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Enchantment Mirror Table for Social-Emotion Comfort in the Smart Home

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Abstract —smart furniture for the smart home a magic mirror table. A magic mirror paradigm is an augmented reality (AR) system where a camera and display device act as a mirror where one can see a reflection of oneself and virtual objects together. The proposed system has a camera to capture the viewer's facial expression. By analyzing the expressions, the system is able to determine the emotion of the viewer. If the viewer is in a negative emotion, the system then speaks positive sentences and plays the viewer's favorite music to alleviate his/her emotion. The experimental results confirm that the system is able to relieve the sad mood of the viewer. In addition, the proposed system can serve as a calendar for event reminding. Hardware like USB Web Cam (8 MP or higher) & Computer System are used for this project. There are three modes in this system that is mirror mode, alleviation mode, silent mode, reminder mode.

Keywords-Social emotion, alleviative effect, magic mirror, facial expression, emotional classification, Augmented Reality.

I. INTRODUCTION

Everyone sometimes has a bad mood. If he/she hears encouragement statements, such as "Don't worry, things canonly get better" or "Oh dear, I know you tried your best" said by the voice from his/her parents or friends along with his/her favourite music, he/she may feel better. For this purpose, we propose a mirror table system which is able to aware the social emotion of the viewer. Unlike the magic mirror in the fairytale story to say the most beautiful lady in the world, the proposed mirror system try to alleviate the home member's bad mood by providing positive statements and music therapy. In terms of implementation, A magic mirror paradigm is an augmented reality (AR) system where a camera and display device act as a mirror where one can see a reflection of oneself & virtual objects together. The causes of depression is increased stress, lonely lives and the falling apart of the social support systems like joint families. Nuclear families & busy schedules of family members also causes depression. Remedy over this all depression is contact a family member or friend create support network of friends & co-workers & talk out openly.

The proposed system has a high resolution camera to capture the viewer's facial expression. By analysis of expressions emotions of a person can be determined. If the viewer is in negative emotion, system speaks positive sentences & plays the viewer's favorite music to alleviate his/her emotion. The proposed system can serve as a calendar for event reminding. Thus, in a broad sense, the proposed mirror system provides a social relationship between the viewer and the mirror. The music therapy is given along with the building of positive system. Music therapy is the clinically proved therapy for physical and psychological treatment effects. The mirror system tries to alleviate the home member's bad mood by providing positive statements and music therapy. Variability of heart rate can be used for evaluating the effects of music therapy on anxiety reduction. Home does not value efficiency in the same way that business does, instead home favours lifestyle, aspirations, emotions, and aesthetics. Likewise, our design concept is to build the system integrated with human social facts. This work demonstrates the considerable possibility on the development of socially awareness device. The average lifetime rates of depression, according to the study, were found to be 14.6 per cent in ten high income countries, and 11.1 percent in eight low to middle income countries. But lifetime incidents of what was identified as Major Depressive Episodes (MDE), were highest among Indians at 35.9 percent, while china was at the lowest at 12 percent. Minor depression in older adults- feelings of helplessness or a loss of pleasure in life that doesn't rise to the threshold of major depression-is also a significant concern and should not be overlooked, Lebowitz said. Up to 20 percent of older adults are thought to have "sub-threshold" depression; this raises their chance of developing major depression by almost 30 percent. As there is no clear dividing line between office and home life, life has become more stressed. Today's world of technology is a mixed blessing. It's easier and faster to work with mobiles and laptops but difficult to deal with the problems of occupational stress. With many workplaces downsizing, there is more expectation that fewer employees/workers must do work, thus the problem is becoming severe health hazard. Besides spending long hours in an office, also bring home their office work & do late sitting work in house as well. MDE is characterized by sadness, loss of interest or pleasure, feelings of guilt or low self worth, disturbed sleep or appetite, low energy and poor concentration, besides feeling depressed.

Lowest prevalence of MDE was in China (12%). The average age of depression in India is 32 years China is 18.8 years, and US is 22.7 years. The causes of depression is Increased stress, lonely lives and the falling apart of the social support systems like joint families is a major cause of growing depression among Indians. Remedy over this all depression is:

- Contact a family member or friend.
- Create support network of friends and coworkers and talk out openly.

