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Magic Mirror For Mentally Retarded Person

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Abstract : *Magic mirror is an augmented reality system. Automatic recognition of human facial language having advanced techniques for detection of face, facial expressions, facial emotions and their classifications. Human-machine interface challenges advanced techniques, day by day. This proposed system can be used as smart furniture for mentally retarded person. It includes camera and display device which plays a role of mirror. In this, mentally retarded person come across the mirror (i.e. HD camera and display device), initially it recognizes the person and then its state of mood. With the help of software, it compares the input image with the stored image (database). We proposed a system which helps the doctor/patient's parents to know about the emotional status of that patient, with the help of an algorithm for facial language recognition by using face detection algorithm using viol-john detection algorithm.*
Keywords: *Human-machine interface system, human facial language recognition system. Face detection from viol-john detection algorithm, Global System for Mobile communication (GSM).*

I. Introduction

Mirror is nothing but an object that reflects the incident light i.e. it shows the object view in mirror image. Mirrors are commonly used at furniture, decoration purpose, etc. also for scientific use like in telescope, microscope, laser, etc. Magic mirror is a mystical object, used in fairytales as in snow white.

In this paper, we proposed a system, used as smart furniture for mentally retarded person. In this, when person come across the mirror (camera and display device), it detects the person. Software identifies the patient, and facial expressions are detected by face detection algorithm. Hardware sends information about patient's mood/facial language through SMS. Facial emotion/expression is nothing but movement of muscles beneath the skin, which results into facial expression. As explained in [1], to simplify the problems related to human emotions, different methodologies like optical flow, neural network process, active appearance model, hidden Markov model etc. can use. As in [2], unlike the magic mirror in fairytale, system tries to alleviate the person's bad mood by providing music therapy. In this proposed system patient's state of mood is detected and informed to doctor/ patient's parents. Hence named 'Magic Mirror: for Mentally Retarded Person'.

Rest of the paper is organized as follows. Section 2 contains related work. Section 3 shows the prototype of proposed work. Section 4 experimental setup and results. Project is concluded in section 5.

II. Related Work

Brief review of proposed system is as follows.

A. Identify Patient:

Identity recognition is the first step for emotion recognition [2]. The system equipped with embedded network computers, input/output devices, sensors etc. used as smart furniture [2], [3]. It provides better home life [3], getting emotional satisfaction, and getting relive from breakdown from their daily routine [4]. Design of proposed system is almost fixed. Demand of time [4] forces the patents parents to compromise about activities towards the patient. Control [4] over the patient from remote place is possible because of this smart system. Facial expression is most powerful and natural way for human beings to communicate their emotions and intensions [5].

B. Facial Expression Recognition:

Automatic facial expression recognition system [5], [6], [7], [8], [9], [10] recognizes set of prototypic expressions such as anger, fear, happiness etc. Human emotions are communicated by changes in one or more discrete facial features [5]. Psychological research argues that temporal dynamics of facial behavior includes timing and duration of facial activities becomes a critical factor for interpretation of observed behavior [6]. Automatic analysis of facial expressions is highly beneficial for the fields as diverse as behavioral science, psychology, medicine, security, and education and computer science. Such wide applications produce interest in human-machine interaction through machine analysis [7]. Active apparatus model [7] implementation creates fully automatic model of a face depicted in an image [8].

III. Prototype Of Proposed System

The proposed system includes some hardware and some software components. The applied techniques with these components are briefly described as below.

A. Overview of proposed system:

Fig 1 is the prototype of proposed system. The high definition camera is mounted over the mirror display. Camera is connected to computer through the USB connector. PIC 16F877a microcontroller conveys the information in to and fro manner to computer. GSM helps to send the message, connected to PIC through max 232 communication wires.

