

# IOT Based Smart Mirror Using Raspberry PI

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*Abstract—In today's modern world, Intelligent systems are not only present in the smartphone and tablet-based computers but also in automation of home appliances and industrial machines. More intelligent devices came into existence due to new technological advancements and communication systems. The smart mirror is also an intelligent system that is built with microcontroller to support various applications. It is perfectly suitable for smart homes. Smart mirror has the advantage of small size and less weight and more compact to use and it is suitable for families.*

*Keywords— Smart mirror, Intelligent system*

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## I. INTRODUCTION

Our lifestyle is all connected to the internet in other words Internet has become the essential need of human life. Time management is an important factor in our lives for performing multiple tasks. The smart mirror act as a personal assistant and plays an important role in providing instant updates like current news, daily appointment reminders, time, date, day, temperature, and weather report etc. In this paper a web-based system interfaced with mirror displays information like time, date, news updates. This paper presents the implementation of a smart mirror using IoT using Raspberry Pi controller.

## II. LITERATURE REVIEW

[1] This paper describes the work and application of smart mirrors built using raspberry pi. Smart mirrors can show weather, date, time and updated news with equipped face recognition and voice control features to increase more interactions. The method used is evolutionary prototyping that collects feedback from users. Smart mirror functions to be personal assistant and notice board for users but it has both technical and non-technical issues. The expenses and sturdiness of the equipment is main drawback with the developed system.

[2] The design of the smart mirror is based on raspberry pi4 that is equipped with high technology and innovative applications. Voice information is recognised by Alexa and given to the microphone. LED is turned on while the user is speaking or in answering mode of Alexa. It is also used as a smart home device to operate devices. Smart mirrors are interactive, time-saving, security, and future technology.

[3] The smart mirror future with IoT can be used in smart home where objects will connect to the internal. It was developed to make it easy for users to manage and control objects. This technology is a mirror that can display information needed by the users such as weather forecasts,

the latest news, schedule of activities, and others.

[4] The paper discusses on plan and improvement of an intelligent mixed-media modern smart mirror with manmade reasoning for the surrounding home condition just as for business utilizes in different enterprises. The mirror can incorporate a touch screen to permit direct clients to audit electronic news, data, and projects. The brilliant mirror gives a close to the easy experience that permits the client to simply stroll up and be welcomed with data.

[5] The smart digital mirror contributes to a more time-efficient life. It provides information such as time, date, day, weather, forecast, the remainder for important daily tasks, multimedia news, updates on the user's health status, and recognition of the user's emotion.

[6] Smart mirror, which performs user recognition, face recognition, proximity recognition and registers the health information through a proxy. Health information of the user is stored in real-time, it is analyzed and thereby designing a system for providing a user of the health information and risk areas access service.

[7] The mirrors allow to receive news online and display it on the mirror screen along with other details. It has widgets for displaying the current weather conditions, time, events and latest news headlines. Smart mirrors have great potential to enhance the user experience of accessing and interacting with information and in saving time.

[8] The mirror concedes an interaction through which the users can have access and control to the smart appliances present at homes and also an ingress to personalized services. Whether it is a home or a workspace, it makes all the users pretty convenient to work. Artificial Intelligent system takes voice information as input to identify the registered users. An infrared touch screen technology can be added in the future to make Reflecta better and more interactive.

[9] This mirror provides the users a platform to monitor their health and fitness on daily basis. It employs sensors to monitor Body Mass Index (BMI) and the amount of body fat present in the user's body. A smart home gateway is used to

send these data to a private cloud. Once the user is recognized, the BMI is analyzed and displayed on the mirror.

[10] The smart mirror can display time, weather, temperature, and daily needs based on voice commands, and users can also view Facebook, Gmail, etc. The user can interact with the mirror using voice commands.

[11] The interactive smart mirror based on the raspberry pi is widely used for the home automation through internet. The interaction with the smart mirror is done using a speaker and microphone. The mirror consists of all the basic features like display unit for date and time, news, weather, etc. The additional feature includes in this mirror is a detection module that is used to capture some malicious act in the house.

[12] The smart mirror helps in activating multimedia devices with the help of voice commands making use of google assistant software. This smart mirror can act as a good friend it listens to the user query and responds accordingly. It is more interactive by using the Google Assistant software. Using face detection technology to detect a particular member and can be used in health care. Smart mirrors can be used along with the IoT for enhancing more applications such as home automation.

[13] The smart mirror does smart things like it showing time, date, weather, etc. using raspberry pi. An etcher is a software that is used to burn the OS image to make it compatible to install into a storage disk, here installed Raspbian. Raspbian is the main and basic software for Raspberry Pi devices, supported by the Raspberry Pi Foundation.

[14] The mirror technology is applied to health care to predict and monitor the aspects of health and diseases naturally. This helps in the record and evaluate body position and is mostly used to identify movement and posture issues.

[15] The design and development of smart mirror using raspberry pi, displays information like date, time, news, and needed information and they used voice commands to on and off the mirror.

