



IOT BASED SMART MIRROR WITH VOICE ASSISTANT

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Abstract: The paper describes the overall working and design of the Smart Mirror. In today's constantly changing world, anything that makes us work efficiently is of great value. This is where Smart Mirror comes into the picture. Smart Mirror is designed with the innovative idea of having every bit of information such as weather, time, date, news, etc. which is fetched from the internet using API keys on the screen while we're getting ready in front of the mirror. The Smart mirror constitutes a two-way mirror, LCD monitor, and a Raspberry Pi which is connected to the monitor using an HDMI cable. The Raspberry Pi has inbuilt Wi-Fi and Bluetooth and is encoded with different modules that manage the data displayed on the screen. The mirror also consists of a microphone to control it using voice commands and remote control to navigate the modules. With this kind of extensive variety of features, the Smart Mirror will absolutely turn out to be an important part of an era in future times.

Keywords - Smart Mirror, IOT, Raspberry PI, Microphone, Remote-Control, Two-way mirror, LCD Display, Voice Control, Google Assistant.

I. INTRODUCTION

The world has changed drastically over the past 20 years. We used to have to wait for newspapers to come in or watch the television to get updates on daily news or weather. 20 years ago, nobody would have thought that we would be having groceries delivered to our place and have medical consultations with doctors without having to visit the hospital. Now, just with the internet and a smart phone, we have the world in our hands.

Technologies are evolving day by day. Smart Mirror is one of those technologies. While we used to look at the mirror just to check our reflection to see how we look at the moment, A Smart Mirror is a technology which comes with smart features, it interacts with its users and displays date, time, weather, news etc. as per the user's needs.

With a huge number of research done on Smart Mirrors, it can be concluded that Smart mirror comes with various possibilities. A mirror initially developed with just the idea of displaying date and time can be further modified into anything the user wants. We can add features like home appliances control like turning the lights on and off with either with voice control or remote control. This interactive mirror can also be used by students to set reminders for their assignments, school events etc. With camera embedded, the mirror can have features of face recognition where only an authorized user can enter and see the synced data, mirrors with 3D cameras can give you a quick body scan and basic data like BMI, height, hence can be used in health sector, with motion sensors, the mirror can work as a thief detection system.

II. LITERATURE SURVEY

Smart mirror [1][22] comes with an elegant two-way mirror frame which has a monitor and is connected to the Raspberry pi via HDMI cable. The Raspberry Pi has inbuilt Wi-Fi and is encoded with various modules that are used to display data fetched from the internet on the screen. This mirror comes with basic features like date, time, weather, local news, compliments, upcoming holidays etc.

[2][3] has all the basic features like date time, weather, local news, compliments, upcoming holidays and additional features like Google map, voice control to show and hide different modules and zoom in and out of different locations.[3] has one additional feature QR code which gives you access to connect your phones to the mirror and have it act as a remote control.

[4] comes with all the basic features like date, time, weather, news, upcoming holidays, compliments and additional features like displaying pictures synced through your phone and other display services like YouTube videos, Google maps etc. The author also discusses further possibilities of the mirror and how it can be integrated with thief detection system.

Along with the basic features like date, time, compliments, news, upcoming holidays, weather and so on, [5] Also allows the user to set reminders on upcoming events, daily plan and refreshes and filters it according to time. This mirror is also smart enough to detect moist conditions, screen the temperature and alert the user to prevent damage.

[6] [14] are more focused on literature review where the author discussed about different papers on Smart Mirror and how the mirror has evolved with time. Where in the past, the most the mirror could display was date, time, weather and news, the applications of Smart Mirror have increased widely with time. With different sensors added, the mirror can also be used in various fields like medicine, fashion, education, entertainment etc.

[7] is mostly controlled via voice control. It can set reminders for upcoming events, appointments, show date, time, news, weather, twitter and also shows pictures from the phone synced to the mirror on command. The mirror also has text feature and can also give output in the form of voice.

[8] has a feature that acts like a personal assistant, it responds to user commands like time, date, weather, emails, news, event reminders etc. The product, being linked to an android device also, can also be updated with academic notices hence acting like a notice board.

