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Smart Mirror Using IoT

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ABSTRACT: The technology becomes more and more advanced with time, automations are taking over our day to day lives. More and more innovations are being done in this space to enable people getting exposed to technology and in turn live a tech-supported Lifestyle. This research paper proposes a model of a Smart mirror which is a normal mirror but with which the user can interact. The proposed model is robust and full of features which can directly used in a person's day to day life. The proposed model consists of two sub systems namely software and hardware. The hardware subsystem of the model includes Raspberry Pi and a few components. While the software sub system enables the functioning of the proposed system. The core of the smart mirror is a magic mirror model which can stores all the APIs are critical as the help in fetching real time information. The proposed model has features like calendar, to do list, Weather Forecast, News, taking selfie etc. The model can be scaled to add as many features as one can in order to make it customized. The ability of the proposed model to use APIs and add more features makes it more robust and cost-effective in general.

KEYWORDS: Raspberry Pi, Calendar, To Do List, Weather Forecast, News, Taking Selfie, Authentication, Two way mirror.

I. INTRODUCTION

The emergence of the Internet of Things (IoT) has catalyzed a technological revolution, ushering in a new era of interconnected devices that seamlessly communicate and enhance our daily lives. Among the myriad applications of IoT, the concept of a smart mirror stands out as a compelling fusion of innovation and practicality. A smart mirror is not merely a reflective surface; it is a sophisticated piece of technology that integrates IoT capabilities to deliver a multifaceted and interactive user experience.

At its core, a smart mirror harnesses the power of embedded sensors, cameras, and connectivity to transform an ordinary reflective surface into a dynamic and intelligent interface. This technological marvel goes beyond the traditional notion of a mirror, offering users a portal to real-time information, personalized data, and interactive features. The integration of IoT allows the smart mirror to connect with other smart devices, creating a seamless network that enhances the overall user experience. Imagine a mirror that not only reflects your physical appearance but also displays pertinent information such as weather updates, calendar events, and news headlines. This amalgamation of the physical and digital realms is made possible by IoT-enabled sensors that gather data from various sources, enabling the smart mirror to provide relevant and timely information. The user, therefore, experiences a convergence of their reflection with a personalized digital dashboard, creating a harmonious blend of aesthetics and functionality.

Moreover, the smart mirror serves as a hub for home automation, allowing users to control smart devices within their living spaces. With built-in voice recognition and gesture controls, the mirror becomes an intuitive interface for managing connected devices, adjusting smart lighting, or even querying virtual assistants. This level of interactivity transforms the smart mirror into a central command center, streamlining the user's interaction with their IoT ecosystem. The incorporation of biometric sensors further elevates the smart mirror's capabilities. Imagine a mirror that not only reflects your image but also monitors vital health metrics in real-time. With the ability to analyze facial expressions, track changes in skin complexion, or even measure heart rate, the smart mirror becomes a valuable tool for health monitoring and wellness management. This health-centric dimension adds a layer of functionality that extends beyond the traditional scope of mirrors. As we develop deeper into the functionalities of the smart mirror, the customization

aspect emerges as a key feature. Users can tailor the display to suit their preferences, selecting widgets, themes, and information sources that align with their individual needs. This personalization fosters a sense of ownership and enhances the mirror's relevance in the user's daily routine.