[16] The smart mirror helps in the constant monitoring of children with high advancement technology. This mirror is firstly targeted for the working parents to monitor their children. The main focus is to save the time of working parents, enable efficient parenting and make day to do life easier and faster which is an integral part of home automation as well.

[17] The mirror has an elegant interface that provides information for multiple users in a home environment. The facial recognition technology is used for security applications using smart mirrors.

[18] The futuristic and interactive smart mirror is used in an ambient home environment. It provides basic common functionalities such as weather of the city, latest updates of news and headlines, and local time corresponding to the location.

[19] The smart mirror is mainly used for the home environment and it is connected to the real world through the internet. The mirror could also support human gestures. The mirror performs some advanced functions such as booking a ride on uber etc. Also, real-time photo editing and synchronisation with other devices supporting home automation.

[20] The concept of smart home-based Internet of Things technology. The smart mirror will provide convenience to the users by managing things and also controlling the usage of electrical appliances in the home with a network connection between the appliances and the smart system.

[21] Smart mirror platform is designed as a lightweight and extensible application. To enhance security purposes, facial recognition system is implemented to achieve privacy and authenticity.

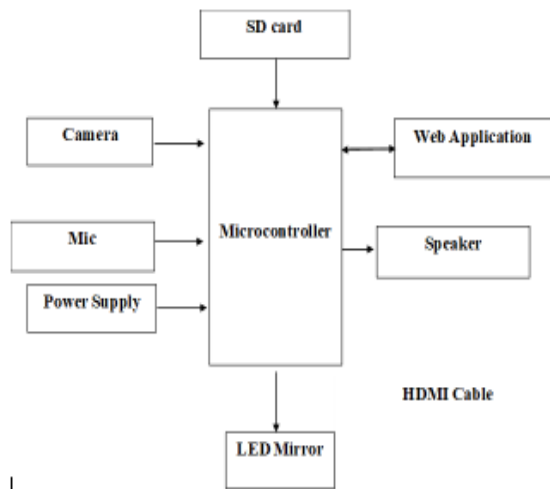
[22] The smart mirror represents an unobtrusive interface for an ambient home environment. Smart mirror using off-the-shelf technologies provides personalized data feeds, camera feeds, and other services in addition to controlling the smart appliances in the household.

[23] The smart mirror helps in providing both the image and information to a user. With the help of this smart mirror, users can gather electronic information. The smart mirror in a power-on mode acts as a display device.

### III. PROPOSED SYSTEM

The smart mirror system consists of a microcontroller, camera, microphone, SD card, speaker, LED mirror display, and web application. The system consists of Raspberry Pi as the heart of the system which can process all the instructions. It is interfaced with a camera, speaker, and display unit. By using weather cloud API, the system extracts the weather report to be displayed in mirror. In the existing system, the microcontroller is interfaced with a camera and display unit. It can display the date, time, and some additional information. In the proposed method, every morning at a specific time system gets ON and displays date, time, and weather with a welcome note, and also whenever the user stands in front of the camera it will recognize the user. For the registered user, it displays time, date, and weather in a mirror display and gives a voice output. In this system instead of ALEXA, ESP Skainet is used for offline voice recognition.

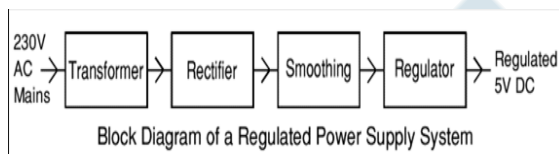
The block diagram of IOT based smart mirror using raspberry pi is shown in figure 3.1. Each block is discussed in detail in the forthcoming section.



**Figure 3.1:** Block Diagram

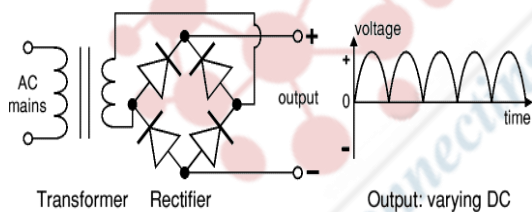
**A. Power supply**

The power supply is a reference to a source of [electrical power](#). Figure 3.2 shows the power supply block. It consists of transformer, rectifier and the filter unit to give a DC supply of 5V.



**Figure 3.2** Block diagram of a Power Supply

Transformers convert AC electricity from one voltage to another with less loss of power. The rectifier block is shown in figure 3.3.



**Figure 3.3** Rectifier

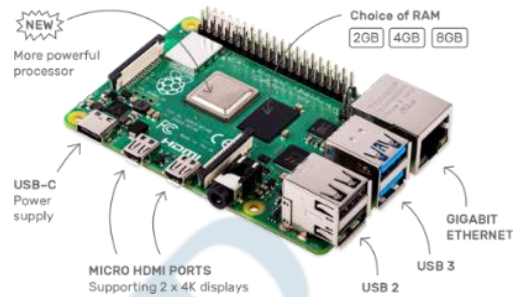
The bridge rectifier is the most important and it produces full-wave varying direct current. A full-wave rectifier can also be made from just two diodes if a centre-tap transformer is used.

