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Design of Intelligence Smart Mirror Using IOT

Prof. Pradeep Kumar G.M, Deepa P N, Simron S A, Bhavya E O, Anjum Taj S A

***Abstract*— This paper presents the design and development of a smart mirror using raspberry pi with additional features which provide face recognition for security and smart unlocking process and works in two modes: Online mode and Standalone mode. In Standalone mode it works as normal reflecting mirror and in Online mode it gets connected to internet using Raspberry Pi and provides users a relevant information like digital display showing the contents such as time, date, weather and news simultaneously. The user can interact with the mirror by. The contents are displayed on an LED monitor which is enclosed in a wooden frame and covered with a sheet of reflective one-way mirror. The mirror provides basic amenities like weather of the city, time and news details. All the computing is done with the help of a raspberry pi. Using face recognition technique, we can detect the user's face and verify the user. This provides a better security technique.**

***Index Terms*— Infrared Module, Raspberry-Pi, Smart mirror.**

I. INTRODUCTION

Internet of Things (IoT) plays a important role in interacting with human life. In daily life all household and gadgets get connected to internet and it is controlled by the internet itself.

[1] Smart mirror provides an easy access to user to retrieve the information in detail and convent with expectation of user as it takes few seconds to check daily activities. The user required fewer efforts and less exertion to execute this process. [2] This system acts as multitasking mirror interface. The user can interact with the mirror by givingcommands to it, so it is referred as an interactive display. It has different applications like displaying real time information, updates and appliances control. Smart mirror can be used in halls, malls, hospitals, office and home and it is useful for busy individuals that want to multitask and stay informed while on to go. Smart mirror can be implemented by using raspberry pi and data from the internet. Raspberry pi runs with Raspbian Jessie pixel operating system. User interface is developed by using web browser or python or JavaScript. The purpose of this paper is to develop an assistant using a mirror which is very common thing in human life whose job is to provide all necessary information such as news, temperature, weather conditions, meetings, remainders and etc. using Raspberry pi, electronic modules and supporting sensors.

Over 1 million #selfies are taken every day with 30% of photos taken by people between the ages of 18 and 24 being a #selfie1. In total, 28% of time spent online is on social media2. According to a TODAY/AOL survey, women spend an average of 6.4 hours/week while men spend 4.5 hours/week working on their appearances3. The Smart Mirror is a system that combines these tasks in an efficient and enjoyable way to provide time savings for the user.

Prof. Pradeep Kumar G M Assistant professor, Department of Computer Science and Engineering, SJC Institute of Technology, Chickballapur, Karnataka, India
Deepa P N Visvesvaraya Technological University, Department of Computer Science and Engineering, SJC Institute of Technology, Chickballapur, Karnataka, India
Simron S A Visvesvaraya Technological University, Department of Computer Science and Engineering, SJC Institute of Technology, Chickballapur, Karnataka, India
Bhavya E O Visvesvaraya Technological University, Department of Computer Science and Engineering, SJC Institute of Technology, Chickballapur, Karnataka, India
Anjum Taj S A Visvesvaraya Technological University, Department of Computer Science and Engineering, SJC Institute of Technology, Chickballapur, Karnataka, India

II. PROPOSED SYSTEM:

Proposed system and block diagram for smart mirror are shown in Fig. The aim of designing this model is to create an interactive interface which can be conveniently used in home environment as well as commercial space.

Various services like weather, calendar, traffic, news stock updates etc. can be accessed and controlled using voice commands.

The Raspberry Pi 3 is connected to a Monitor via HDMI cable and a webcam is attached using a universal serial bus. Raspberry Pi is powered up using a 5V/2A DC supply.

III. BLOCK LEVEL SYSTEM DESIGN OVERVIEW

Smart mirror works in two modes as mentioned below

A. Standalone Mode

When user is not in-front of mirror, it acts as a normal mirror. As in this mode all electronics circuits are in OFF state which is called as Power Saving Mode.

B. Online mode

When user come in front of mirror this mode is activated and, in this mode, raspberry pi module gets connected to internet and display all related information to the user.

Block level system overview is shown in fig. 3.1.

Hardware and Software requirements for the design of system are mentioned below.

1) Hardware Requirements:

- Camera – REES52 Raspberry Pi 3 model B+ supportive 5MP camera.

