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Smart Reflect: A modular Smart Mirror Application Platform

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Abstract: Smart mirror also called magic mirror is a wall-mounted mirror or a bathroom mirror which helps in displaying data along with the functionality of a normal mirror. It displays the plain texts, image, date, time and weather as well as recent news headlines, etc. It can also display mails, shopping list, important reminders which are present in someone's mail account. Biometric authentication is used in this project to use the smart mirror displaying functionality. The statement "everyone is unique" becomes the basic premise for biometric authentication. It supports facial recognition technology for the authentication. So, only the authorized person will be able to use the display facility on the mirror as long as he/she is in front of the mirror. These type of smart mirrors can be used in bathroom or bedroom. In this model, the user is required to authenticate himself by Face detection biometric technique. This helps in saving lot of time in viewing any personal mail feeds or social app notifications using phone or laptop instead use that time wisely by doing to daily tasks in morning like brushing your teeth or washing your face simultaneously watching the smart mirror.

Keywords: Smart mirror, Authentication, Face recognition, Bio authentication, Magic mirror, Security, Raspberry pi.

I. INTRODUCTION

This project has been developed within the context of a time where every day we see more and more connected devices. The Internet transformed our lives by connecting us more easily to information and other people in the virtual world. Cell phones at that point progressed toward becoming cell phones and from that point forward this idea has ejected and transformed into the Internet of Things, things which interface us to regular items. There are no end of objects that could be made "smarter", some being more suited to this than others. Mirrors, for example, provide a large surface ideal

so the concept for displaying information and interacting with. Most people have mirrors at home of a smart mirror that you can interact with is attractive and has been fantasized in many futuristic movies. Smart mirrors, such as Magic Mirror What's more Home Mirror need as of late off with make produced Toward individuals in the creator community, with changing degrees of interactivity. However, thus far, those features of these mirrors need been restricted. . This final year project describes how a smart mirror was built from scratch using a Raspberry Pi for the hardware and custom software built on top of Raspbian, a Linux distribution. Those objective of the task might have been will make An keen mirror gadget individuals Might cooperation for as well as with further create the innovation so that it might give. You introduce Also create your own requisitions for it. Those advanced mobile mirror might have been produced On four months, beginning with those product Also At long last coordinating it with those equipment. . On the whole results were good because a higher level of interactivity has been achieved by being able to use voice commands, gestures and smartphones. A few problems arose in the construction and software side of the project, such as the glass not being reflective enough and the gesture recognition being unreliable but these drawbacks can be addressed by doing more tests and trials to further develop the Smart Mirror.

II. LITERATURE SURVEY

Smart mirrors usually were made just to show the time and weather using a tablet or a smart phone as display behind the mirror. The whole mirror comprised of a normal mirror with display attached to its back and a wooden frame covering entire sides of the mirror. In case of displays like tablets or smart phones, widgets were used to display time and weather. Later on displays like monitor were used, which were connected to a raspberry pi. To make display turn on or off sensors like motion sensor were used with the raspberry pi so that whenever a person comes in front of the mirror the display used to turn on and turnoff when the person goes away. Back in 2014 when Michael Teeuw posted his first smart mirror blog, since it was very new product to the world so gained lots of attention reaching above 2 million views. It was one of the project which gained lots of attention. He used raspberry pi 2 and display as monitor. It simply displayed the time and weather using modules. It was simply an information panel, we cannot interact

with the mirror. Later on when Hannah Mittelstaedt made a home mirror and posted in reddit, also gained lots of attention. She actually used Nexus 7 tablet as the display panel. Since it was an android tablet so she used android widgets to display time, weather, date, reminders. Lots of new ideas generated by then as smart mirror got lots of attention. People started integrating lots of technologies with it. Evan Cohen eventually built a smart mirror which has a voice controller which help in adding reminders, show current weather, time, etc. He also used it to control house lights as he was focused more on house automation using IOT. This is how smart mirror evolved starting from simple display to using raspberry pi and then integrating other devices like voice control, motion sensor, camera, etc. Earlier when tablets and smart phones were used it was very easy to build the mirror. Those devices simply used default widgets in the tablet or phone to display the time or weather information. Later when raspberry pi became a part of smart mirror normal monitors were connected to them to display the information. Web browser was used to display the time and date. Plugins were installed in the raspberry pi and web browsers were used to run those plugins. We can simply add new plugins to add a new feature to display on smart mirror. Plugins generally comprised of HTML files, CSS files, JavaScript files, scripts and web GUI. The websocket protocol used to handle the communication between the plugins and display. For the connection establishment servers use to take care of plugins so that while establishing a connection between a plugin and display it should not interact with other running plugins.

A. Summary of Literature survey

The basic idea is to display weather forecast, temperature, daily news and to-do list which will save time. All the confidential documents of the employees are stored on the server which is accessed via Wi-Fi and connected to the smart touch. We install a trusted facial recognition software in the mirror which detects the user's face and provides access and authenticity to the secure data.