II. HISTORY

Smart mirrors represent a fascinating fusion of technology and everyday life, seamlessly integrating digital functionality into a common household item. The history of smart mirrors traces back to the early 21st century when the concept emerged as a futuristic idea in science fiction and speculative discussions. Initially conceptualized as a device capable of displaying information and offering functionalities akin to a smartphone or tablet, the smart mirror gradually evolved from a conceptual novelty into a tangible reality. In the early 2010s, the first prototypes and DIY projects started to surface, showcasing rudimentary versions of what would later become sophisticated smart mirrors. These early iterations often consisted of a two-way mirror with a monitor behind it, displaying basic information like weather updates, calendar schedules, and news headlines. Despite their limited functionality, these early experiments laid the groundwork for further innovation in the field. Companies specializing in home automation and smart technology began to develop polished versions of smart mirrors, equipped with touchscreen interfaces, voice recognition capabilities, and integrated IoT (Internet of Things) connectivity. These modern iterations offer a wide range of features, including personalized health metrics, virtual assistant integration, entertainment options, and smart home control. Today, smart mirrors have become increasingly prevalent in both residential and commercial settings, revolutionizing traditional mirror functionality. In homes, they serve as multifunctional hubs, providing users with convenient access to information, entertainment, and home automation controls right from their reflection. In commercial spaces such as retail stores and hospitality venues, smart mirrors offer interactive experiences, enabling customers to virtually try on clothing, access product information, and even place orders seamlessly. Looking ahead, the trajectory of smart mirrors seems poised for further innovation and integration into everyday life. With advancements in AI, augmented reality, and sensor technology, future iterations of smart mirrors hold the promise of even more immersive and personalized experiences, blurring the lines between the physical and digital worlds.

III. MAIN OBJECTIVE OF THE PROJECT

- 1. Information Display:** Display real-time information such as weather updates, news headlines, calendar events, reminders, and traffic updates on the mirror's surface. This provides users with useful information at a glance while they're getting ready in the morning or throughout the day.
- 2. Home Automation Control:** Allow users to control smart home devices such as lights, thermostats, and security cameras directly from the mirror interface. This enables centralized control and monitoring of various IoT devices within the home.
- 3. Personalized Experience:** Customize the mirror's interface to suit individual preferences and needs. This could include displaying personalized greetings, health and fitness data, social media notifications, or recommendations based on user behavior and preferences.
- 4. Voice Assistant Integration:** Integrate voice assistants like Amazon Alexa, Google Assistant, or Apple Siri to enable hands-free operation of the mirror. Users can issue voice commands to access information, control devices, or perform other tasks without needing to touch the mirror.
- 5. Health Monitoring:** Incorporate sensors into the mirror to track health metrics such as weight, body fat percentage, heart rate, and skin condition. The mirror can provide visual feedback on health metrics and track changes over time, promoting health awareness and wellness.
- 6. Interactive Features:** Enable interactive features such as gesture control or touch-screen functionality to navigate through menus, customize settings, or interact with applications displayed on the mirror.
- 7. Integration with Wearable Devices:** Sync with wearable devices such as smartwatches or fitness trackers to display health and activity data directly on the mirror. This allows users to monitor their progress and stay motivated towards their fitness goals.

8. Energy Efficiency: Implement energy-saving features such as motion sensors to activate the display only when someone is in front of the mirror, helping to conserve energy when the mirror is not in use.

9. Security and Privacy: Ensure that data transmitted and displayed on the smart mirror is secure and encrypted to protect user privacy. Incorporate authentication mechanisms to prevent unauthorized access to sensitive information.

10. Customization and Expansion: Provide users with the ability to customize the functionality of the smart mirror through third-party apps, plugins, or extensions. This allows for expansion of features and integration with new IoT devices as they become available.

IV. LITERATURE SURVEY

Newspapers may provide inconvenience in obtaining updated news attributing to the facts that

- a) newspapers have static information, i.e. the information cannot be updated
- b) they cannot compete with the speed of conveying information through digital media (usually, newspapers are distributed once a day).

Certain devices are now coming up with the idea of providing comfortable services to users in their own houses, workplaces as well as for use in the hospitality industries. The Smart Mirror, by Electric Mirror, utilises touch interaction technology with integrated application software support, which is not affordable for consumers. As per the current standards all products in the smart-mirror market are either too expensive or limited to general hobbyists. For example, Samsung Display Co., Ltd. has produced a smart mirror which utilizes Intel® Real Sense™ technology. This technology is bleeding edge and is not easily procurable or affordable for this implementation, currently. This section tells about the hardware and software components used for the proposed system.[1]

