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Smart Assistance for Asperger Syndrome using Raspberry Pi

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Abstract: ***This paper focuses on autism people who need smart assistance for their everyday survival. One of the most common Autism categories is Asperger syndrome. The motive of this project is to promulgate their tasks efficiently by detecting and recognizing their faces which will be stored in the database using Raspberry Pi.The "Smart Assistant for Asperger Syndrome using Raspberry Pi" involves IoT (Internet of Things) and Robotics. This mirror not only allows the users to plan their daily schedules, but also helps them to be updated with the environment such as weather conditions.***

Keywords: Autism, LBPH, Viola- Jones, face detection, face recognition.

I. INTRODUCTION

Mirror is one particular object that we often use in our house. In current world where everything around us acts smartly, the mirror that we use in our house can also be used smartly with the help of latest technology. Smart Mirror can be used to display basic information like time, date, weather update, compliment message, news, audio, video etc. The main aim of this project is to utilize the mirror to help the children affected by Asperger Syndrome. The Asperger's are the people who have difficulties in social interaction and nonverbal communication. People with Asperger Syndrome doesn't have learning disabilities, but they may have specific learning difficulties. This project is based on intuition that Anything seen through eyes stays strongly with us. Hence this Smart Mirror will help the children's suffering from Asperger syndrome to view their daily tasks and thereby the need for people assisting them in the activities should gradually decrease. This project is developed with the help of a two-way mirror, which acts as a mirror as-well-as a monitor to display the information, Raspberry Pi 3 Model B, OpenCV(Open Source Computer Vision) for face detection and face recognition, SQLite for storing the daily activities of each children.

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II. LITERATURE REVIEW

Whole determination of the project was done with the aid of Raspberry Pi 3 in accordance with the webcam that is utilized for face detection. This smart device displays time, news, weather etc. [1]. This paper deals with a mirror that handles human gestures along with the daily amenities like weather, news and time. The proposed assistant can be extensible for other platforms like phone calls[5].The interactive smart mirror presented here comprising of various functionalities for the surety upon the chronology stating that time isn't wasted unnecessarily. In order to obtain the knowledge of the current affairs, and in supplement to the weight tracker which is utilized for checking if the person is fit and shows the weight on a routine check, data is sent to the mirror via Wi-Fi with the help of standard library GUI module called Tkinter. Health tracking is an added benefit in leading a disease free life. [7]. The smart mirror provides a basis for physically challenged people to update themselves with their daily necessities and to manage their time productively. It also focuses on emotional intelligence with the help of camera. [8].The efficient algorithm for face detection and face recognition is viola-Jones and Local Binary Pattern(LBP) algorithm[16][19].Developmental screening or monitoring analyzes how your child grows and changes over time drastically or if he meets the essential developmental milestones in speaking, behaving and the other to-do activities. However, a misplaced milestone could result in a predicament where the care-taker, doctor or some other specialist would take a closer look or should keep on continuously monitoring the child. This magic mirror works with the help of hardware and software implementations Electron, an application running on Raspberry Pi serves as the purpose along with web application called Angular[18]. The main limitation of the survey is that only single user can use the system and only basic details like time, weather, news, weather forecast and calendar can be displayed. We are developing a multi user system and their daily activities will be displayed

III. PROPOSED SYSTEM

A. Face Detection

There are many techniques to detect user's face with higher frequency. The algorithm was proposed by Viola Jones, which is used to detect objects in an image or video[16][19]. The algorithm consists of a cascade function, which is trained with a lot of positive and negative images. This algorithm has 4 stages:

1. Haar Feature Selection
2. Creating Integral images
3. Ada boost Training
4. Cascading Classifiers

Since the aim is to detect the face, Haar Feature Selection algorithm is used. First, the User's face is captured as colored image through webcam. This is then converted into gray scale image. Next the Haar-Feature Selection detects the location of human face in an image or video. All human faces have similar properties. For example, the eye region is darker than upper cheeks and the nose region is brighter than eye region.