**B. Raspberry pi Module**

Raspberry Pi is a series of small single-board computers. The speed and performance of the new Raspberry Pi 4 are a step up from earlier models.

Raspberry Pi 4 has upgraded USB capacity: along with two USB 2 ports, additional USB 3 port is available for transfer of data up to ten times faster. Raspberry Pi 4 comes

with Gigabit Ethernet, along with on-board wireless networking and Bluetooth. The Raspberry Pi 4 model is shown in figure 3.4.



**Figure 3.4** Raspberry pi 4 model b

**C. Camera**

A USB webcam is used to connect the mirror to a computer, usually, through plugging it into a USB port on the machine. It has 8 megapixels with resolution 3280\*2464 and captures video at 1080p30, 720p60 resolutions. Figure 3.5 shows the USB camera used in the smart mirror.



**Figure 3.5** USB Camera

**D. Microphone**

Raspberry Pi USB Plug and Play Desktop Microphone offers compatibility with any plug-and-play enabled Raspberry Pi Model B+, 2 model B, Raspberry Pi 3 as well as it is also compatible with personal computers and Mac.



**Figure 3.6** USB Microphone

**E. Speaker**

Speaker is a device for converting electrical energy into acoustical signal energy that is radiated into a room or open air. If the volume is about halfway (which is still really loud), the current draw is 200-400mA. At maximum volume, current drawn will be up to 1 A. The USB speaker is shown in figure 3.7.



**Figure 3.7** USB Speaker

**F. HDMI Cable**

HDMI stands for High-Definition Multimedia Interface, a standard for simultaneously transmitting digital video and audio from a source, such as a computer or TV cable box, to a computer monitor, TV, or projector.

**G. Two-way Mirror with LED display**

A 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. A LED display is a flat panel display that uses an array of light-emitting diodes as pixels for a video display. Their brightness allows them to be used outdoors where they are visible in the sun for store signs and billboards.

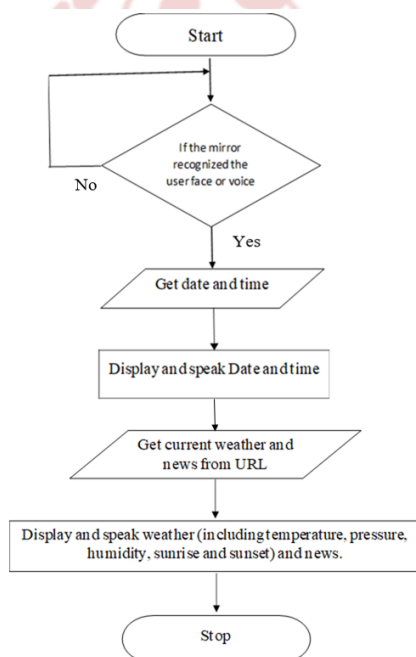


**Figure 3.8** Two-way Mirror with LED display

**H. Driver**

A driver is a circuit or component used to control another circuit or component, such as a high-power transistor, Liquid Crystal Display (LCD), stepper motors, and numerous others. A relay is an electromagnetic switch that use a low voltage circuit to switch on and off.

**I. Flowchart**



**IV. SOFTWARE DESCRIPTION**

**A. Raspbian Jessie:**

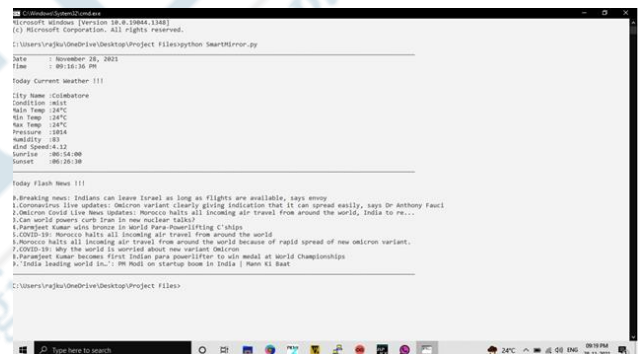
Raspbian Jessie is a full desktop operating system that can perform lots of tasks just like any PC. Along with the common uses, it can also be used in home automation systems as well. Raspbian Jessie is the official operating system for Raspberry Pi.

**B. Weather cloud:**

Weather cloud is a large network of weather stations reporting data in real-time from all over the world. Weather cloud helps you monitor and manage your sensor data through an easy-to-use, highly versatile, and fully customizable platform.

**V. RESULT**

The software part of the system is implemented and the code is simulated using python 3.9 software. The data was collected using the web URL. The system displays date, time, temperature, weather, pressure, humidity, sunrise, sunset, news on the screen with voice output. Figure 5.1 shows the output obtained through software programming of the smart mirror.



**Figure 5.1** Output of Smart Mirror

**VI. CONCLUSION**

The smart mirror developed by a Single board minicomputer is connected to the network via Wi-Fi. Weather information is obtained through API of the weather cloud, date, time, and calendar information are displayed in the monitoring display unit. The user can interact with mobile through APP and can communicate through voice synthesis module. Smart mirror design has advantages like simple to use, low cost, small size, user-friendly, and is suitable for homes.

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