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Smart Mirror

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Abstract: The design and the development of an interactive Smart Mirror is for the ambient home environment as well as for commercial uses in various industries. The project which would display data on the mirror and the data and would be managed by the Raspberry Pi. The smart mirror implemented as a personalized digital device equipped with peripherals such as Raspberry Pi, microphone, speakers, LED monitor, webcam covered with a sheet of reflective mirror provides one of the most basic common amenities such as weather of the city, latest updates of news and headlines and local time corresponding to the location and schedules using face recognition.
Keywords: Smart Mirror, Raspberry Pi, Weather, Time, News and Schedule

I. INTRODUCTION

The term Internet of Things(IoT) is related with the connection of physical devices through Internet. The 'thing' in IoT could be anything that has the ability to collect and transfer the data over a network without any human's assistance. The devices are embedded with technology so that they can be controlled and monitored remotely. IoT is a larger part of home automation which controls almost all the devices used for domestic purpose remotely through internet.

IoT basically emerged to ease human effort and make the device to perform the task by collecting information from surrounding environment. An example of IoT would be an alarm clock which wakes you 15 minutes late than the prior set time because it mapped the arrival time of train which would be delayed by 15 minutes. Another example of an IoT based home automation could be house walls that change its color according to a person's mood. Smart mirror is also developed to reduce human effort. Mirror is a basic thing that is available at everyone's home, taking advantage of this technology is embedded in it to make it smart and of more use. Now-a-days we get all the updates on our smart phone which we go through timely, but during morning rush hours it becomes a great haste to complete all morning routines. Smart mirror reduces this haste by providing you with the basic information you need to check in the morning such today's date, time according to your location, weather updates, news feed and today's schedule only by face recognition.

II. LITERATURE SURVEY

"A Mobile-Programmable Smart mirror for Ambient IoT Environment" published at 5th International Conference on Future Internet of Things and Cloud Workshops in 2017 describes the design and development of Interactive Smart mirror that offers simplified and customizable services to the home environment[1]. The Smart mirror also controls home appliances with very less human intervention using a mobile application. For controlling home appliances the mobile needs to be paired with the smart mirror successfully. "Smart Mirror for Smart Life" published at IEEE Conference publication also describes about the monitoring and controlling of home based devices with the mirror. To ease the human tasks and develop interaction between people and system, the mirror system uses Sonus technology as a medium[2]. The Smart mirror takes voice commands as input to give response and Sonus is a speech to text library that can quickly and easily add VUI(Voice User Interface) to any hardware or software[2]. Security in IoT in developing but not much strong in order to make Smart mirror secure and to display information according to a person's choice facial recognition algorithm is implemented in it. The "Implementation and Customization of a Smart Mirror through a Facial Recognition Authentication and a Personalized News Recommendation Algorithm published at 13th International Conference on Signal- Image Technology & Internet-Based Systems (SITIS) in 2017 includes the above advancement. The daily news recommendation predictive model is implemented through the facial recognition algorithm. The "SmiWork: An Interactive Smart Mirror Platform for Workplace Health Promotion" describes about a multi-user Smart mirror that promotes wellness and healthier lifestyle[4]. Each user have personalised user-interface which can be accessed using RFID reader in ID card. "The Smart Mirror" published at International Journal of Advance Research, Ideas and

Innovations in Technology and "Design and development of a smart mirror using Raspberry pi" published at International Journal Of Electrical, Electronics And Data Communication gives the design of futuristic mirror and development of mirror using Raspberry pi.