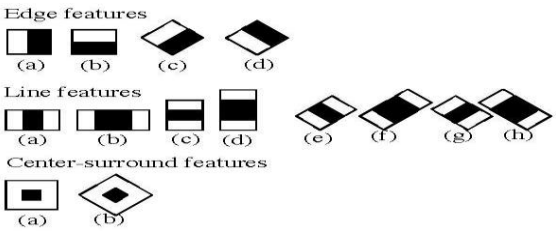

Fig.1.Haar-like features

The Haar-Feature Selection is also used to detect eyes, nose, and mouth with the help of edge detection, line detection and center detection. Now we need to give the x,y,w,h coordinates to make a rectangle box in the picture to show the location of the face. There are also other detection techniques that are used to detect smile, eyes and blink.

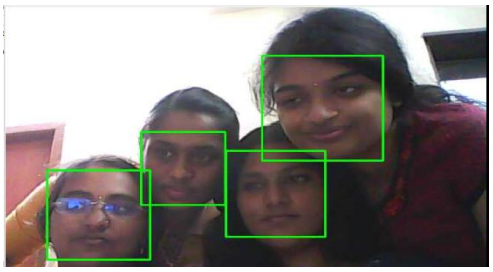

Fig.2. Face Detection

B. Face Recognition

There are different Face Recognition Algorithms for recognizing the faces. Here we use Local Binary Pattern(LBP) Algorithm.LBP algorithm captures the image and splits the image into 3x3 matrix. The matrix consists of intensity of each pixels varying from 0-255. The central value of the matrix is taken as the threshold value. For each neighborhood pixel of the central value(threshold),we set a new binary value. 1 is set for values equal or higher than the threshold value and 0 is set for values lower than the threshold value. The matrix contains only binary values where each position from the matrix line by line into a new binary value.

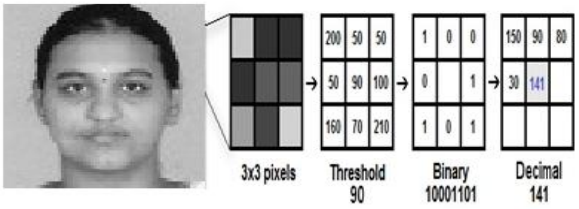

Fig.3. LBP Algorithm

Then we convert this binary value to a decimal value and assign it to the central value of the matrix, which is actually a pixel from the original image. Once the LBP procedure is complete, we have a new image that represents better characteristics than the original image.

IV. METHODOLOGY

The entire system is developed by carrying out 5 different phases:

- Face Detection
- Data Collection
- Train The Recognizer
- Face Recognition
- Display the User's Daily Task

A. System Architecture

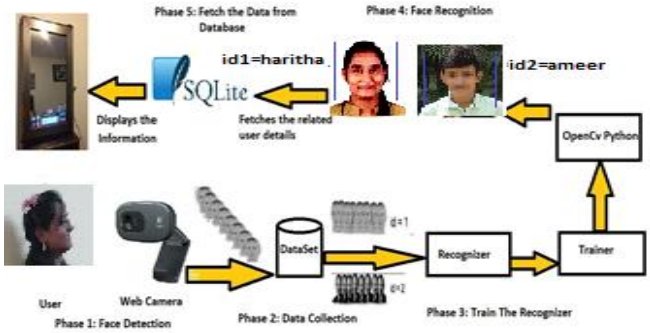

Fig.4. System Architecture

B. Face Detection

In this module, we will detect the face of the user. OpenCV contains pre-trained classifiers for face, eyes, nose, smile etc. The classifier consists of some important parameters like gray, scale Factor, minNeighbors and minSize.

C. Creating a dataset

In this module, we need to create a dataset to store the images of the user. The user has to first enter the ID they need according to their wish and their face is captured in different angles using the webcam and is stored as a gray scale image in the dataset folder.

D. Training the recognizer

In this module, training is done with the created dataset and it will return 2 arrays: Faces and Ids which will act as inputs to train.

E. Face Recognition

In this module, we capture the new face of the user with the help of a web camera. By doing so, the face is recognized.