Objective of this project is to recognize the mood of a person & to give them support as a digital friend. Nowadays, because of over hectic schedules people don't have friends to share their feelings & so this project gives a reliable friend that will motivate you, keeps you always happy. Social signals reveal individual emotions toward of a person by facial expressions, vocal intonations and outbursts, body gestures and postures, etc. However, we only focus the research scope in the facial expression for the purpose of simplifying the problem.

II. RELATED WORK

Since our system is based on several existing techniques, we briefly review the related work as follows.

A. Identity Recognition:

The identity recognition is the pre-processing step before emotion recognition. Multiple detection techniques, such as Bluetooth [2], RFID, and natural interaction [3], all allow us to identify the user (viewer). Natural interaction uses face and voice recognition techniques to imitate the human senses for automatic identification of users. In our case, we use face recognition to identify the user.

B. Facial Expression Recognition:

Facial expressions play a very important role in human social interaction, which reveals our attention, response the Dialogue, and expresses signal about agreement or disagreement [4]. In our case, we use the facial-expression to Recognize six basic emotions, namely, fear, sadness, happiness, anger, disgust, and surprise. A facial-expression recognition system [4], [5], [6] analyzes the motion and the appearance of facial features for classifying the expression into predefined emotion categories. Currently, most existing methods extract facial features from Geometric features such as the shapes of the facial components (eyes, mouth, etc.) and the locations of facial fiducial points (corners of the eyes, mouth, etc.) or appearance features (wrinkles, bulges, and furrows, etc.) [3]. Social emotion can then be detected by facial expressions. The detection of facial expression is achieved through various methods such as optical flow, hidden Markov model, neural networks, and active appearance model [3]-[8].In terms of applications of facial recognition, Kwang et al.[9] present a novel architecture for future interactive TV, Which is able to perform face detection, face recognition, and facial expression recognition. They point out that facial expression recognition is an important part for automatic feedback of information about the viewer's internal emotional state, intention, or social communication. The facial recognition system is also available for smart Phones. As reported by Terzis, et al. [10], their system can achieve a success rate of 89 % to recognize six basic emotions (happy, angry, sad, surprised, scared, and disgusted) plus neutral based on facial expressions.

C. Alleviative Effects:

Based on the valence-arousal (V-A) mood plane [11], human affective response or state can be represented with valence and arousal coordinates. Valence is typically characterized as the feeling of a person from pleasant or positive to unpleasant or negative. Arousal is the activation of the emotion. Music therapy is a clinical practice that lets the client hear and touch to sense music in order to achieve physical and psychological treatment effects [12]. As [13] indicates, "Familiar Songs Method" is effective enough to improve the arousal level of senile dementia. Another case of music therapy treatment is applied to hypertensive Patients [14].Variability of heart rate can be used for evaluating the effects of music therapy on anxiety reduction of patients [15].The study of Cheng et al. [16] confirms that music therapy on patients with dental anxiety can obviously relieve patients' symptoms and dreadful emotion. They also point out that different types of music should be chosen for different groups of people. Affective computing is the technology about using systems and devices to recognize, interpret, process, and simulate individual emotions. However, individual emotions and social emotions are different. Happiness and sadness are individual emotions on their own; their feelings are not directed to any other person or agent. In contrast, empathy, admiration, envy, and compassion are typical examples of social emotions we have these feelings toward another person or agent. Social emotion can be detected by facial expressions. Using video detecting have been the predominant methods in measuring facial expressions. Facial expression is achieved through various methods such as optical flow, hidden Markov model, and neural network processing and active appearance model. For example, the Face Reader recognizes facial expressions by distinguishing six basic emotions (happy, angry, sad, surprised, scared, disgusted), plus neutral. Also, some researches combined with multi-modalities to achieve a more robust analysis of the subject's emotional state. Positive word inspiration, alleviating negative emotions, and affairs reminding is done through optical flow, hidden Markov model, neural network processing and active appearance model by Yuan-Chih Yu, Shing-chern D. You1, and Dwen-Ren Tsai2 in 2012.

III. SYSTEM DESIGN FOR MAGIC MIRROR TABLE

The proposed system includes several hardware and software components. The following briefly describe these Components with the applied techniques.

