IoT BASED SMART MIRROR USING RASPBERRY Pi 4

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Abstract: In the morning it is an important time to prepare you in front of the mirror, which is often slow and time-consuming. This Smart Mirror is able to handle a variety of problems in doing business in the same time. Just using the word "ALEXA", this voice service system will analyze questions and instructions from users. Smart Mirror is a design based on the Raspberry Pi 4 that is equipped with high technology and innovative applications and is the latest design in place of the mirror that we use today. In this era of modernization, we've all been exposed to many things that lead to the development of the country and abroad. Usually, an individual becomes difficult to find enough time in the day to accomplish all the tasks that are part of life, so multitasking becomes necessary. The problem lies in identifying ways to control all the factors that can affect a person individual to prepare us for each day in addition to performing all the tasks those are important just in front of the mirror with more efficient.

The basic goal of this project is to create a product called smart mirror that meets the needs of common person and receive the general information like news, time, weather and also other needy information. This mirror is designed with the ability to collect this information during the preparation of a morning daily life in order to more efficiently and easily. To make this more interesting mirror, we can develop our products to include a variety of control methods, as well as music and other entertainment. In future we hope that the project based on smart glass will enhance a innovative and modern way of life. The face recognition feature will improve the application level of the mirror.

Keywords: *Raspberry pi 4; Smart Mirror; IoT; ALEXA; Voice services; Amazon application.*

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I INTRODUCTION

Nowadays, IoT is the major concept regarding all the devices and projects. The use of internet can be seen everywhere. It is estimated that by the year 2020,there will be up to 21 billion devices across the globe connected with 'Internet of Things' means every man can carry 7-8 IoT devices which will be continuously connected to the Internet. Our lifestyle is all connected to the Internet in other words Internet has become the essential need of human life. The growth of IoT will result in accumulation of special data which will need to be processed and analyzed. Internet of Things offers limitless opportunities to enhance communication between devices and data sharing but this same feature makes it highly vulnerable from the point of view of security. It is a wall mounted mirror it displays information such as news, weather, calendar and other things related to our needs.

A common goal for building a smart mirror is to use a high quality one-way glass, a LCD monitor, a frame to hold the glass and monitor, and a motion sensor to detect a person and a web browser called flash with python to provide the software features like 'Alexa' and drive the display further.

This paper will discuss about the design of smart mirror. Smart mirror comes with Amazon ALEXA application which is a voice service that responds to our questions. The smart mirror is also able to perform face recognition using pi camera.

II LITRATURE SURVEY

Research has been made on projects which are related to smart mirror project. Here are some projects about smart mirror discussed about their work.

In 2003 Phillip sunveiled their Mirror TV that was built using the same principles that of smart mirrors. Their product was a normal TV that was put behind a two way mirror so that the TV would appear as a mirror when turned on and as TV when turned on. They also had a option to

have the mirror be larger than the TV. A usage example presented by Phillips was to have the children watch cartoons while brushing their teeth at the same time.

Later in 2005 Phillips announced their research project MyHeart that built upon the idea of an informative mirror. While their original Mirror TV was simply a TV that also functioned as a mirror, the MyHeart project would integrate a display to showcase various medical statistics. However this project required onbody electronics to collect and analyze the data. The mirror itself simply served as an informative display.

James Law Cyber tecture developed a commercially sold smart mirror in 2011. This mirror is more in line with the smart mirror we've come to know today. The product consists of a 32"LCD-display covered by a 37" two way mirror. The display can show weather forecasts, stream internet, TV, the current time and various widgets. The smart mirror has numerous input methods such as remote controller, smart phone app and onscreen virtual keyboard.

Chidambaram Sethukkarasi et al. (2016) created an intelligent mirror that identifies users based on facial recognition, recognizes emotions, records health parameters and gives clothing advise. Their paper does not go in-depth on any of its subjects, but rather try to unite the ideas under the concept of an intelligent mirror. In 2017 a company called New Kinpo Group launched their take on the smart mirror called Hi-Mirror. This smart mirror has a camera to specifically monitor your skin health. The mirror will scan your skin and give you metric to tell you what to improve. The mirror uses facial recognition to log a user's skin firmness, texture, clarity, brightness and health on a day to day basis.

Griffin Technologies unveiled their take at the smart mirror at the 2017 CES convention. They call their product the Connected Mirror and it will serve as the smart home hub for several smart home appliances made by Griffin Technologies.

The mirror can display local time and weather, notifications from your phone and statuses from other Griffin smart home tech connected to the mirror.