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III. SYSTEM ARCHITECTURE

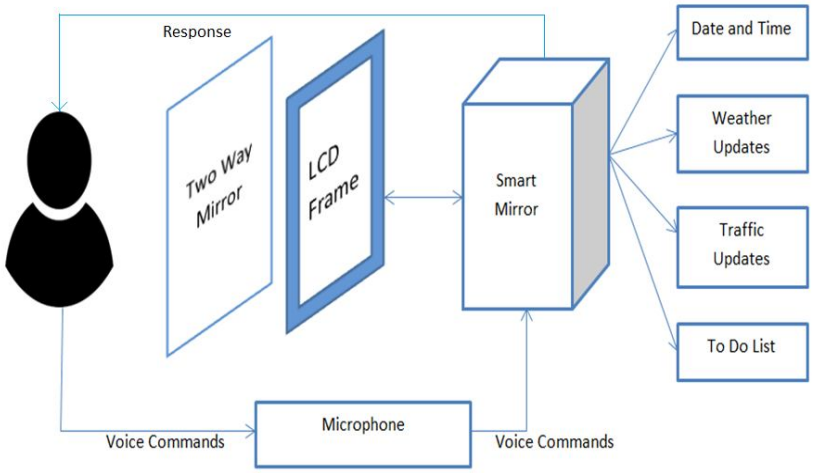

figure 1 : System Architecture of Smart mirror

The System architecture of Smart mirror is shown in above figure. The Smart mirror system mainly consist of three parts a two-way mirror, LCD monitor and Raspberry pi. The two-way mirror is the mirror which is reflective on one side and transparent on the other side. There will be a webcam behind the transparent side so that it can capture and identify faces for security purpose. The LCD monitor is used for displaying different widgets on the mirror. The LCD monitor will be connected to the Raspberry pi. The Raspberry pi will be used for programming of different widgets using Python language. The Smart mirror will be switched on using a voice command such as "Hello Mirror!", "Good morning mirror" or any other keyword. The Smart mirror will also give voice as well as text response like greeting the user or give some compliment as response, for which the system will use system compatible microphone and speaker.

The process will be firstly programming will be done for displaying images which will be displayed on LCD monitor and user will be able to see those widgets on the mirror when the Smart mirror is switched on using the keyword. The Smart mirror will also display some personal basic information only by recognizing the user's face.

IV. ALGORITHMS

There are two algorithms that will be needed to run the system those are for face recognition and speech to text conversion. For face recognition 'Eigenfaces', 'LBPH(Local Binary Pattern Histogram)', 'Fisherfaces' and 'OpenFace' were considered. Eigenfaces is based on statistical approach which uses principal components of face for detection. Fisherfaces is modified version of Eigenfaces. Eigenfaces does not make the difference between two pictures from different classes during the training part which Fisherfaces can do. In LBPH grayscale picture is used for face recognition. The LBPH works in block of 3x3 pixels. OpenFace is face recognition library based on Google's FaceNet system. OpenFace works using deep convolutional neutral network.

For face recognition for our system we found OpenFace as the best suitable algorithm. OpenFace came into picture a couple of years back but due to its high accuracy was adopted widely. OpenFace uses Torch, a scientific computing framework to do training offline that is only once training is performed by OpenFace on hundreds and thousands of images and handed over to the user as a ready to use product which does not need repeated training.

In Torch feature extraction is performed using deep neural network which needs to be performed only once and results are passed to the Neutral network part for further processing. The face detection is performed by dlib's pre-trained detector, the face is detected from several images. The detected face is then passed for preprocessing and after that to Convolutional Neural Network(CNN). The CNN then uses features extracted in the first part(Torch) for predicting class of unknown person.

The conversion of speech to text is done using Sonus technology. Sonus enables you to easily add VUI(Voice User Interface) to any software or hardware project. Sonus is always listening offline to the hotword and once that hotword is detected it is streamed to the cloud recognition service of your choice to get your results.

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V. CONCLUSION AND FUTURE WORK

This paper proposes an interactive mirror that ease the user's task by displaying widgets such as date and time, weather updates, news feed and schedule according to the user. The schedule of user is displayed only when the mirror recognizes the user, this also provides security to the Smart mirror. The Smart mirror is switched on/off using voice command and also gives voice response to the user.

The future work on this project can be adding more widgets such as e-mails, social media applications, traffic updates etc. For security of these widgets iris detection can be used along with thumb impression for accessing mails and personal data. Artificial Intelligence can also be added as an extra feature for recommending news according to the user's choice, suggesting the best path to reach the destination according to the traffic or suggesting clothes and accessories according to the climate conditions.