A. Overview of the Proposed System & methodology:

Fig. 1 is the prototype of the proposed minor system. The mirror itself is an LCD monitor mounted with a one-way Mirror in front of the monitor. If the monitor turns off, the one-way mirror acts as a regular mirror. On the other hand, if the monitor turns on, the mirror is transparent for viewers to see the screen of the monitor. The power of the monitor is controlled by the system based on the state of the operation. On top of the monitor is a camera for detecting the emotion of the viewer based on his/her facial expression. To guarantee sufficient lighting for the camera, the system also controls an LED light source. The system connects to speaker(s) by an USB control box. The control box also connects to motion sensors and the LED light source. The system controller is a
Computer mounted on the base of the mirror (and monitor). The speakers are typically placed on both sides of the mirror base. The proposed system operates in four different modes, as described below.

(1) Mirror mode: When the system is in this mode, its primary function is to act as a mirror. In the meantime, However, the camera captures the user's facial expression. The system then analyzes the identity of the user and his/her facial expression. Based on the analysis, the system may enter to the alleviation mode. Alternatively, the user may choose the reminder mode to view the planned calendar.

(2) Alleviation mode: When the system is in this mode, suitable text messages are displayed on the LCD monitor for the user to view. In addition, a voice message followed by background music is played through the speakers

(3) Reminder mode: When the system is in this mode, the monitor shows the text message with a voice message to signal the user of the present mode. In this mode, the user can manage his/her personal calendar to check for any future events. When done, the user can exit this mode so that system may enter the mirror mode again.

(4) Silent mode: The system is in this mode if it is in the initialization phase or the user is out of the operation range. When in this mode, the camera does not capture pictures and the LCD monitor always turns off.

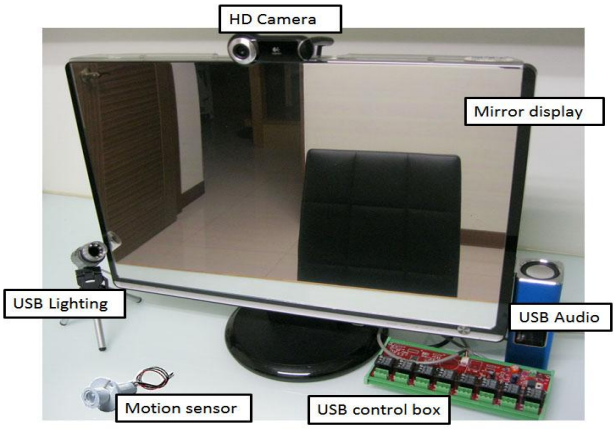


Fig. 1. The prototype of the proposed system.

B. Detection of the Presence of the Viewer:

In a typical house, the space is divided by room walls. Therefore, it is easy to detect the distance between the viewer and the mirror. To simplify the design, instead of distance measuring sensor, we deploy the motion sensors on the entry or main pathway of the room, as shown in Fig. 2. If the sensor close to the room door detects a body motion, the system leaves the silent mode and enters the mirror mode. Such a design simplifies the problem of detecting the n viewer and gives the system additional time for mode transition or main pathway of the room, as shown in Fig. 2. If the sensor close to the room door detects a body motion, the system leaves the silent mode and enters the mirror mode. Such a design simplifies the problem of detecting the viewer and gives the system additional time for mode transition.

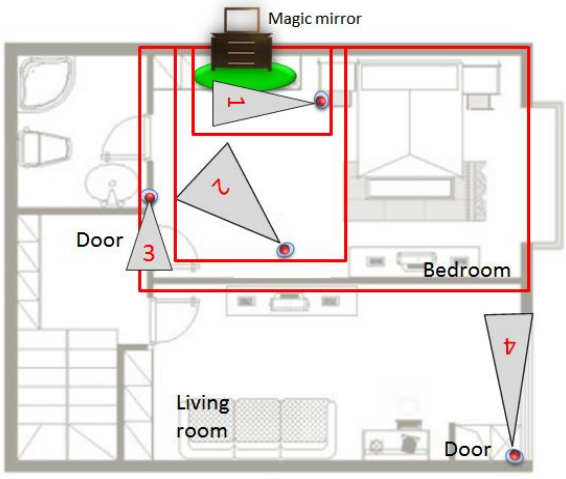


Fig. 2. The deployment of motion Sensors for detecting the presence of the viewer.