1. DESIGN OF A COST-EFFECTIVE SMART MIRROR USING RASPBERRY PI

Smart Mirrors being a subsection home automation, they can be really used efficiently in dealing with home appliances. Voice commands processing using google assistant is the go to approach. Magic mirror module enables seamless integration of the same. In order to take smart mirrors to the next level, techniques like face recognition and recommendation systems can be incorporated to make the mirror more customized. Video streaming platforms like YouTube provide a whole new experience from user's point of view. While Raspberry pi, APIs and the two way mirror remains constant for all prototypes designed in this space, one such thing which can be enhanced further is the display. With the help of Plasma display the mirror can be accommodate each and every minute detail on the screen. Though home automation remains the primary use of smart mirrors. It's application in other sectors cannot go unnoticed. These mirrors can also be used as simulators for students of medicine as well as commercially used for assistance in fitting rooms. The voice command feature is really be a game changer as it allows the user to do a lot of tasks with even less effort Many leading voice assistants are in the market waiting to be used.[2]

2. DESIGN OF THE SMART MIRROR BASED ON RASPBERRY PI

Numerous smart devices that improve our daily lives have been developed as a result of the quick development of technology. One such innovation is the smart mirror, which blends digital capabilities with the functioning of a conventional mirror. The smart mirror monitoring system suggests in this project makes use of a Raspberry Pi, allowing for real-time monitoring and interaction with various data and apps. This project's main goal is to create and put into use a smart mirror that can show a variety of data, including the time, weather updates, calendar events, news feeds, and social network notifications. A Raspberry Pi, a two-way mirror, a display screen, and different temperature sensors are the hardware necessities for this project. The central processing unit, or Raspberry Pi, is in charge of collecting data from sensors, locating pertinent information on the internet, and displaying it on the surface of the mirror. Python will be used to create the smart mirror software system, together with libraries for image processing and data visualization like Open-CV and API for obtaining outside data. Graphical user interface (GUI) frameworks will be used to develop the mirror's user interface in order to make it simple and easy to use.[3]

3. REAL TIME SMART MIRROR SYSTEM USING INTERNET ON THINGS

Smart device configuration figured with interactive media knowledge to give agreeable, advantageous and secure individual administrations in home turns out to be progressively critical in the period of data correspondence innovation. Advanced mirror gives responsive interface to working framework is smart mirror. The mirror with the



glass can be utilized. The graphics on the display come through clearer with two side glasses. Our daily routine life is involved in such a way that optimizing time becomes key factor. On basis of user studies and implementation, the rapid growth of smart devices which gives multiple services of data through a user interface of a mirror. Smart Mirrors will replaces ordinary mirrors used daily provides mirror and PC supported data information to user. This project is collect information from web and can be seen on smart mirror. The result of smart mirror gives the complete information about weather, date, time, mailbox, activity list by using Raspberry Pi 3 card. The face recognition module in implemented for authorized access. This paper shows advanced structure design and use by multiple users which is beneficial for regular life. The technology can be used at workplace to make work easy and time saving. By methods for a RFID pursuer, the intuitive mirror perceives diverse clients through their own corporate ID card, which enables them to approach their customized UI. The advanced mirror gives working environment's indoor conditions individual physical exercise information acquired from wearable gadgets and broadly useful data (for example climate and day by day news). End user can likewise ask the mirror about their positioning position in a reasonable every day that gives social acknowledgment to the most dynamic user. The actualized mirror has been assessed in a one week think about directed in the wild in the working environment premises. The quantitative information assembled all through the investigation, just as the subjective clients' criticism acquired in a post preliminary centre gathering, gave promising discoveries to the acknowledgment and accommodation of such an enticing gadget in the workplace. Moreover, important structure bits of knowledge were gotten for future emphases of the keen mirror that empower. In this paper various tasks are been created using number of increasing functionalities. The information get by using internet on things is proper and accurate. Internets on things are created using the ideas. Internet of Things can be used in daily things also. Device is smarter and make user smarter. It shows date, time and recent update about climates.[4]

V. METHODOLOGY

A. Block diagram

Developing a smart mirror with IoT capabilities combines innovative technology with everyday functionality. The system requirements for such a project involve a blend of hardware and software elements. The hardware components must include a two-way mirror or a regular mirror with a transparent display overlay, a small form-factor computer (like a Raspberry Pi or similar), a high-resolution display panel, and various sensors (such as motion or proximity sensors). These components form the physical foundation for the smart mirror's functionality.