V. INTERMEDIATE RESULT

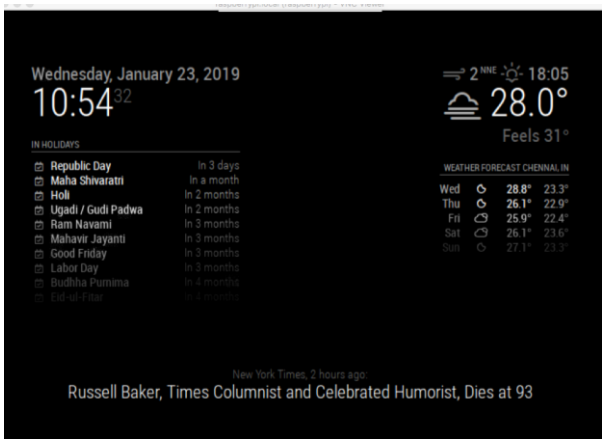

Fig.5. Basic Information

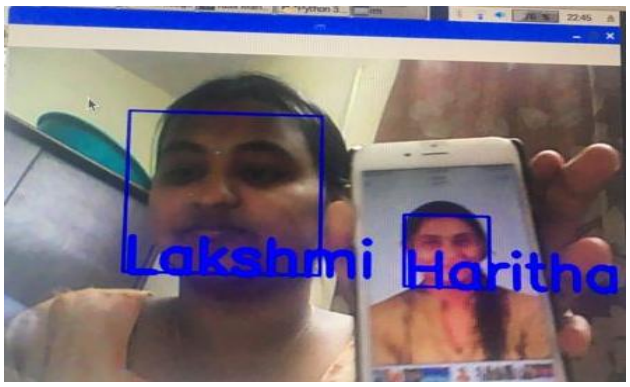

Fig.6. Face Recognition of both the User's

VI. PERFORMANCE EVALUATION

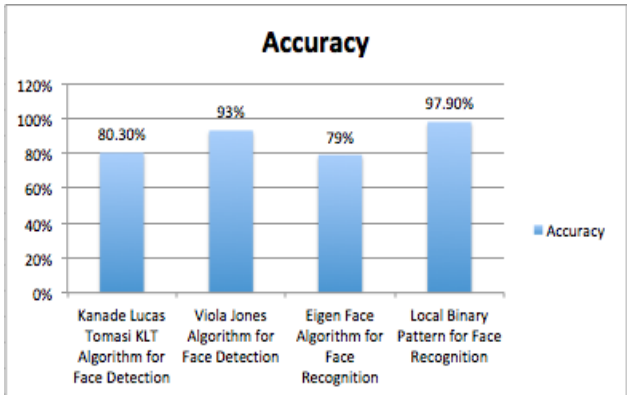

Fig.7. Chart indication the accuracy of different face detection and face recognition algorithm

The Kanade Lucas Tomasi (KLT) Algorithm for face detection gives the accuracy of 80.3% whereas Viola-Jones Algorithm for face detection gives the accuracy of 93%[16]. The Eigen Face Algorithm for Face Recognition gives the accuracy of 79% whereas the Local Binary Pattern (LBP)[19] Algorithm for Face Recognition gives the accuracy of 97.9%. Since the performance of Viola-Jones and LBP Algorithm is higher, we have used this for face detection and face recognition. [16][19]

VII. CONCLUSION

Thus, a smart assistant has been developed for Asperser's that could be used for performing their daily activities without the need for guidance from an elder person. After analyzing the data being fetched with the help of Raspberry pi, it displays their actions to be performed. Identification of face is done with the help of open CV. In future we shall add voice control and other functionalities which will be understandable by autism people without the help of any assistant.

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Dr. S. Kanaga Suba Raja is working as an Associate Professor in Easwari Engineering College. He obtained his Ph.D degree in Computer Science in 2013 from Manonmaniam Sundaranar University, Tirunelveli. He has about 14 years of teaching and research experience. He has successfully guided many graduate and under-graduate students for their research projects. He has several papers published in International journals and conferences to his credit. His current research interests are Wireless Body Area Networks, Ad hoc and Sensor Networks and Mobile and Ubiquitous Computing.

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