C. Operation of the Proposed System:

- The basic operations of the system are outlined below: When a viewer walks into the room, the motion sensor detects the motion. Then, the system enters the mirror mode.
- The digital camera begins to capture the image sequences. The system uses features extracted from the face of the viewer to find his/her identify. Based on the identity information, the system fetches the emotional profile of the viewer for emotion classification in the next step.
- If the identity is identified, the system checks each frame of image sequences for facial emotion recognition. The detailed method is given in the next subsection. If the emotion belongs to negative, the system calculates the temporal emotion energy. When the accumulated energy is greater than a threshold, the system switches to the alleviation mode.
- The alleviating mode consists of several steps. First, emotionally supporting sentences are selected from the database based on the personal profiles. For example, a sentence such as "Don't worry, things will get better" may be displayed on the mirror (monitor) and simultaneously read out from the speakers. Then, the system plays favorite background music about sunshine. For such a mechanism, the database for positive words (sentences) is built in advance. Similarly, the database of background music is also collected and selected by the individual user before the actual operation of the system.
- The combination of the voice and music usually begins with fade-in background music. Then, the voice of positive words (sentences). Finally, the background music only. In a typical case, the background music often lasts for several minutes.
- In addition to the alleviation mode, the system can be operated as an event reminder. When in this mode, the system checks all planned schedule to determine whether a reminder message should be provided or not. If so, the system displays a message and reads the message with a voice. If necessary, the user may instruct the system to switch to the reminder mode. Then, the monitor can display today's To-do-list and event calendar.
- The operation of the reminder mode is similar to that given in the home calendar service [17] proposed by the authors. The snapshot of the schedule interface is shown in Fig. 3. To use the calendar, the user drags and drops a time slot on the screen to schedule the selected event. To check the calendar, the user clicks a time slot to check the event.

D. Social Emotion Recognition:

In the proposed system, a high resolution digital camera(Full HD 1080p video recording) is mounted on top of the mirror to capture the sequence of face images. Following the approached proposed by [5], we use the head-tracking algorithm to find the bounding box of the face. The detailed contour of the face is obtained inside the face box by the skin color blob detector with convex region calculation. The detector detects and clusters the pixels of the face based on the *YCbCr* color space. As [18] proposed, we also use the elliptical model for skin-color modeling. The pixels are calculated by a model function. For each pixel with *Y, Cb,* and *Cr* components, we calculate its intermediate values (*x, y*) using the following equation (*Y* component is not used):

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} cos\theta & sin\theta \\ -sin\theta & cos\theta \end{bmatrix} \begin{bmatrix} C_b - C_x \\ C_r - c_y \end{bmatrix} \quad (1)$$

Where C_x=109.38 , C_Y =152.02, and Θ =2.53. A pixel is considered as a skin pixel to be clustered together to form a Skin blob if it satisfies the following constraint:

$$\frac{(x-eC_x)}{a^2} + \frac{(y-eC_Y)}{b^2} < 1 \quad (2)$$

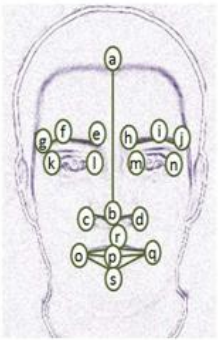
Where eC_x=1.60,eC_Y==2.41, a =25.39, and b =14.03, Finally, skin blobs fuse together to form a convex face area. After the face area is determined, the facial features can be detected based on the point-based face model and anatomy algorithm [8]. We extracted geometric features of the face such as eyes, mouth, nose, corners of the eyes, mouth shape, etc. These features are related to facial expression in a temporal consequence. In our prototype system, the front view face model is composed of 12 features from a set of 19 facial points, as shown in Fig. 4. Because our system is used in real time, we use fewer facial points and features to reduce the complexity of the algorithm. The recognition rate can be improved with more features and training data.

To recognize the emotion of the viewer based on the facial expression, we use a back-propagation neural network (BPNN) [19] as the classifier to identify six basic emotions (happy, angry, sad, surprised, scared, and disgusted). In the home environment, however, the service of magic mirror is only for home members. Therefore, each home member has his/her dedicated neural network for performance consideration. Each network had 12 input nodes, with each corresponding to the 12 input facial features. The output layer contains 7 nodes (six emotions plus neutral) to represent different emotion categories. There are one hidden layers and the number of hidden nodes is 14, 28, or 35.

Other factors affecting the recognition performance are learning rate α, momentum value λ, and the parameter σ, in the activation function. In the training process, different numbers of neurons (14,28, or 35) in the hidden layers are used. The values of α, λ, and σ, are also experimentally determined with repeated training. The error criterion is set at 1*10-9 and the maximum number of epochs used for training varies from 160 to 1100. The facial features are normalized against the viewer's distance and angle to the mirror or angle before sent to the neural network.

