into assistive technologies, which is important for helping ASD children learn effectively and reducing therapist workload so they can focus more on the child. In addition, we had the children tested for autism and saved all of the data in the cloud, which can be downloaded as an Excel spreadsheet. Therapists can view data stored in the cloud online, which can assist therapists or practitioners in making treatment plans for the future. The data stored can also be improved by automating graph plotting, making it easier to analyse the trend for each child's progress. Also, we tested the comfort ability of the children when they connected with GSR and got to know they were not facing any discomfort.

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6. CONFLICT OF INTEREST

The seven authors of this paper have no conflict of interest in any means.

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