Raspberry Pi Based Intelligent Mirror for Facial Recognition

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ABSTRACT

This paper talks about a smart mirror built using a Raspberry Pi and facial recognition technology. The mirror doesn't just show your reflection—it also gives you useful information like the weather, time, news, and reminders. It uses a Raspberry Pi computer to run the system and OpenCV software to recognize faces in real time. A camera hidden behind the mirror can recognize who is standing in front of it and show personalized content without needing any buttons or touch. This smart mirror is designed to make daily life easier and shows how Internet of Things (IoT) technology can be used at home. The project uses affordable parts and free software to create a helpful, easy-to-use device.

General Terms
Internet of Things, Facial Recognition, Smart Mirror, Raspberry Pi

Keywords

Smart Mirror, Raspberry Pi, Face Recognition, IoT, Home Automation

1. INTRODUCTION

A smart mirror is a special kind of mirror that uses technology to do more than just show your reflection. It can also show helpful information like the weather, news, time, or personal reminders. This makes daily routines easier and more fun. This project uses a Raspberry Pi, which is a small and low-cost computer, to build the smart mirror. The Raspberry Pi is powerful enough to run different features like facial recognition, voice control, and showing content for each user. It also lets you connect cameras, sensors, and the internet to the mirror. This smart mirror is a great example of how we can use simple technology in everyday life. It combines style and smart features in one device. Because Raspberry Pi uses open-source software, it's easy to improve and add new features over time.

This smart mirror uses facial recognition to recognize who is standing in front of it. With a camera and smart computer programs, it can tell different people apart and show them personalized information like the weather, calendar events, and reminders. This makes the mirror more useful and interesting because it gives each person the information they care about. Besides facial recognition, the mirror can

also be controlled in other ways, like using hand gestures, a touchscreen, or a phone app. These options make it easy for anyone to use. So, instead of just showing your reflection, the smart mirror helps you stay organized and informed. This report talks about how the smart mirror is built using a Raspberry Pi, how it works, and how facial recognition helps make the experience more personal. It also looks at other ways to improve how users can interact with the mirror.

2. LITERATURE SURVEY

Varsha Singh: She made a smart mirror that shows the weather, Twitter, news, calendar, and to-do list. It helps people stay updated with important daily tasks. You can see everything you need to know in the morning just by looking at the mirror.

1. Raju Nadaf: Designed a mirror that adds security by sensing movement around it.

It can notice if someone walks by or enters the room. This is useful for homes, especially when no one is around. It uses a Raspberry Pi to control the system and camera.The mirror is both smart and protective .built a smart mirror that can watch for movement around it to help with security.

2. Derrick Gold: Made a magic mirror that users can interact with easily.

You can use your voice or touch to ask for info like weather, time, or reminders.It's helpful for people who want quick access to daily updates. The design is simple but very useful for daily life.It makes using technology feel more natural and fun.

3. Kun Jin: Created a smart mirror that works with other smart home devices.

You can control things like lights, fans, or temperature from the mirror.It's great for people who like smart homes and automation.It makes life easier and more connected.The mirror turns into a control center for your house.

4. Ayushman Johri: Designed a mirror that shows useful things like date, time, news, and weather.

It helps people save time while getting ready in the morning.

You don't have to check your phone again and again. All the important updates are right in front of you.It's a smart and simple solution for daily use.

5. Charles Njaka: Built a mirror that is smart and also focused on safety.

It helps people stay informed and feel secure.The mirror includes features that make life more convenient. It's more than a regular mirror—it's like a digital helper. It's designed to fit into modern smart homes.

6. R Akshay: Improved the smart mirror by adding better and new features.

The goal was to make the mirror easier and more fun to use. It may include brighter displays, better response, or more functions. The design focuses on both looks and usefulness. This makes the mirror a better daily tool.

7. Mohammed Ghazal: Designed a smart mirror to give helpful services in the home.

3. METHODOLOGY

1. System Planning and Design
- First, decide what features the smart mirror will have (like weather, time, facial recognition, calendar, etc.).
- Make a list of all the hardware and software needed.
- Plan how the mirror will look and how users will interact with it (touch, voice, or gestures).

2. Hardware Setup
- Use a Raspberry Pi as the brain of the smart mirror.
- Connect a monitor or screen behind a two-way mirror glass.
- Attach a camera module to the Raspberry Pi for facial recognition.
- Add other parts if needed, like speakers, mic, or motion sensors.

3. Installing the Operating System
- Install Raspberry Pi OS (formerly Raspbian) on an SD card.
- Insert the SD card into the Raspberry Pi and boot it up.

- Connect the Raspberry Pi to the internet via Wi-Fi or LAN.

4. Facial Recognition Integration:
- Install libraries like OpenCV and face recognition in Python.
- Train the system by saving sample images of users' faces.
- The camera captures a face and compares it to the saved ones.
- If it matches, it shows personal content (like user's name, reminders, etc.)