Fig. 3. The home calendar in the reminder mode

Hyperbolic tangent sigmoid (TanSig) and logarithmic sigmoid (LogSig) functions are used for the hidden-layer neurons and output neurons, respectively. At the output neuron, an output of 0.6 or higher is set to 1, otherwise set to zero.
For the training data, each home member is taken 30 pictures of his/her front view with different emotions. The size of the images is 640 *480 pixels with 24-bit color intensity encoding. For better training performance, we manually remove unqualified images.



Feature	description
f1/f2	Angle gfe, hij
f3/f4	Angle kle, hmn
f5	Distance ab
f6	Angle cbd
f7/f8/f9	Angle orq, osq, opq
f10	Distance oq
f11	Distance eh
f12	Distance (ko/nq)

Fig. 4. The facial features for social emotion classification.

E. Calculation of Temporal Emotion Energy

In our system, we define sad, scared, and disgusted as negative emotion. Since we have a sequence of images, we define the temporal emotion energy as the accumulation of temporal change of emotion. When the accumulated negative energy is greater than a threshold, the system goes into the alleviation mode. The threshold is experimentally determined and may be fine-tuned by the viewer's historical data The temporal emotion energy is calculated as follows. Firstly, we give each emotion a value *e*. The mapping we use
in the experiment is: happy = +3 surprised = +2, angry = +1,scared = -1, disgusted = -2, and sad = -3. Then the temporal emotion energy *N*(*k*) for frame *k* is calculated as,

$$N\,(k) = -\sum_{i=0}^{N-1} e\,(k-N+i)\;.D\,(i)$$

where *N* is the length of the sliding window and

$$D\,(i) = S_y\,\left(1-e^{\lambda i S x}\right)$$

.is a weighting function to give larger weights for recent emotion values. In (4), λ > 0 is a parameter to control the Temporal decay, S_x and S_y are the scale factors of descending curves on x-axis and y-axis, respectively. In our experiment, we use *N* = 75 (for NTSC video system) ,λ =1.05, S_x =5/*N and* S_y = 0.7 *threshold.

F. The Alleviation Treatment

Positive words can bring positive thinking, uplift your mood, and inspire your life. The magic mirror table is C_V designed for doing this job. When the viewer has a negative emotion, the magic mirror can give you positive words to alleviate the viewer's negative emotions. In addition, we also use music for alleviation as the music therapy has been clinically proven to be effective. In our system, a positive words dictionary is built in advance. Then, the system can select sentences from the dictionary according to the detected emotion type and the viewer's preference. In the meantime, the background music is also selected according to the detected emotion type and the viewer's favorite music style.

G. Methodology

The mirror is itself a LCD monitor mounted with one way mirror in front of monitor. When monitor turns off it will act as a regular mirror. If the monitor turns on viewer can see the screen of the monitor. On top of monitor high resolution HD camera is mounted, that detects the face of the family member. After detection, emotion of the person is recognized. To give the sufficient lighting LED lighting source is also available. The system connects to motion sensors and the LED light source. The system connects to speaker by an USB control box.

- OPERATING MODE :

1. Mirror mode: Main function is to act as a mirror. Mirror analyses the expressions and detects the emotion of the person.
2. Alleviation mode: Suitable text messages are displayed on the LCD monitor for the user to view. In addition 3D objects are rendered on the screen, favorite and suitable music is played in background.
3. Reminder mode: Monitor shows the text message with a voice message to signal the user of the present mode.
4. Silent mode: When in this mode, the camera does not capture pictures and the LCD monitor always turns off.