[9] [23] has all the basic features like date, time, weather, current news and additional features like voice control, home appliance control and IR frames which provides touch ability to the mirror. [23] With a camera embedded inside the mirror, it also acts as a thief detection system which will be able to send alert of the intrusion. Since the camera is hidden inside the mirror, the intruder cannot see it hence they won't be able to destroy evidence either.

Along with basic features, [10] provides additional features stocks, SoundCloud, Maps, Giphy, YouTube, Calendar, Timer, Reminder, Geolocation, Motion detection and Remote login and auto sleep mode background services run in low power. Auto sleep mode can be controlled using voice control. This mirror consists of three modes: Independent mode (displays information of when the device was still online), Internet mode (since the system is online, it displays the current updated data) and Health monitoring mode (health data of the user is displayed through health monitoring sensor). Health monitoring mode can be controlled through voice command.

[11] is embedded with all the basic features (date, time, weather, local news etc.). The authors also analyzed people's needs and added the mirror with additional features like camera that records a one second video every day and another feature that updates you on various games and sports.

MirrorMe [12] is the name of the mirror described in this article. It consists of all the basic features like date, time, calendar, weather, compliments, news, YouTube, maps, set reminders, Gmail, stock exchange that can be controlled via voice control but what makes it more special is its additional features that is face recognition which is required to access all features and data from the mirror. This adds extra security to the mirror.

In [13], the author focuses on the use of smart mirror to enhance learning. Along with the basic features (date, time, news etc.) that are already there, Smart Mirror can be used as a source to enhance student learning. To increase interaction with its user's, the mirror is embedded with a camera and voice control. The mirror can be used to display class routines, upcoming deadlines, notes that can be updated via voice recognition. The mirror turns on when it senses a presence near the mirror and turns off automatically when there is no one around. This feature works with the installed camera that can detect objects.

[15] [24] is embedded with a Home automation system. As listed in the above papers, the author states that the basic features like date, time, weather etc. displayed in the screen does make the mirror smart, however there are other additional features that make the mirror way smarter and how we can make most of it. A microphone embedded to it makes the mirror act according to the user's commands. Another thing the author discusses is using IOT for Home Automation e.g.: Our houses could automatically open and close the doors and windows according to weather conditions, or automatically switch on and off the lights according to the time of day. [24] The sensors embedded automatically turns off the mirror when the user is not around resulting in less power consumption.

[16] Focuses on monitoring health status using an IOT based smart fitness mirror. It consists of a number of sensors to calculate the BMI and body fat of the user. The ultrasonic sensor and the load sensors present in the mirror helps the user to measure their height and weight simultaneously. It also consists of an IR temperature sensor to monitor the body temperature of the user. The author states that the system is able to provide an accuracy of 92.5% and 93.7% accuracy in calculating the BMI and height of the user respectively, whereas a total accuracy of 95.3% was found in measuring the temperature of the user.

[17] focuses more face recognition, to-do list and can recognize one's emotion through the camera. They have used the broadcastTodoList() function to display the To-do List found in the Firebase Realtime Database.

[18] is similar to paper [1], this mirror also includes basic features like date, time, weather, local news, compliments, upcoming holidays etc. The additional module in the mirror is booking an uber as soon as you leave the house. This mirror also consists of an optical screen to navigate the mirror as using a normal screen could leave fingerprints in the mirror.

[25] consists of time and location information, weather condition, news feed, and road map for navigation by using Raspberry Pi 3 micro- controller card. The mirror provides access to different services using Voice control features. The mirror consists of Google Map application which is directly displayed to the mirror of the vehicle. It reduces the need to use mobile phones thus resulting in less road accidents.

III. MODULES

A. Calendar

This is a default module that displays holidays in India throughout the year. The data on holidays is fetched from OpenWeather website.

B. News Feed

This is a default module that displays the updated news from Indian Times. The data is fetched from EconomicTimes website.

C. Update Notification

This is a default module which alerts the user every time there is a software update available

D. Remote Control

This module allows us to control the different features of Smart Mirror like display and hide modules or shutdown or restart the mirror through any device (smart phone, tablet, monitor).