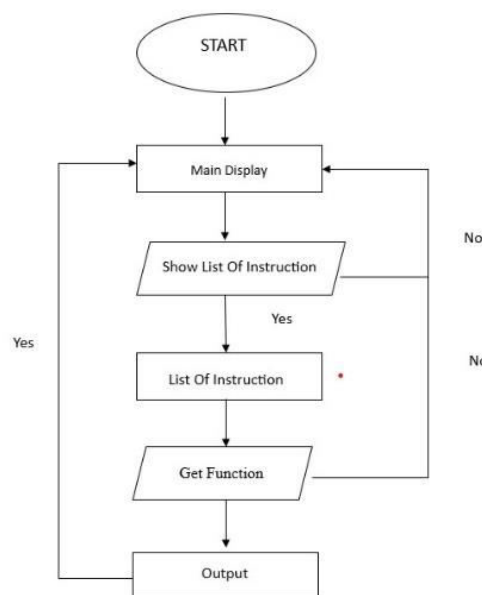


Figure 1. Data flow diagram.

B. Architecture

Define Objectives and Features: Start by determining what you want your smart mirror to do. Common features include displaying the time, weather updates, news headlines, calendar events, and customizable widgets. Define the user experience you want to create.

Select Hardware: Choose the display panel, mirror, and any additional components you'll need. For the display, consider options like a regular LCD monitor or a transparent display for a more seamless look. Ensure that the mirror's reflective surface allows for clear visibility of the display behind it.

Choose Software and Platform: Decide on the software platform you'll use to power your smart mirror. Popular choices include Raspberry Pi with MagicMirror² software or using a customized solution with a microcontroller like Arduino or ESP32. Consider the programming languages and libraries you'll need to achieve your desired functionality.

Design the User Interface: Create a layout for your smart mirror's interface. Consider factors like readability, aesthetics, and usability. You may want to use modules or widgets for different types of information (time, weather, news, etc.). Keep the interface clean and uncluttered for easy viewing.

Assemble Hardware: Install the display panel behind the mirror and connect it to the chosen hardware platform. Ensure that the components are securely mounted and properly connected. Pay attention to cable management to maintain a neat appearance.

Install and Configure Software: Install the chosen software platform on your hardware device. Configure it according to your preferences, including setting up modules for the desired information and customizing the appearance of the interface. Test the functionality to ensure everything is working as expected.

Add Customization and Extensions: Explore additional customization options and extensions to enhance the functionality of your smart mirror. This could include integrating voice control, motion sensors, or IoT devices for added interactivity.

Test and Debug: Thoroughly test your smart mirror to identify any issues or bugs. Ensure that all features work correctly and that the user interface is responsive and intuitive. Debug any problems and make necessary adjustments to improve performance.

Finalize Installation: Once everything is working smoothly, finalize the installation of your smart mirror in its intended location. Consider factors like mounting, power supply, and ambient lighting to optimize visibility and usability.

Iterate and Improve: As you use your smart mirror, gather feedback from users and monitor its performance. Continuously iterate on the design and functionality to address any issues and introduce new features or improvements over time.

