SMART MIRROR USING RASPBERRY PI

A project report submitted in partial fulfillment of the requirements for the award of the Degree of

BACHELOR OF TECHNOLOGY

in

ELECTRONICS AND COMMUNICATION ENGINEERING

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VISAKHAPATNAM – 530045

2016-2020

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CERTIFICATE

This is to certify that the project work entitled ***'SMART MIRROR USING RASPBERRY PI''*** *is a bonafide work carried out by* ***JAKKA SAI GIREESHMA (1210416419), MANDA SAM ROSHAN ISAIAH (1210416446), MOLAKA UDAY KIRAN (1210416435), CHIVUKULA KRISHNA SAI SHANMUK (1210416413)*** *submitted in partial fulfilment of the requirements for the award of the degree of Bachelor of Technology in Electronics and Communication engineering,* ***GITAM Institute of Technology, GITAM deemed to be University****, Visakhapatnam during the academic year 2019-2020.*

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ACKNOWLEDGEMENT

Acknowledgements are always inadequate in a work of this sort and we wish to express our heart-full gratitude to all the people who have made it possible for us to successfully implement the project and to present this report.

'We are immensely thankful to **Dr. L.L.Rajeswara Rao,** Assistant Professor, Department of EECE, **Project guide** who has provided us with enriching guidance and paved a path.

We are thankful to **Dr. D. ELIZABATH RANI** Professor, and **Dr.T.MADHVI** Professor**, Project coordinator** in helping to complete the project by taking frequent reviews and giving the suggestions.

We are also thankful to **Dr.P.V.Y Jaya Sree, Head of Department, ECE,** to provide an opportunity like this to put our theoretical knowledge into practical knowledge.

We express our gratitude towards **GITAM Institute of Technology, GITAM Deemed to be University** for providing the required resource and also the knowledge

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DECLARATION

This is to declare that this report has been written by us. No part of the report is plagiarized from other sources. If any is plagiarized is mentioned in the references or acknowledged.

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ABSTRACT

By the rapid developments of new technologies, monitoring, controlling services have been started to be served along with internet as an instrument providing interaction with machinery and devices. The system can be use in several places like banks, hospital, labs and other sophisticated automated system, which dramatically reduced the hazards of unauthorized entry. The Project, describes the design, construction and working of a Smart Mirror.

Every morning our day begins by watching ourselves at least once in mirror before leaving our homes. We interact with it psychologically to find out how we look and how our attire is. Smart Mirror or Magic Mirror is one of the applications of Raspberry Pie. A computer screen embedded in mirror looks very futuristic. The Raspberry Pie stays at back scenes and controls the data displayed on mirror. While looking at mirror you can look at various notifications from social sites as well news, weather forecast and more things. Such mirrors can be programmed to work as AI and control home appliances by voice input or touch screen. The Raspberry Pie is connected to monitor via HDMI.

The Smart Mirror thus accomplishes this, by still being a mirror without all the technology inside it, making it very approachable to use and integrating seamlessly into our lives. The Smart Mirror has scope in the field of IOT and home automation. The Smart Mirror can be connected to the home appliances, mobile devices, etc. which can expand the functionality of the mirror. The facial recognition technology used can be future enhanced as a means of security. Adding security means that no one can try to access sensitive data that maybe displayed on your mirror via the use of APIs.

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CHAPTER 1

1. INTRODUCTION

Nowadays, the use of the internet can be seen very widespread, and has made it important. This is because the community will now use the internet in various ways. The Internet transforms people's lives more ease by connect with the information such as news and traffic info and others in cyberspace. This can be linked to technology and science. Technology and science have shown widespread improvement in terms of achieving the goal of designing and expanding things that can provide comfort to human life and make it easier.

The standard and quality of life is changing vigorously by the help of interactive computing and embedded systems that are being used in our daily life. A variety of devices and products based on this interactive technology have been introduced to the world. With this kind of artificial intelligence and interactive computing, we are provided with a comfortable, user convenient and a very secure personal service. Whether it is a home or a workspace, it makes all the users pretty convenient to work or enjoy the multimedia. We use the mirror multiple times every day to see if we have dressed well or how our hair looks and even do a lot of grooming in front of it. Smart Mirror is an advancement effort to develop an embedded intelligence onto a mirror and offer enhanced features such as latest news, headlines, weather, and local time corresponding to the user's location. The Smart Mirror is a stepping stone in development of smart homes with the help of embedded artificial intelligence. It's found its applications in various workspaces as well. This project intends to implement an electronic board known as Raspberry Pi 3 board. The main goal of this project was to develop a smart mirror device as well as an operating system to run on similar devices. The device was to look like a regular mirror but would have a screen inside and you would be able to interact with it using voice commands.

Basically, the Smart Mirror consists of a 2-way mirror with a hardware technology including the LCD display and raspberry pi 3 board connected to process the inputs and display the outputs in the LCD screen which tend to appear in the mirror. We believe that the future of the home will

be a brilliantly connected ecosystem of smart technology designed to make your life easier, more enjoyable, and efficient. Obviously there are a ton of opportunities in the home for technology integration but a mirror is one of the best places to start.

A smart mirror is a two-way mirror with an electronic display behind the glass. The display can show the viewer different kinds of information in the form of widgets, such as weather, time, date, and news updates. This product would be useful for busy individuals that want to multitask and stay informed while on the go. Instead of constantly pulling out a device, one could get informed while finishing daily grooming tasks. I designed and built my own prototype and delved into the world of do-it-yourself smart mirrors. Smart Mirror or Magic Mirror is one of the applications of Raspberry Pie. Our project aims to construct a functioning "smart mirror". When not in use, the product looks and functions exactly like a typical mirror.