E. Compliments

This is a default module that displays compliments. The compliments change throughout the day. This is a default module that displays compliments. The compliments change throughout the day as shown in the picture below.

F. Clock

This is one of the default modules that displays the updated date and time fetched from the device that the code is executed in.

G. Current Weather

This is a default module that displays the current weather of the location that is set by the user on the code. In this project we chose Bangalore as our location. The required data like locationID and apiKey was fetched from OpenWeather website.

H. Weather Forecast

This is a default module that displays the weekly weather forecast of the location that is set by the user on the code. In this project we chose Bangalore as our location. The required data like locationID and apiKey was fetched from OpenWeather website.

I. Google Assistant

This is a voice control module which allows the user to invoke the Google Assistant and interact with it using voice commands. It can be used to open websites, maps, YouTube and anything available on the internet.

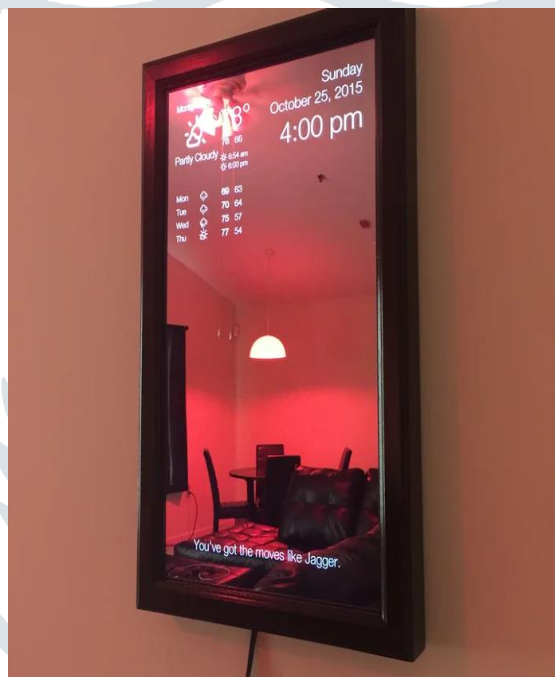


Fig. 1. smart mirror (Demo)

IV. ADVANTAGES AND DISADVANTAGES**A. Advantages**

- Easy to communicate
- Time saving
- User friendly
- Voice input
- Very low power consumption
- Can be customized as per the user's needs

B. Disadvantages

- Swipe gestures can be unreliable and can leave fingerprints on the mirror.
- Lack of human interaction.
- Can be quite expensive due to its engineering and materials used.

V. APPLICATIONS

- In the automotive sector using advanced electronic technologies such as Wi-Fi connectivity, integrated sensor systems to further improve road safety.

- Household: It can assist us in making plans for our day-to-day activities by means of checking weather, time, mails, news and so on.
- Medical & healthcare: It can be used as a health assistant. Using a 3D body scanner, the mirror can be used to have a deep scan of your body measuring height, weight, body mass index, etc.
- Fashion sector: It can be used for realistic, real-time virtual try-on of various products such as make-up, jewellery, glasses and eyewear, and more.
- Example: Noyal Technologies, a Calgary-based company was invited by Visa and Monse to work on an innovative iMirror that would allow users to view and purchase items through the touchscreen mirror. The mirror's underlying technology equips it to collect customer data such as shopping habits, colors, styles, and trends to help you shop better.
- Education: The smart mirror can be used by students to set reminders for upcoming school events like exams, assignments list, etc. This will help students to manage their schedules easily and complete tasks more conveniently.

VI. HARDWARE

- Wooden Frame, which holds the rest of the hardware.
- Two-way glass mirror: The two-way glass mirror has two distinct sides, there's one bright reflective side and the other side that's darker. The darker side should be facing back in a hollow frame.
- Raspberry Pi 4 Model B, 1GB RAM, which is the latest model and the most powerful variant available currently.
- Dell 1920f 18.5 Inch Monitor, Resolution - 1366 X 768 at 60Hz is used which is connected to the Raspberry Pi. It is the monitor screen which enables the data to be visible through the two-way mirror.
- Frontech Multimedia Speaker SW-0081, Power Supply- USB 5V, Output Power - 3W x 2, Source Input – AUX. These USB powered speakers enable the output audio to be heard by the user while interacting with the Smart Mirror.
- Raspberry Pi USB 2.0 Mini Microphone is used for detecting the input audio from the user while invoking Google Assistant and interacting with the Smart Mirror using voice commands.
- HDMI to VGA Convertor for Connecting Raspberry Pi to the LCD Display.
- USB Extension Cable for better flexibility for placing the Microphone.
- 5V ~ 3A Adapter which serves as the power source for the Raspberry Pi.