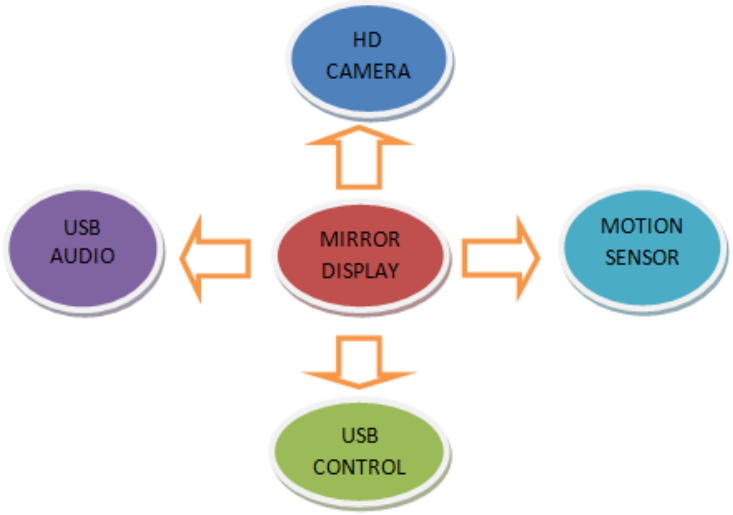


Fig 5. Prototype of proposed system

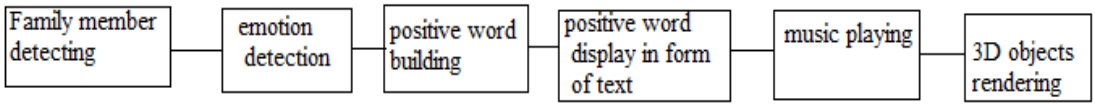


Fig 6. social emotion awareness process

- TECHNOLOGY :

When a viewer walks into the room, the motion sensor detects the motion. The digital camera begins to capture the image sequences. The system fetches the emotional profile of the viewer for emotion classification in the next step. If the emotion belongs to negative, the system calculates the temporal emotion energy. When the accumulated energy is greater than a threshold, the system switches to the alleviation mode. First, emotionally supporting sentences are selected from the database based on the personal profiles. Then, the system plays favorite background music.

- AR TECHNOLOGY :

Computer vision renders 3D virtual objects from the same viewpoint from which the images of the real scene are being taken by tracking cameras. These methods usually consist of two stages: tracking and reconstructing/recognizing. optical images, or interest points are detected in the camera images. Tracking can make use of feature detection, edge detection, or other image process methods to interpret the camera images Types of tracking: feature-based and model-based tracking. Once a connection is made between the 2D image and 3D world frame, it is possible to find the camera pose by projecting the 3D coordinates of the feature into the observed 2D image coordinates and by minimizing the distance to their corresponding 2D features. [4]

Let pi be the set of 3D non collinear points in the world.

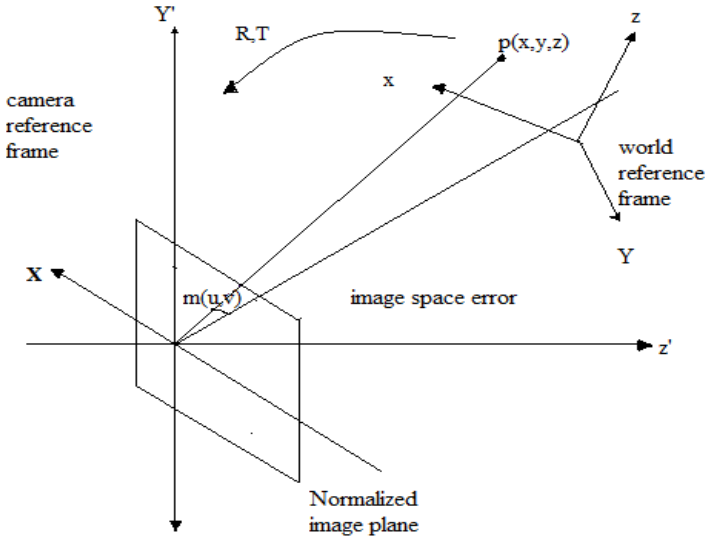
$$q_i = Rp_i + T$$

$$\text{where } R = \begin{pmatrix} r_1^T \\ r_2^T \\ r_3^T \end{pmatrix} \text{ and } T = \begin{pmatrix} t_x \\ t_y \\ t_z \end{pmatrix}$$

The image space error gives the correlation between 3D reference points, their corresponded 2D extracted image reference points, camera pose parameter.

$$E_i^p = \sqrt{\left(\hat{u}_i - \frac{r_1^T p_i + t_x}{r_3^T p_i + t_z}\right)^2 + \left(\hat{v}_i - \frac{r_2^T p_i + t_y}{r_3^T p_i + t_z}\right)^2}$$

T



- EMOTION DETECTION TECHNIQUE :

In emotion detection technique, gray scaling is done gray scaling is range of shades of gray without apparent color. Darkest shade is black without apparent color that is absence of reflected light. scaling is resizing of the image and clip the face from image. Face detection and eye detection is done using HAAR algorithm. Then from the outline of the eyes and lips emotion of the person is detected. E.