III PROPOSED SMART MIRROR

The smart mirror consist of a USB microphone, Raspberry pi 4 board, two led strips, pi camera for face detection and speaker and monitor display with two way glass mirror film. LED1 and LED2 is used for indicating purpose. After the word alexa is given to the microphone one led is getting turned ON i.e. listening mode of Alexa and the other led it is getting turned on while speaking or answering mode of alexa. A two way mirror which can

function both as reflective and see through mirror is attached to a LED monitor. This provides two major functionalities i.e. mimicking a normal mirror as well as working as a display for real time data updates. iii) Personalized data and information services: Anyone using this mirror will be able to get real time updates of traffic, stocks, news and headlines, date, time, weather updates as well as other reports of our particular interests. iv) Voice Commands: User will be able to give voice commands to the mirror using a microphone connected to the Raspberry pi 4. The Magic mirror will display data in accordance to the user commands.
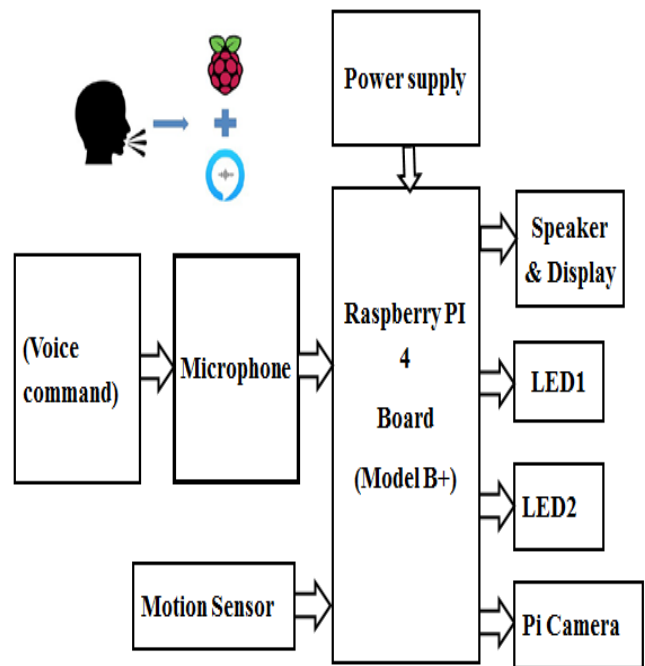

Figure 1. Block Diagram of IoT Based Smart Mirror

The proposed project block diagram is shown in figure. The voice command is given to the usb microphone it is attached to the raspberry pi 4 board. The raspberry pi is powered with power supply. Smart Mirror will turn ON when there is motion. But, if opposite it will remain OFF.

The Second was triggered as per the command is given to the mirror like switching on/off fan, light etc. Hence it is used as smart home device to operate the devices at home. The motion sensor acts as a limit switch whenever there is a person in front of the screen the sensor detects the person and displays the information.

IV HARDWARE COMPONENT OVERVIEW

1) Raspberry pi 4 B

Raspberry Pi 4 Model B was released in June 2019 with a 1.5 GHz 64-bit quad core ARM Cortex-A72 processor, on-board 802.11ac Wi-Fi, Bluetooth 5, full gigabit

Ethernet (throughput not limited), two USB 2.0 ports, two USB 3.0 ports, and dual-monitor support via a pair of micro HDMI (HDMI Type D) ports for up to 4K resolution . The Pi 4 is also powered via a USB-C port, enabling additional power to be provided to downstream peripherals, when used with an appropriate PSU. The initial Raspberry Pi 4 board has a design flaw where third-party e-marked USB cables, such as those used on Apple MacBooks, incorrectly identify it and refuse to provide power. The design flaw was fixed in revision 1.2 of the board, released in late 2019.

2) One-Way Mirror Film

A one-way mirror, also called two-way mirror (or two- way glass) and semi-transparent mirror, is a reciprocal mirror that is partially reflective and partially transparent. The perception of one-way transmission is achieved when one side of the mirror is brightly lit and the other side is dark. The objective of designing the mirror is to provide a natural interface in the ambient home environment for accessing various services such as location based weather, time, calendar etc. as well as provide access to using Voice Services. The project includes downloading the Raspbian operating system based on Debian and extracting the image on SD card, inserting the card in the Raspberry Pi SD slot an then performing the required steps.

3) LCD Panel

A LCD panel is an output device that displays information in the form of photographs. The monitor usually consists of display devices, circuits and power supplies. An LCD panel placed behind the mirror is used to present to the user the desired interface. LED monitors are flat panel display which uses array of light emitting diodes in the form of pixels for video display. There allowed to be used in the outsource because of the brightness where the can be visible to the sun store signs and billboards.

4) USB microphone

This microphone is very much compatible with raspberry pi. It is used to interact with Alexa voice assistance. Its accuracy is much better than our general microphone. We can easily connect it to the Raspberry USB port. It is very much smaller is size and can fit easily on raspberry pi.