III. IMPLEMENTATION

Requirement gathering, and analysis step have been allocated a large amount of days, because it forms all the development steps and all expected processors will depend on it. It has main two approaches as primary and secondary data. This project uses hardware as Raspberry which allows the different computing devices to access the web page which provides greater security, the user can browse web page from different area using the home area network/internet. Smart mirror will be able to save lot of time if news feed, mails, notifications from private social accounts like facebook, Instagram, etc will be displayed. While washing our face or brushing our teeth in morning we can simply stand in front of mirror and look the important notifications. In addition to the existing infrastructure there should be a security feature that needs to be integrated if the smart mirror is capable of displaying notifications from facebook, mails, Instagram, etc. Camera is attached on top of the mirror. It is connected to the raspberry pi which can take a snap of the user and send it to pi and upon a match feeds, time, weather, etc are displayed on monitor. If it doesn't detect anyone then it just acts like a normal mirror. Basically raspberry pi contains preloaded set of images of the user. Whenever the user comes in front of the mirror camera captures an image and try to find a match with the preloaded images. This not only increases security to the mirror but also becomes a safe device to see the notifications from private social accounts, mails, etc. Every time the user get authorized he or she will see the latest feeds from different accounts. Every feed category will have a certain limited number of messages or notifications that it can display.

It is highly useful for office purposes because, in case of power leakages or high voltage fluctuation the power monitor sensor sends an alert message to the mirror so that electricity can be saved. In case of fire accidents which releases high amount of carbon monoxide, the CO Sensor detects and sends the alert message which is displayed in the mirror. To enhance security, we implement facial recognition system to achieve privacy and authenticity

IV. SYSTEM ANALYSIS AND DESIGN

A. Introduction

A webcam placed behind the mirror is used to recognize the user standing in front of the mirror. By recognizing the person, the mirror then knows how to interact or behave next. The output of user recognition then triggers the display of the interface. The interface is designed as per the user. The interface allows a user to view Rich Site Summary (RSS) feeds of social media and email, have access to maps, calendar, weather and time.

B. Analysis of the problem

- 1) Different security Products, easy code password, Lacks regular maintenance, leaving your system open to hackers.
- 2) Avoiding a corrupted SD card, rely only on the main power, check the cables.

C. System Architecture

The functions of the various components are given below:

- 1) Hardware Tools-Raspberry pi, Web camera, Two way mirror ,Led Monitor, Power supply
- 2) Software Tools-Python, OpenCv, Raspbian OS,Php/ HTML.

D. Raspberry Pi

Raspberry pi is a small credit-card sized computer capable of performing various functionalities such as in surveillance systems, military applications, etc. Those Different functionalities of the parts are provided for The following the Different segments for Raspberry- phytotoxin need aid.

- 1) SD Card Slot is used to install OS/booting/long term storage .The total memory of the SD card is about 8GB.
- 2) Micro USB Power Port provides 700mA at 5A.
- 3) RCA Video Out is connected to display if HDMI output is not used. It is mainly used to carry audio and video signals. They are otherwise called as A/V jacks.
- 4) Audio out Digital audio is obtained if HDMI is used to obtain stereo audio. Here analogue RCA connection is used.
- 5) Ethernet Port is used to connect to the Internet. It also plays a role in updating, getting new software easier.
- 6) HDMI OUT (High Definition Multimedia Interface) is used with HDTVs and monitors with HDMI input. Also HDMI-HDMI is used here.
- 7) BROADCOM BCM 2835 will be Overall characterized Likewise framework around chip. It is An 700 mhz Processor. It need An feature center iv GPU.
- 8) GPIO allows us to control and interact with real world.

E. Web Camera

Web Camera captures the image and sends it to the USB port of the Raspberry Pi board. The camera model used here is USB Camera model 2.0.

- 1) *LED Monitor*: An headed show is An level board presentation which employments a show light emitting diodes Likewise pixels for a feature presentation.
- 2) *Two Way mirror*: Two-way mirror (or two-way glass) may be An semi-transparent mirror, will be An complementary mirror that is incompletely reflective What's more incompletely transparent. . The observation for one-way transmission is attained The point when person side of the mirror will be brilliantly lit and the different side may be dull. This allows examination from the blurred ancillary but not carnality versa..

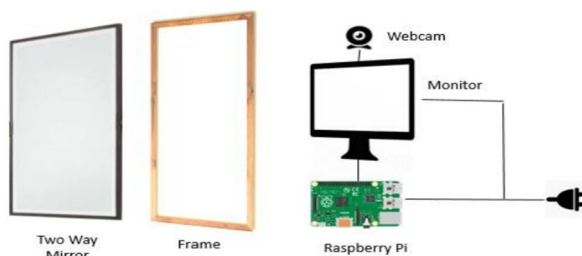


Fig 1: Archietecture Design

Fig 2:

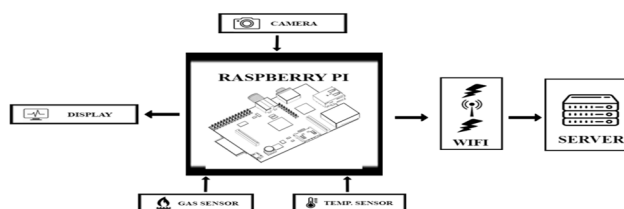


Fig2:Working Model

F. Summary

The software and the hardware requirements are been specifically allocated to run the smart mirror which is going to be hosted using Internet of things and explanation of each software is been done.