VII. METHODOLOGY

The Raspberry Pi has a Mini Microphone, 3W X 2 Speakers, LCD display and a wireless keyboard and mouse connected as its peripherals. The Raspberry Pi runs on the Raspberry Pi OS loaded in the 16GB SD card JavaScript, HTML, CSS, Python and Node.js programming tools are used for the smart mirror's software. The package manager that runs the software and is responsible for error handling is called "npm". Advanced process manager for production of Node.js applications with load balancer called "pm2" is used to keep the process of the software alive and restart the process if it goes down. It is configured to start the Smart mirror software to run on boot of the Raspberry Pi.

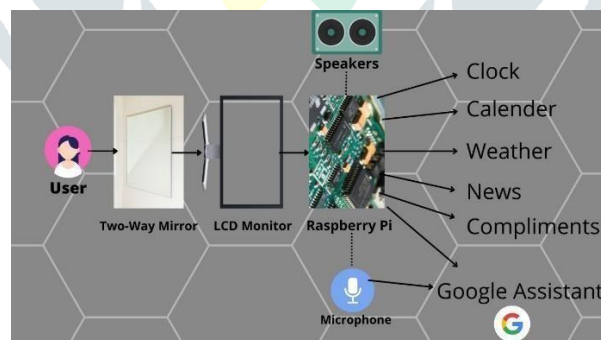


Fig. 2. working of smart mirror

Note: It requires working internet connection using Wi-Fi for the software to function as intended.

Once the Smart Mirror is switched on, the Raspberry Pi OS boots up and the pm2 process manager starts the npm package manager to run the Smart Mirror Software on boot. The software runs and displays all the modules on the screen. The Google Voice Assistant can be invoked using the hotwords "Jarvis" or "Okay Google". These hotwords are detected by the microphone that starts the Google Assistant. It can be used to ask anything that you would ask a normal Google Assistant on an Android phone. You can ask for directions, play videos, music, weather and many more.

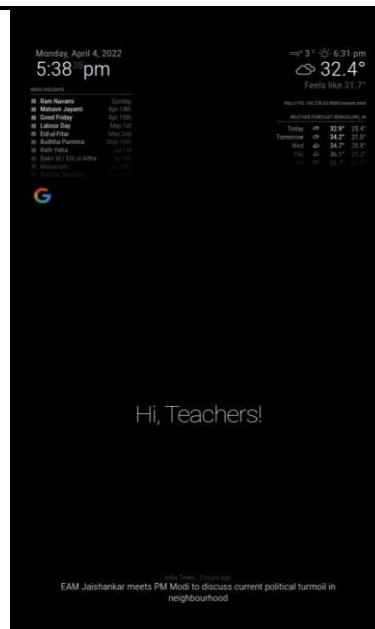


Fig. 3. screenshot of software design



Fig. 4. snapshot of hardware inside the wooden frame



Fig. 5. snapshot of working smart mirror

VIII. CONCLUSION

As convenient and futuristic the mirror is, we encountered certain difficulties while modeling the Mirror. We used Raspberry Pi 4, which is the latest model and is fully compatible with the HDMI output screen. However, since we used an LCD monitor which had a VGA port, we had to use an HDMI to VGA converter which detected the input but always gave 'out of range' error as the resolution was not compatible.

Another problem we faced was with the reflection of the two-way mirror because it is not as good as a normal mirror and sometimes if we look closely, we can see what is behind the mirror like, the LCD screen frame. Despite certain difficulties faced, the final result was worth the effort. Since the Mirror comes with various possibilities, we can modify it the way we want and add additional features like face recognition, home automation system, etc. in future.

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