Figure 2 USB camera

5) Pi Camera

The **Pi camera module** is a portable light weight camera that supports Raspberry Pi. It communicates with Pi using the MIPI camera serial interface protocol. It is normally used in image processing, machine learning or in surveillance projects. It is commonly used in surveillance drones since the payload of camera is very less. Apart from these modules Pi can also use normal USB webcams that are used along with computer. In this project pi camera is used for face recognition feature. It is situated at the top of the mirror glass.

V SOFTWARE COMPONENT OVERVIEW

1) Raspbian Operating System

Raspbian Is the Best All-Around Operating System. Raspbian is the "official" operating system of the Raspberry Pi and because of that, it's the one most people will want to start with. Raspbian is a version of Linux built specifically for the Raspberry Pi. Raspbian is a free operating system based on Debian optimized for the Raspberry Pi hardware. An operating system is the set of basic programs and utilities that make your Raspberry Pi run. There are few steps that may apply for installation this Smart Mirror by using Raspberry Pi. Firstly, install the Raspbian Jessie, then boot the Pi. Unmounts the SD card from your computer and insert it into your Pi. Connect your keyboard, mouse, HDMI cable and, lastly, the Pi's power cable. You will now see the Raspbian Pixel desktop (GUI). This "Smart Mirror" needs to be Wi-Fi-enabled so that it can connect to the internet and so that we can access it remotely through VNC Viewer to set things up. In the top right of your screen, click on the network icon. Select your network enters your Wi-Fi password, and click OK After that, find the IP address so thus can be connect to it from any regular computer and complete the rest installation from there. Lastly, we start our "Smart Mirror" on system boot with appearing of all features that include.

2) ALEXA Voice Services Installation

ALEXA Voice Services (AVS) is one of the products of Amazon services are built around AI voice-controlled assistant for various things such as system requirements and system Smart Home Smart Mirror as "Smart Mirror". AVS and ALEXA first introduced to Echo, intelligent speaker company, allowing two-way voice interaction with multiple systems in the environment and online. ALEXA is available in the growing number of other devices, including smartphones, tablets and remote controls. ALEXA was chosen as the name for this voice service because ALEXA refers to the ancient Library of Alexandria known as the "keeper of all knowledge".

3) VNC Viewer

VNC stands for Virtual Network Computing and has been developed by far-flung console consoles for penetration and hacker testers. RFB protocol are used by VNC to send screen pixel data between device such as computer and laptop or smartphone through internet network and the used of the IP address that already available in the Raspberry Pi to monitor the "Smart Mirror". It is an easy and powerful protocol created by Real VNC.

VNC Server captures desktop computers in real time and sends them to VNC Viewer for display this VNC Viewer facility, users can control the desktop remotely by using various electronic devices such as smartphones.VNC Viewer collects input (mouse, keyboard, or touch) and sends it to VNC Server to inject and completely reach remote control.

About flask

Flask is a micro web framework written in Python. It is classified as a microframework because it does not require particular tools or libraries. It has no database abstraction layer, form validation, or any other components where pre-existing third-party libraries provide common functions. However, Flask supports extensions that can add application features as if they were implemented in Flask itself. Extensions exist for object-relational mappers, form validation, upload handling, various open authentication technologies and several common framework related tools. Extensions are updated far more frequently than the core Flask program.

We used flask web framework for displaying the mirror information. In python there is a library called flask. We have to import that library into python.

VI METHODOLOGY

A. Smart Mirror As A Mirror

We can use this mirror as natural mirror while looking we can see other information too using two way mirror and monitor sceen.

B. Mirror as a information system or wall

In the smart Mirror features like Time, Date, weather details and news are fetched from online using predefined URL.

C. Mirror as a Alexa

Alexa voice service is the best tool to interact with mirror. It helps you to make your time more informative as well as time saving.

D. Mirror as a Face recognition device

We have used 5 mp camera for face recognition. According to our face the mirror will identify and give the information

related to database and schedule. In future using this feature various projects on artificial intelligence can be deployed.

The key features of smart mirror are:

Date: Will be update the date everyday

Time: Will show the time.

Weather: Will update the weather.

Greetings: Hello! (Can be set)

Voice Services, ALEXA (use any command in proper)

Face recognition: Will identify your face and act upon your database.