5. Software Programming:
- Use Python to write the main program: o Capture images from the camera.

  o Process face recognition.
  o Show different content for each user.

6. Final Setup and mounting:
- Place all the parts inside a wooden or plastic frame.
- Mount the mirror on a wall or place it on a table.
- Power it up and enjoy your smart, intelligent mirror.

7. Install Software:

- Install Raspberry Pi OS on the device.
- Use a smart mirror framework like MagicMirror².
- Add modules to show clock, weather, calendar, news, and more.

8.Connect to the Internet:

- Make sure the Raspberry Pi is connected to Wi-Fi.
- This is needed to show live updates like weather, news, and calendar.

MAJOR COMPONENT:

Fig.: **Raspberry pi**

Raspberry Pi Model: Use Raspberry Pi 3, 4, or a newer one **Charger:**

- For Raspberry Pi 3, use a 5V, 2.5A charger.
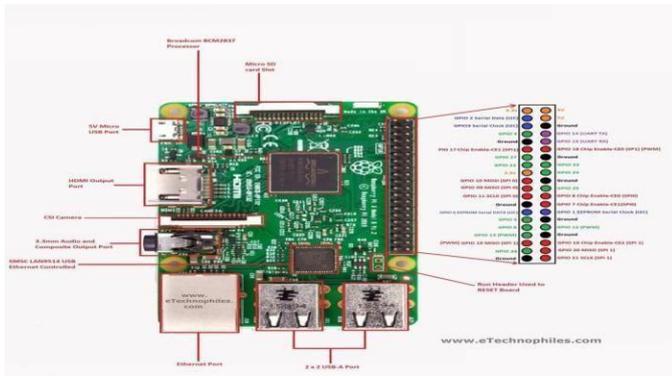- For Raspberry Pi 4, use a 5V, 3A charger.

Fig**: Pin diagram of Raspberry pi**

Fig: PIR Sensor

- This is a PIR sensor (Passive Infrared sensor). It's a small electronic device that can detect movement of people or animals.
- Uses:
- Automatic lights (lights turn on when you walk in)
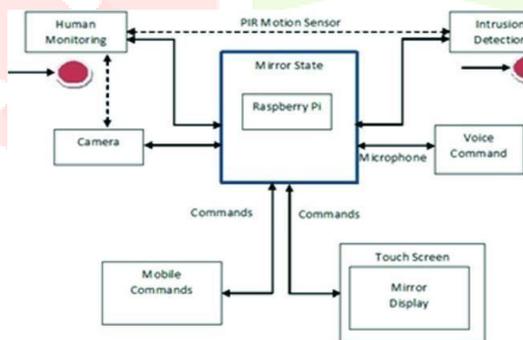- Security alarms
- Smart home devices

BLOCK DIAGRAM:

Fig: Block Diagram

This is a smart mirror system using a
Raspberry Pi (a small computer) to control
everything. Here's what each part does:

- PIR Motion Sensor Detects movement near the mirror.
- Human Monitoring & Intrusion Detection Uses motion data to see if a person is in front or if someone tries to break in.
- Camera
  Takes pictures or videos based on motion or commands.

- Microphone & Voice Command.
  You can talk to the mirror to give it commands.
- Touch Screen Display
  Shows information on the mirror and lets you touch to control it.

- Mobile Commands
  You can also control the mirror using your phone.
- Raspberry Pi (Mirror State)
  It is the brain. It connects and controls all the part

- **Circuit Diagram**
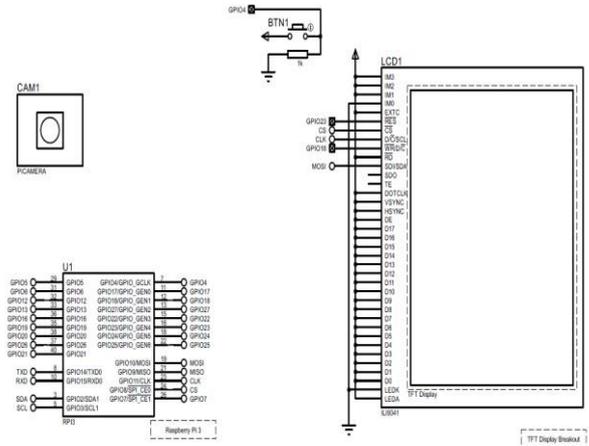
A hardware prototype was built using various electronic components having the values which were tested and approved by the simulation process. LCD screen was used to display the results obtained. The observations ahead show the results of hardware implementation.

- There is a computer screen (like a monitor or tablet) placed behind a special mirror.
- The mirror lets the screen's text and images shine through, but still works like a regular mirror.
- A Raspberry Pi (a small, cheap computer) runs the software to display things like the time, date, weather, or messages.