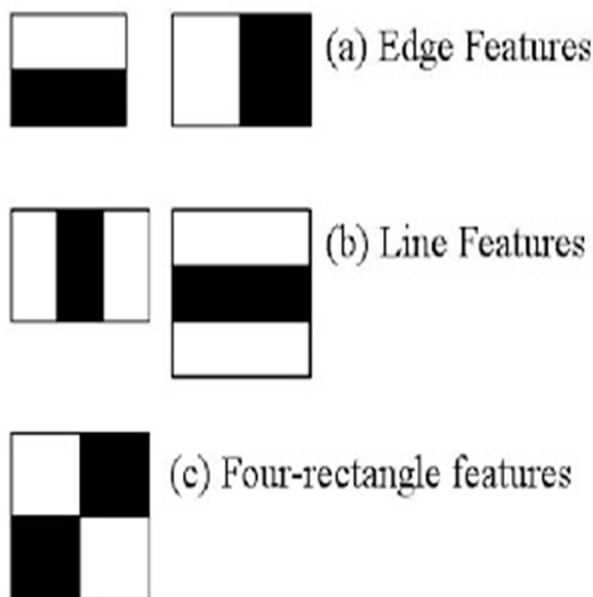
V. WORKING METHODOLOGY

Our complete project deals with the different modules based on the working. The workings are based on the design and implementation. The Smart mirror system with Raspberry Pi consists of various modules as described below:

- 1) Face detection- haar cascade classifier
- 2) Face recognition- drlbp
- 3) Lda classifier
- 4) Iot cloud.
- 5) Algorithm

A. Haar cascade classifier

The algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. Single value obtained by subtracting sum of pixels under the white rectangle from sum of pixels under the black rectangle.



OpenCV already contains many pre-trained classifiers for face, eyes, smiles, etc. Those XML files are stored in the `opencv/data/haarcascades/` folder.

```
import numpy as np
import cv2 as cv
img = cv.imread('sachin.jpg')
gray = cv.cvtColor(img, cv.COLOR_BGR2GRAY)
```

B. Drlbp

Discriminative Robust Local Binary Pattern and Local Ternary Pattern help in discrimination of the local structures that Robust Local Binary Pattern seems to misrepresent. Also, the proposed features tend to retain the contrast information of the image patterns. They comprises of both edge and texture information which seem desirable for object recognition. K Nearest Neighborhood classifier is been used to provide image classification.

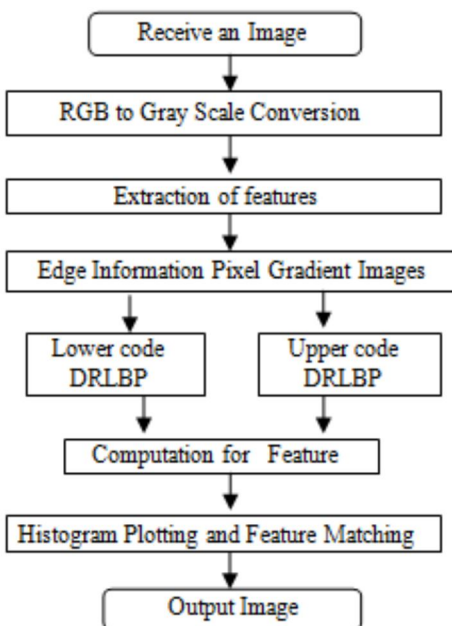


Fig 4: Working module

C. Summary

Thus the above modules describe the working of the application. It is expected that the proposed system can be used worldwide.

VI. CONCLUSION AND FUTURE WORK

I have designed and made this project of smart mirror that works both as a normal mirror as well as a mirror showing daily notifications to the authorized user. There are lots of feeds or notifications that the user can view on the mirror like facebook, gmail, news etc. The mirror is also used to display time, weather, etc. I have integrated facial recognition to this mirror which is added feature for the mirror in terms of security. This mirror in future can be used to do lot of things which earlier was not able to do due to lack of security feature. We can use voice recognition and integrate voice assistant to it. We can also run software in the smart mirror to book cabs, movies tickets, etc. As we cannot interact with the mirror so voice recognition can be integrated with raspberry pi to do booking of cabs, tickets, etc. As we can use this mirror while brushing our teeth in bathroom or doing make up near dressing table, so this product can be very much useful in future to save time.

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