- Two-way Glass mirror - 18 x 24 x 0.2 inches by smart mirror kit.
- Infrared Module – 38KHz Geek worm IR Control
- Kit.
- Raspberry Pi 3 module B+.
- Microphone and speaker
- Display Unit
- Temperature Sensor
- Humidity Sensor

2) Software Requirements:

- HTTP
- PHP
- Python

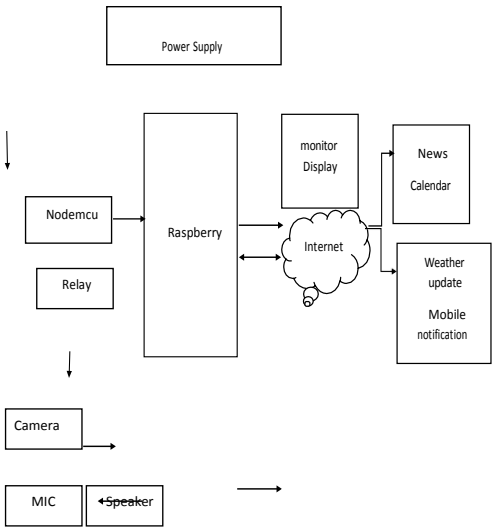


Fig 3. 1. System Block diagram.

a) Camera: Camera is required to identify user correctly which can be done by using image processing or face recognition on Raspberry Pi which has dedicated port to connect camera on it.

b) Two-way mirror: The two-way mirror is what gives the mirror its real identity. It's really magic mirror as it has reflective surface at one side and also its transparent for light with good intensity. The mirror stays at the front where the user can watch himself/herself in the mirror at the same time the allows the light from monitor to pass through it and make available the UI.

c) Infrared Module: IR Module unit always remain in ON mode for continuous observation of user. when user come in front of mirror, this module gives input to camera which takes images of user as input and identify correct user using designed algorithm.

d) Temperature Sensor: This sensor is connected to Raspberry Pi module which gives user current temperature data of surrounding environment.

e) Humidity Sensor: The connection of this sensor is same as temperature sensor. It gives information about humidity around user's environment.

f) Microphone and Speaker: This unit is required to take inputs in the form of voice from the user. In this system mirror and user speak with each other. This can be done by using Emic 2 Text-to Speech module. This unit converts text into voice. This makes mirror to speak out what we need.

g) Monitor Display Unit: This unit is directly connected to Raspberry Pi via HDMI interface thus providing display as well as voice output.

IV. WORKFLOW OF SMART MIRROR

Smart Mirror consists of Infrared Module which is frequently in ON mode. When user comes in front of the mirror, this IR module senses heat (temperature)of human body and activates in online mode. This gives input signal to camera, Face and speech recognition module, which identify user correctly through its facial and speech /voice inputs.

After recognizing correct user, smart mirror displays the data in two formats. In one of the format, it displays hot news, Weather condition, Temperature, Humidity, date, time and etc. to the user and in other format, data displays agendas, remainder, birthdays, assignments, projects to the user from the preloaded online data.

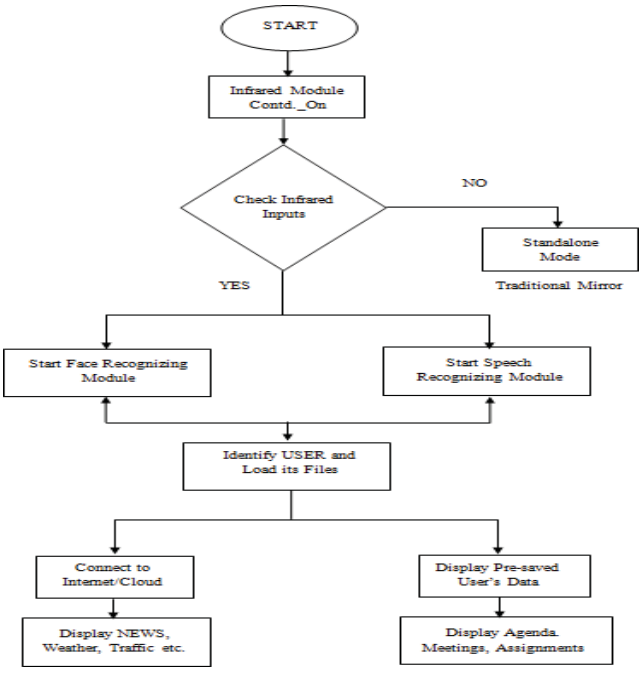


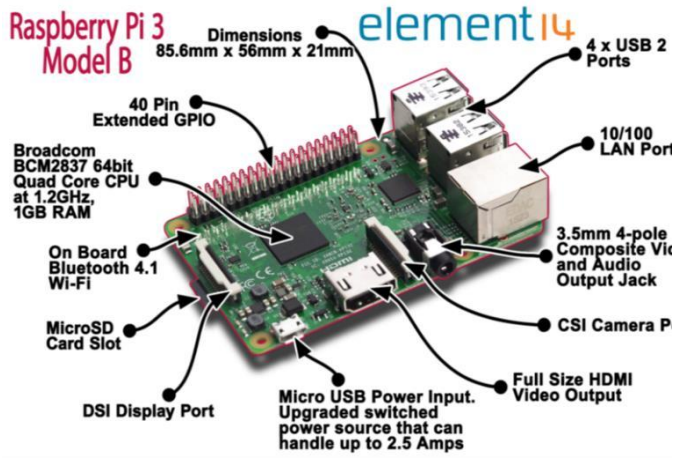
Fig 4.1 Workflow of smart mirror system

V. RASPBERRY PI CONFIGURATION DIAGRAM.

The raspberry pi is the vital part of the mirror, it forms the processing unit of the mirror. The Raspberry Pi 3 Model B+. It has Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit

SoC @1.4GHz, 1GB LPDDR2 SDRAM,2.4GHz and 5GHz

IEEE 802.11.b/g/n/ac wireless LAN, Bluetooth 4.2, BLE, Gigabit. Ethernet over USB 2.0 (maximum throughput 300 Mbps), Extended 40-pin GPIO header, Full-size HDMI, 4 USB 2.0 ports, CSI camera port for connecting a Raspberry Pi camera, DSI display port for connecting a Raspberry Pi touchscreen display, 4-pole stereo output and composite video port, Micro SD port for loading your operating system and storing data, 5V/2.5A DC power input and Power-over-Ethernet (PoE) support (requires separate PoEHAT)[3].



a) Fig 5.1 Raspberry pi-3

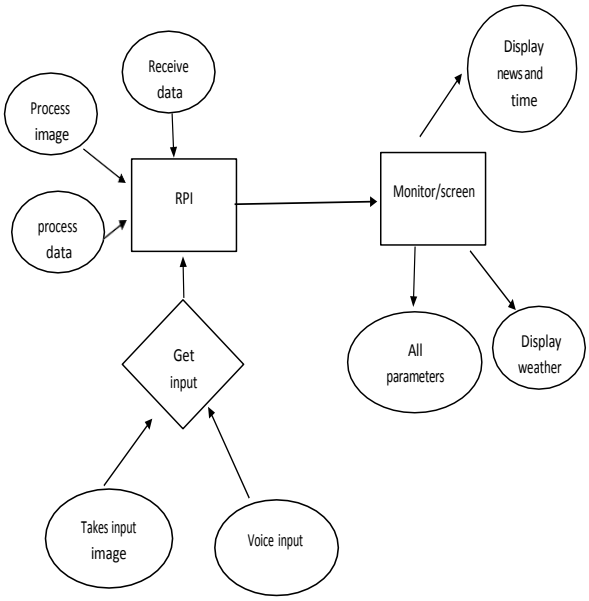
OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. This software is mostly used for image processing and video analysis. With the help of this programming the computer processes and ultimately understands images and videos.

VI. FUNCTIONAL TESTING

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

VII. FEASIBILITY

Here, we use Economic feasibility. Economic analysis could also be referred to as cost/benefit analysis. It is the most frequently used method for evaluating the effectiveness of a new system. In economic analysis the procedure is to determine the benefits and savings that are expected from a candidate system and compare them with costs.



b) Fig 7.1 Feasibility Study Diagram.

VIII. SOFTWARE DESIGN FLOW

This section briefly describes working of face and speech recognition. Raspberry Pi has a port for Ethernet. Mirror is connected to Internet through Raspberry Pi using specific APIs. This section requires PHP, HTML, and Python. HTML and PHP coding is required for creating and displaying web pages which contains information about calendar, weather information, and access to required websites.

Function Name	Tests Results
Facial input	Recognized or not
Voice input	Taking the command or not
Display result	All the functionalities displaying such as time date etc.

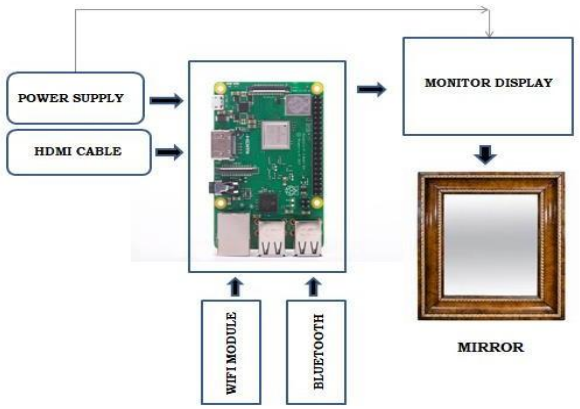


Fig 8.1 System Design Flow Diagram.