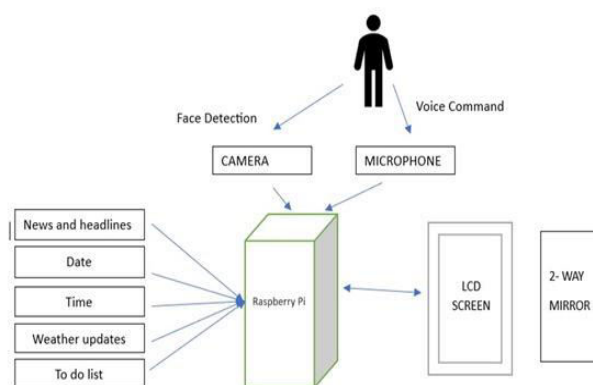


Figure 2. System Architecture

VI. EXISTING SYSTEM

The existing system of a smart mirror integrated with IoT technology combines a traditional reflective surface with modern digital functionalities, creating an interactive and informative display. Utilizing a two-way mirror setup, the mirror conceals a display unit powered by microcontrollers such as Raspberry Pi or Arduino. These microcontrollers facilitate connectivity to the internet via Wi-Fi, allowing access to various APIs and services for real-time data retrieval. Through this connection, the smart mirror can display dynamic content like weather forecasts, news updates, calendar events, and personalized information, transforming the mirror into a hub for information dissemination. IoT sensors integrated within the mirror enable user interaction and environmental monitoring. These sensors may include motion detection, ambient light sensors, or temperature and humidity sensors. The mirror's interface is designed for customization, providing users with the ability to personalize the content and layout according to their preferences.

Moreover, the integration of voice control and gesture recognition enhances the user experience, enabling hands-free interaction with the mirror's interface.

PROPOSED SYSTEM

In proposed work we designed smart, intelligent mirror which uses raspberry pi and STM32 controller. Smart mirror is the combination of Raspberry pi, controller module, wi-fi module and API interface. Controller Module is the core brain of the proposed mirror which is the main part of the system. It consists of two modules in proposed work, one is microcontroller STM32 and another is raspberry pi module. Display module consist of plasma display which is used to see the functional changes with size of 24 inch and 1-way display. Clock module is used for getting exact time and date with the help of CMOS based module. For wireless transmission and reception, we used Wi-Fi module. For hardware and software module connectivity we used programming.

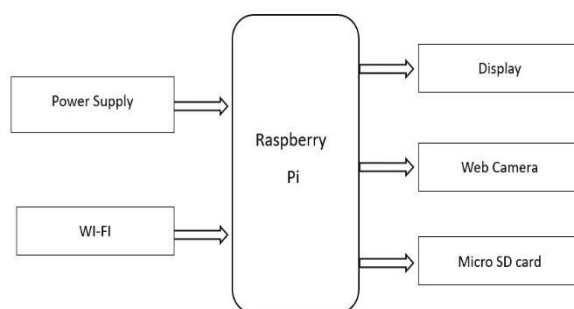


Figure2:Block diagram for proposed system

APPLICATIONS

Home Automation: Control smart home devices like lights, thermostats, and security cameras through the mirror interface.

Personal Assistant: Access calendars, reminders, weather forecasts, and news updates conveniently while getting ready in the morning.

Fitness Monitoring: Display workout routines, track fitness progress, and provide real-time feedback during exercise sessions.

Education: Access educational content, tutorials, and language lessons while getting ready or during leisure time.

Customization: Tailor the mirror's interface and functionalities to suit individual preferences and lifestyle needs.

Weather monitoring: Displays room temperature, atmospheric temperature on real time basis.

Entertainment: Stream videos, listen to music, or catch up on your favorite shows while getting ready or grooming.

ADVANTAGES

- Access information, control devices, and perform tasks hands-free while going about your daily routine.
- Consolidate multiple devices and functionalities into a single mirror, saving space in your home or workspace.
- Provides a wide range of functionalities including weather updates, news, fitness tracking, and more, all within the mirror interface.
- Seamlessly integrate with other smart home devices and services for enhanced automation and control.
- Streamline daily tasks such as getting ready, planning your day, and managing your home with quick access to relevant information and controls.
- Embrace emerging technology trends and innovations by incorporating smart mirror functionalities into your home or business environment.
- Consolidate multiple devices and functionalities into a single mirror, saving space in your home or workspace.
- Provides a wide range of functionalities including weather updates, news, fitness tracking, and more, all within the mirror interface.



VII. CONCLUSION

In smart mirrors offer a myriad of benefits ranging from convenience and space-saving to enhanced functionality and style. By integrating seamlessly into our daily lives, they provide quick access to information, control over devices, and personalized experiences. Whether used for managing daily tasks, staying informed, or simply adding a touch of modernity to living spaces, smart mirrors represent a convergence of technology and design that is both practical and aesthetically pleasing. As the capabilities of smart mirrors continue to evolve, they are poised to become essential fixtures in homes, businesses, and public spaces, offering endless possibilities for customization, efficiency, and innovation.

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