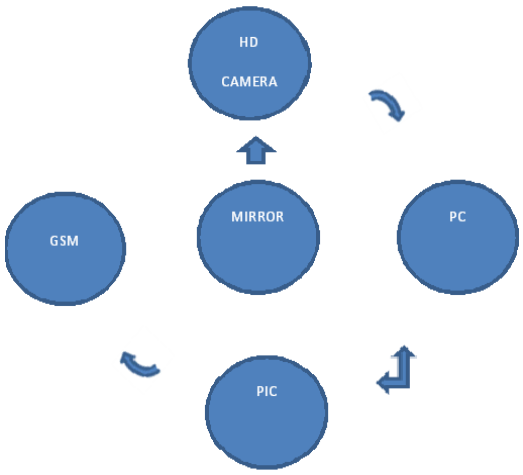

Fig: Prototype of Proposed System.

The proposed system operates on two different modes

a. Mirror Mode:

When system is in mirror mode camera captures the person's facial expression. System analyses the identity of person in front of the camera.

b. SMS Mode:

When camera identifies the patient by comparing captured image with image data base, then send SMS to doctor/parent.

When that person is not patient, then sends SMS as 'not a patient'.

B. Viola John face detection algorithm:

Object detection and tracking are important in many computer vision applications including activity recognition, automotive safety, and surveillance. In this example, you will develop a simple face tracking system by dividing the tracking problem into three parts:

1. Detect a face
2. Identify facial features to track
3. Track the face

First, you must detect the face. Use the vision.CascadeObjectDetector System object to detect the location of a face in a video frame. The cascade object detector uses the Viola-Jones detection algorithm and a trained classification model for detection. By default, the detector is configured to detect faces, but it can be used to detect other types of objects.

```
% Create a cascade detector object.
faceDetector = vision.CascadeObjectDetector();

% Read a video frame and run the face detector.
videoFileReader = vision.VideoFileReader('tilted_face.avi');
videoFrame      = step(videoFileReader);
bbox            = step(faceDetector, videoFrame);

% Convert the first box to a polygon.
% This is needed to be able to visualize the rotation of the object.
x = bbox(1, 1); y = bbox(1, 2); w = bbox(1, 3); h = bbox(1, 4);
```

```
bboxPolygon = [x, y, x+w, y, x+w, y+h, x, y+h];

% Draw the returned bounding box around the detected face.
videoFrame = insertShape(videoFrame, 'Polygon', bboxPolygon);
figure; imshow(videoFrame); title('Detected face');
```

C. Operation of proposed system:

- When person come in front of the mirror, camera mounted there captures the facial image.
- The image captured by HD camera is getting compared with the image stored in data base.
- If image matches, then mentally retarded person is identified by computer.
- This facial expression is compared with the facial expression images stored in data base. And identifies the state of mood.
- Accordingly patients parent/ doctor are getting informed by sending SMS to them, and they can provide medical facilities if needed.
- If image do not matches, then that person is not a patient.

IV. Conclusion

In this paper, we proposed a magic mirror which determines the patient's emotional status through the analysis of his/ her facial expression. The method used in this project shows the combination of virtual image and real time image. In future work, we will attempt to add audio visual techniques, reminder about doctor patient visit and to increase the module potential for wide applications.

V. Acknowledgements

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VI. Results Of Proposed System

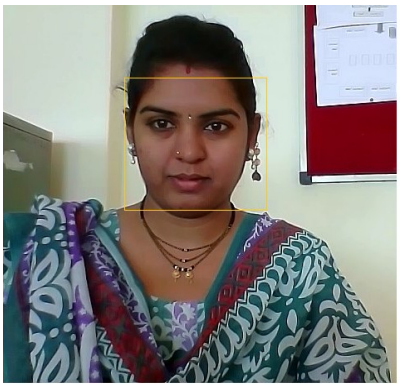

Fig 2: Detected face

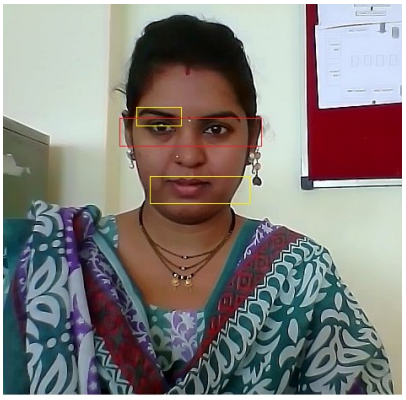

Fig 3: Facial expression detection

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