In flowchart of smart mirror it is explained that when we give voice commands to USB microphone, alexa voice service identifies the questions and answers and face of the person. This will continue in loop.
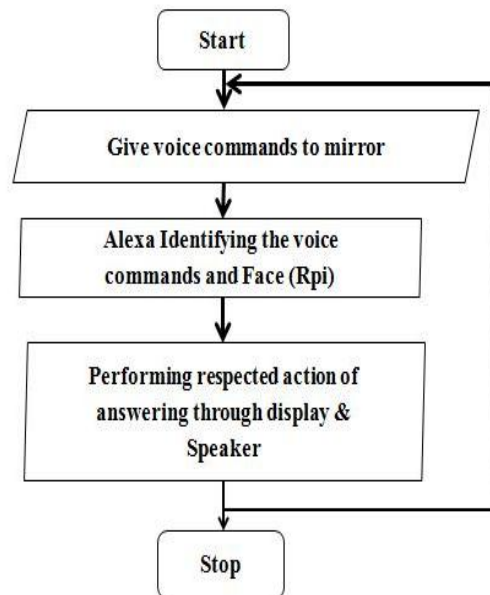

Figure 3 Flowchart of Project

Below are some questions you can ask to "Alexa"

1. Alexa turn to volume 7.

2. Alexa turn of the lights.

3. Alexa tell me a joke.

4. Alexa make a call.

5. Alexa make a playlist.

6. Alexa hows the traffic and many more.

- Steps for amazon developer account:

1. Log into your Amazon Developer Account.

2. Click on the Alexa Tab.

3. Click Register a Product Type > Device.

4. Name your device type and display name (We chose "AlexaPi" for both).

5. Click Next.

6. On the Security Profile screen, slick "Create new profile."

7. Under the General tab, next to "Security Profile Name" name your profile. Do the same for the description. Click Next.

8. Make a note of the Product ID, Client ID, and Client Secret that the site generates for you.

9. Click the Web Settings tab, then click the Edit button next to the profile dropdown.

10. Next to Allowed Origins, click, "Add Another" and type in: https://localhost:3000.

11. Next to Allowed Return URLs, click "Add Another" and type in: https://localhost:3000/authresponse Click Next when you're done.

VII RESULT AND DISCUSSION

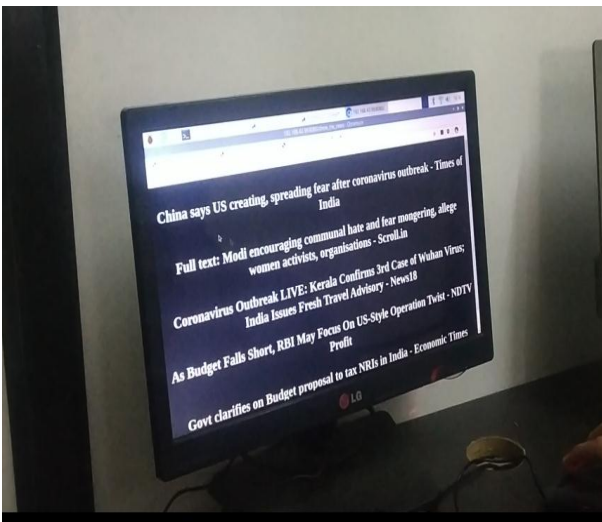Below are the some images shows the results of our project

Figure 4. News on monitor

The smart mirror will display the news feed and other information as shown in figure. The motion sensor will be in top of the screen.
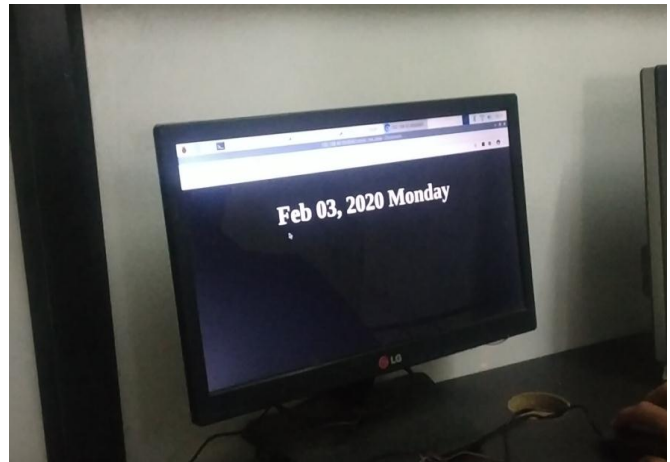

Figure 5. Raspberry pi 4 with Alexa

Figure 6. Dates on monitor

In python coding the algorithms and functions are set and according to that it displays the information on screen. By using flask web framework the widgets are displayed on the monitor screen. At minimum budget the mirror has been deployed. In future by using microphone a voice recognition feature can be added for the enhancement of the project as well instead of monitor screen a touch screen can be used. Hence this project has enough futuristic applications.

VIII APPLICATIONS

It can used in at Office for information purpose

At Home & Vehicles.

Informative.

Home Decor, Smart Home.

Advantages:

Interactive.

Easy life.

Security.

Future technology.

Time saving.

User also use some command something interesting, such as:

"What the latest movies?"

"Play me a song" "Inspire me"

"Set an alarm"

Every command should be start with a wake word "ALEXA" after that it will blink the LED 1 then user may ask any command. After fetching answer the alexa will answer after 4-5 second.

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