- TECHNOLOGY FOR AUGMENTED 3D OBJECT :

Gray scaling is done. Edges are determined from the image. Binary conversion of the image is done. Image is divided into 25 square blocks. Co ordinates of the object are measured. Object is rendered accordingly on the glyph. The glyph is nothing but the symbol on which the object is rendered. Glyph is 5*5 black box, divided into 25 equal boxes. When the pattern of the glyph is recognized, the decided object is rendered on that glyph.

IV. EXPERIMENTS AND RESULTS

Before conducting the experiments, we need to think how to evaluate the effect of alleviation. In the literature [8], both subjective measures (self-reports) and physiological data (skin conductance and heart rate) are used to assess affective responses. For physiological data, heart rate is a reliable index for valence change, whereas skin conductance is associated with arousal. In our experiment, we only use the change of heart rate as the mean to evaluate the alleviation effect. Positive emotion causes the heart rate to accelerate, whereas negative emotion causes the heart rate to slow down [14]. When the heart rate accelerates, it means that the viewer recovers from a negative emotion. Following the convention of most psychological measures, we divide the alleviation effect into five degrees based on the change of the heart rate. For this reason, the heart rate of each home member has been repeatedly measured to obtain the personal distribution of heart rate before using the magic mirror. The distribution is used to map to the five levels of alleviation. In our case, a heart rate in the range between 0.5 and 1.0 standard deviation above average is mapped to level one, between 1.0 and 1.5 standard deviations is mapped to level two, and so on. In the experiment, we do not use self-report to evaluate the alleviation effect. The viewer's report is only used to calculate the correctness rate of the emotion recognition algorithm in the proposed system. In the experiment, if the viewer has a negative emotion, the proposed system then delivers the alleviation treatment, and the degree of alleviation is evaluated. The experiments are conducted as follows. We select a family of four people to test the proposed system. The personal emotion profile for each person is measured in advance. For this family, six emotions are tested 30 times. The success rate of emotion detection and the degree of alleviations are recorded. The difficult part of the experiment is that the emotion cannot follow one's inclinations. If the emotion comes from acting, the results may not represent the actual situation in reality. In our case, we use the self-report to determine the real mood of the viewer.

The experimental results are shown in table I. The results show that angry and sad emotions are much easier to express and to detect, therefore higher success rates. The table also shows that the sad emotion can be effectively alleviated. The results also indicate that positive emotions are significantly easier to detect, particularly with the facial expression. Although the correct rate of our emotion recognition algorithm is not very high, the system nevertheless shows some positive results in emotion alleviation. The correct rate can be further improved with more features and with a larger training set, especially a training set containing historical behavioral data. In the experiment, we use heart rate to represent the alleviation effect. In the future development, the heart rate may be replaced with other physical features such as muscle neural voltage, EGG, skin EKG, and so on. Certainly, more evidences should be collected to support the relationship between physical features and emotion.

V. CONCLUSION

In this paper, we propose a magic mirror system which is able to determine the viewer's emotion through the analysis of his/her facial expressions. The results of scenario-based evaluation confirm that the proposed mirror system is

able to alleviate the viewer's emotion when he/she is in sad mood. With the proposed system, we demonstrate the feasibility of developing a piece of socially-awarded furniture (smart furniture). For the smart furniture, it may engage into a home member's social network and share his/her feeling. In the present design, the emotion of the viewer is determined solely by analyzing his/her facial expressions. However, social signals revealing the emotion of a person include facial expressions, vocal utterance, body gestures and postures, and so on. In the further, the emotion awareness can be extended into multi-modalities analysis to incorporate the above mentioned social signals. Nevertheless, the proposed system is a meaningful starting point toward a more sophisticated human machine interaction (HCI) system.

TABLE I SCENARIOS-BASED EVALUATION

Social emotion	**Success rate of Emotion detection**	**Degree of $alleviation^a$**
Happy	22/30	$-\ -\ -\ -\ -^b$
Angry	23/30	✔✔
Sad	12/30	✔✔✔✔✔
Surprised	14/30	✔
Scared	9/30	✔✔
Disgusted	10/30	✔✔✔✔

$a_{five\ levels\ of\ degree}$; $b_{no\ alleviation\ \ needed}$

This investigation integrates image/speech processing technology. The proposed system is a meaningful starting point toward a more sophisticated human machine interaction (HCI) system. The methodologies used in this project give combination of virtual images & real time image.

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