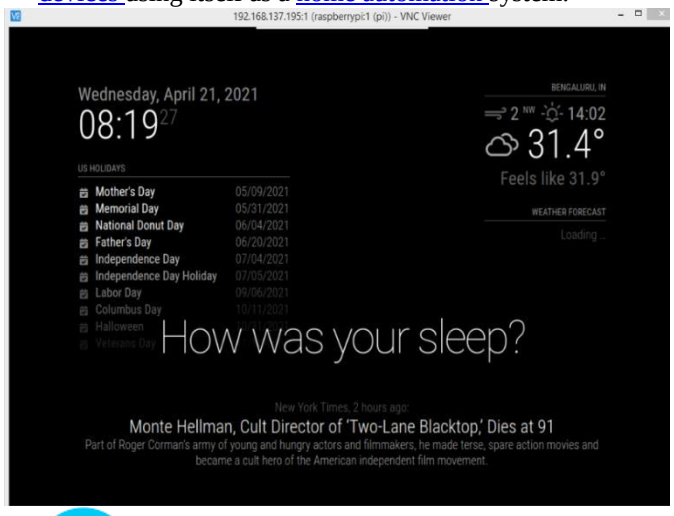
A *true positive* occurs when a positive sample is correctly classified.

A *false positive* occurs when a negative sample is mistakenly classified as positive.

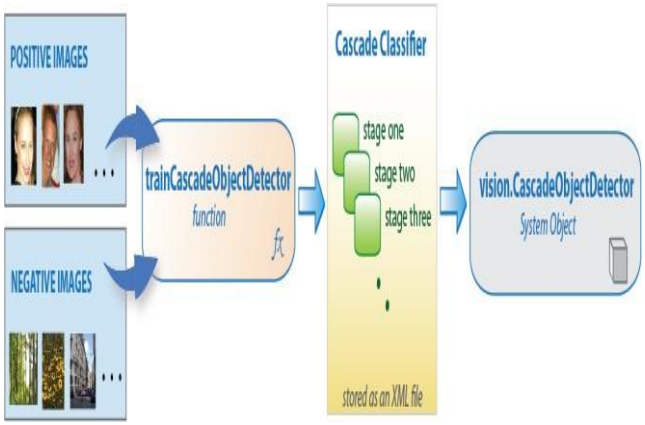
A *false negative* occurs when a positive sample is mistakenly classified as negative.

To work well, each stage in the cascade must have a low false negative rate.

2) Speech Recognition: Amazon Alexa, also known simply as Alexa is a virtual assistant AI technology developed by Amazon. It is capable of voice interaction, music playback, making to-do lists, setting alarms, streaming podcasts, playing audiobooks, and providing weather, traffic, sports, and other real-time information, such as news.[3] Alexa can also control several smart devices using itself as a home automation system.



1) Face Recognition: It requires camera to capture image of user and converts it into digital form by processing it. Then compute image embeddings using deep neural network and identify each face in database. Further compare this embedding with known database and recognize face of the user [4]. This face recognition help system risk free and enhanced itssecurity.



Cascade classifier

. IX .FUNCTIONAL OVERVIEW

The proposed mirror is designed to perform several functionalities that can be summarized as follows:

2) Mimic a natural mirror interface:

3) A flat monitor is used for the mirror display.

A one-way mirror is used to provide real time display of what is located in front of the Smart Mirror using Raspberry Pi thereby mimicking the function of a regular mirror.

4) Personalised Information services:

Users will be able to obtain minute updates of latest news and public headlines; weather reports as well as get reports of ourinterests.

5) Customized management of profiles:

Users can create their own profiles and store them in the system. According to this profile, customized services are provided to the user.

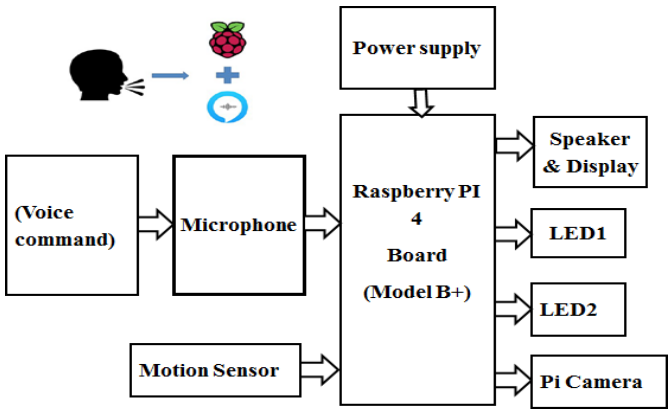


Fig 9.1 Functional Overview of Smart Mirror

X. CONCLUSION

This paper presented design overview of Smart Mirror System which uses Raspberry Pi as a core processing unit. It gives all relevant information like hot news, weather condition, appointments, agendas, assignments etc by recognizing correct user using face and voice recognizing unit when it operates in Online mode. It acts as a traditional mirror in standalone mode when no one is in-front of mirror. This is more interactive mirror in which both user and mirror interact with each other with camera and microphone attached to system. This system can be used in home, hair salon, fashion/film industries etc. By using more advanced sensors, ray optics, image processing tools, proposed system can be used in healthcare, prevailing hotels, Airports etc. In future, this system can be extended to make windows, door as an intelligent gadget.

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