RESULT AND DISCUSSION:

1. Users see personalized content, which helps make their daily routine faster and more fun
2. Important info like the weather, calendar, and reminders can be seen right away—no need to check your phone or other devices.
3. You can control smart home devices (like lights or thermostat) directly from the mirror, making life more convenient.
4. The mirror can learn from how you use it, so it gets smarter and more helpful over time.
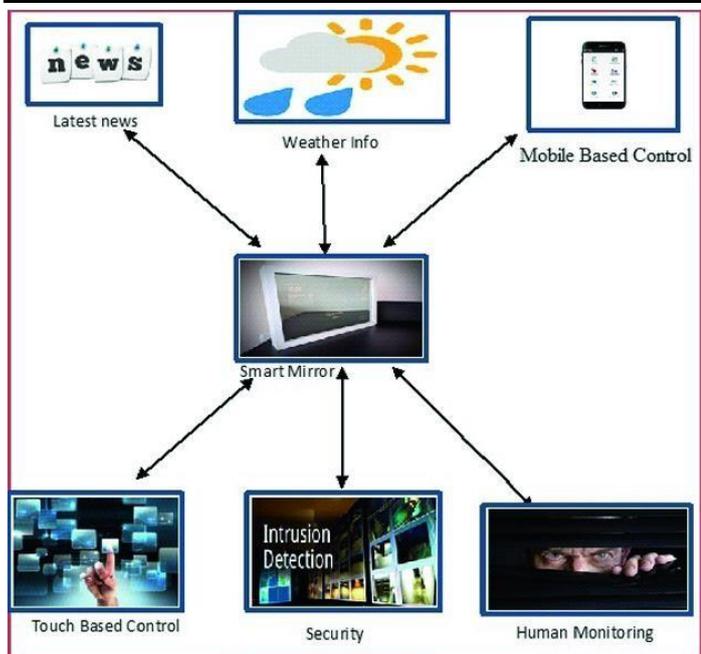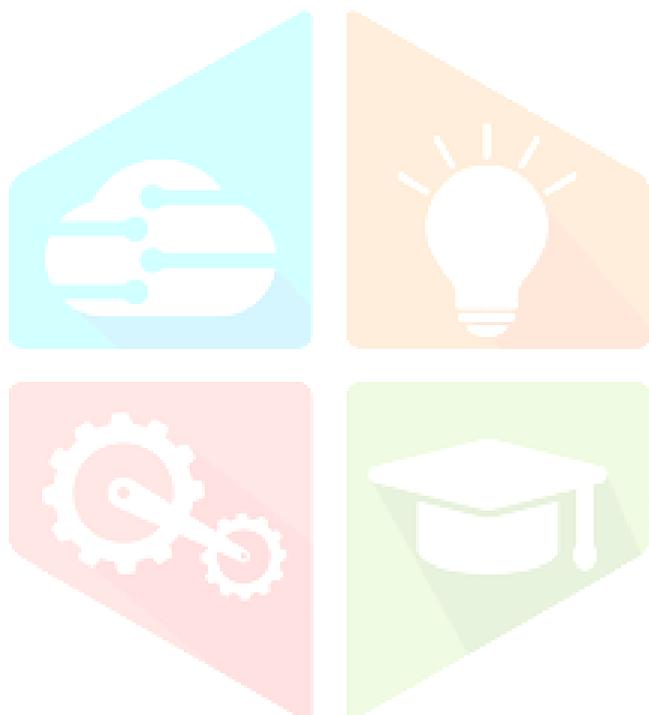
Fig: Smart Mirror

CONCLUSION:

The Raspberry Pi-based smart mirror we developed represents a significant innovation in integrating technology into everyday life. By combining facial recognition with personalized information display, this project enhances user interaction and convenience, transforming a traditional mirror into a multifunctional smart device. The ability to access tailored content, control smart home systems, and engage with various applications demonstrates the potential of DIY technology solutions. Additionally, the project provides valuable insights into programming, hardware integration, and user experience design. As we move forward, further enhancements and features can be added, making the smart mirror an ever- evolving tool that meets the changing needs of its users while addressing important considerations regarding privacy and data security.

REFERENCE:

[1] Magic Mirror Guides – Step-by-step instructions on how to install and set up the smart mirror software, plus info about extra features you can add.

[2] Dlib Library Help – Guides and example codes to help you use face recognition in your mirror.

[3] YouTube Videos – Many creators show how to build smart mirrors and add face recognition, explained in easy video tutorials.

[4] Raspberry Pi Guides – Official tips and help for setting up and using Raspberry Pi, including how to connect hardware and install software

[5] GitHub Projects – Free code and ideas from other people who made similar smart mirrors with face recognition.

[6]

Online Communities – Forums like Raspberry Pi Forums and Reddit where you can ask questions and get help from others doing the same project.