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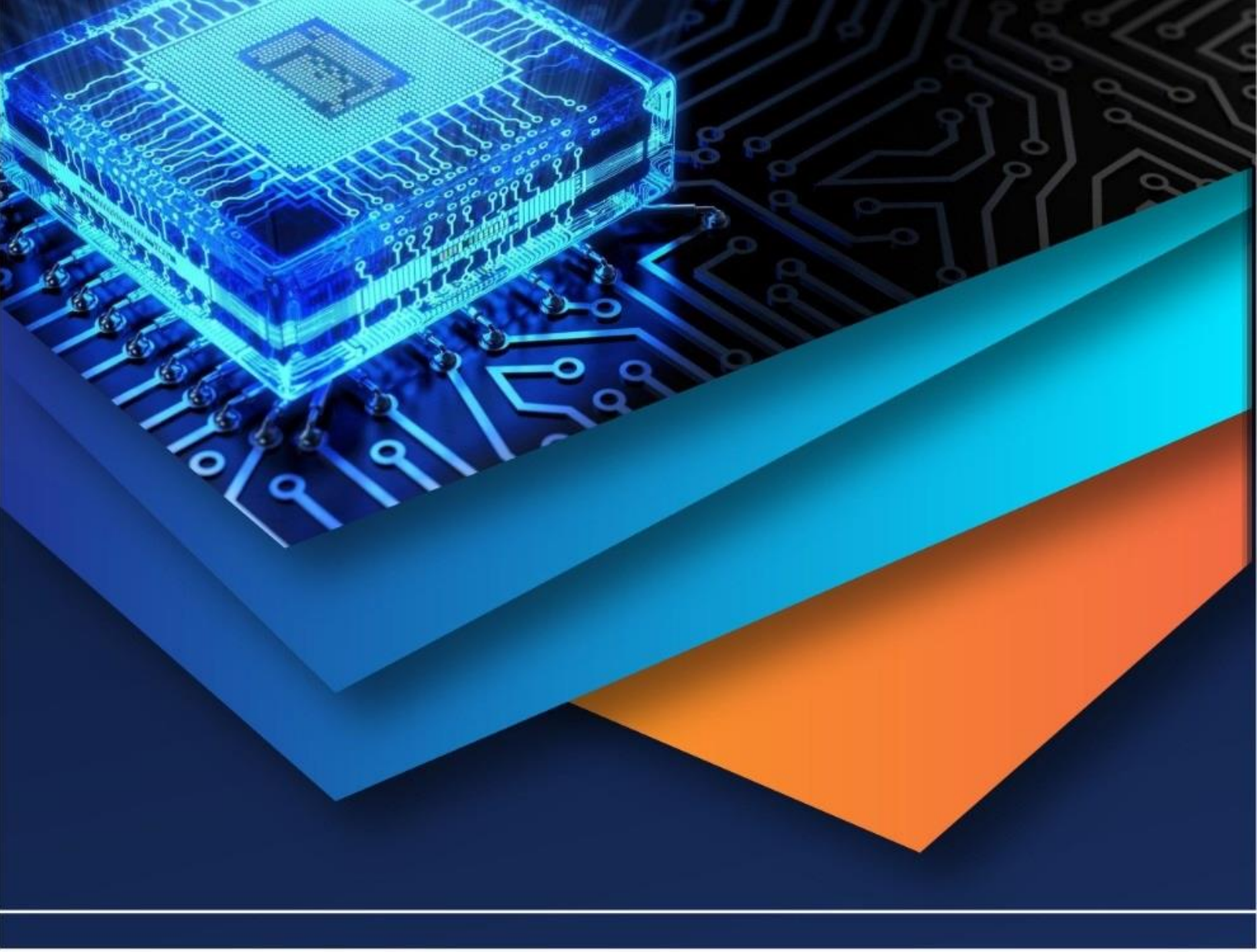

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