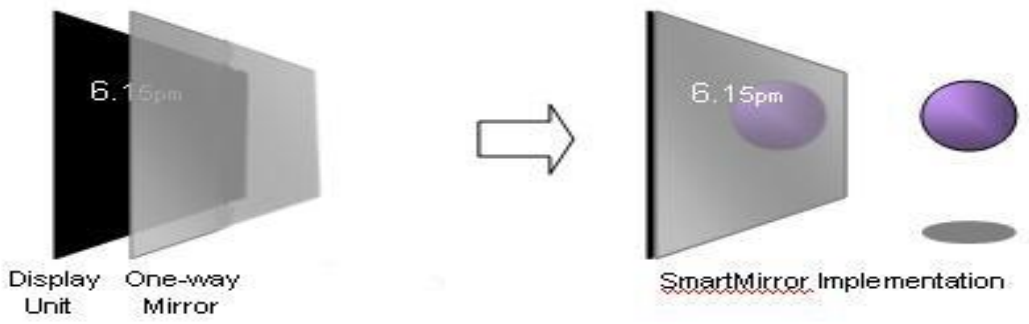


Fig 1 Smart mirror

1.1 IOT

Human-machine interaction (HMI) has become, more realistic in day-to-day life due to the advancement in technology. Today, HMI research has moved one step ahead and switched onto the Internet, which was previously used for communication and now used for things, i.e., IoT (Internet of Things). The aim of this application is to connect any things through the Internet that can be accessed from anywhere.

IoT application is not limited to one particular field. It has shown a significant contribution from small scale applications to the large scale applications such as E-commerce, Coal Mine, Wearable device, Smart Grid, Laboratory Monitoring, Agriculture and many other domains.

The IoT technologies although having evolved over the recent years, most of the earlier work steered towards adopting the IoT technologies for extremely resource contained nodes Home Automation Using Internet of Things like the sensor network node that simply sends collected data to the base station and a little work done on applying IoT technologies into embedded devices around human beings including customer appliances. The IoT application has become popular in this 21st century is due to the dominant use of the internet, the evolution of smart phone technology and raised standards of mobile communication. In this evolutionary field of IoT, there are a lot of sensors present which the user needs to have control. Now to control these sensors a virtual device must be created which in turn provides portability by abstracting each device and operating systems.

Internet of Things(loT) deals with billions of intelligent objects which would be connected to sense & collect the data and also communicate with surrounding people using mobile, wireless and sensor technologies. The main objective of loT is to manage and control physical objects around us in a more intelligent and meaningful manner and also improve quality of life by providing cost-effective living including safety, security, and entertainment. Smart objects gather useful contextual data autonomously and send to remote application servers for offering context-aware or location-based services. The word "context" can refer to any location information, surrounding environment, people & objects that are nearby, etc so that adaptive and personalized services can be provided to the user.

According to CISCO, it is estimated that 50 Billion devices would be connected to the Internet by 2020. Recent advancement in cloud computing and data analytics allows intelligent systems to process and analyze the data in a more efficient manner. Though there are many loT applications, authors propose a unique mobile-based home automation solution that can facilitate people to remotely control home appliances using their personal android smart phones anywhere and anytime. Among many loT applications, smart homes play an important role in realizing smart cities. Smart homes can be used for remotely monitoring and controlling electrical appliances.

China Communication Standards Association gives us a three-layer structure of IoT: The first layer is the sensing layer mainly used for collecting information. The second layer is the network layer used for information transmission and processing; the third layer is the application layer used for storage and decision making. The main concept of IoT is that it can create a virtual connection between a hub or a network and electronic and electrical objects. This virtual connection helps to control, locate, and track down these connected objects. On the basis of device-to-device connectivity concept the development of smart sensors together with communication technologies such as Wi-Fi, Bluetooth, etc. and supported by cloud computing technologies, IoT has become reality and its goal is to make devices more aware, interactive and efficient for a better and safer world.

1.1.1 HISTORY OF IOT

Kevin Ashton, co-founder of the Auto-ID Center at the Massachusetts Institute of Technology (MIT), first mentioned the internet of things in a presentation he made to Procter & Gamble (P&G) in 1999. Wanting to bring radio frequency ID (RFID) to the attention of P&G's senior management, Ashton called his presentation "Internet of Things" to incorporate the cool new trend of 1999: the internet. MIT professor Neil Gershenfeld's book, When Things Start to think, also appeared in 1999. It didn't use the exact term but provided a clear vision of where IoT was headed.

IoT has evolved from the convergence of wireless technologies, microelectromechanical systems (MEMSes), micro services and the internet. The convergence has helped tear down the silos between operational technologies (OT) and information technology (IT), enabling unstructured machine-generated data to be analyzed for insights to drive improvements.

Although Ashton's was the first mention of the internet of things, the idea of connected devices has been around since the 1970s, under the monikers embedded internet and pervasive computing. The first internet appliance, for example, was a Coke machine at Carnegie Mellon University in the early 1980s. Using the web, programmers could check the status of the machine and determine whether there would be a cold drink awaiting them, should they decide to make the trip to the machine.

IoT evolved from M2M communication, i.e., machines connecting to each other via a network without human interaction. M2M refers to connecting a device to the cloud, managing it and collecting data. Taking M2M to the next level, IoT is a sensor network of billions of smart devices that connect people, systems and other applications to collect and share data. As its foundation, M2M offers the connectivity that enables IoT.

1.1.2 WORKING OF IOT

An IoT ecosystem consists of web-enabled smart devices that use embedded systems, such as processors, sensors and communication hardware, to collect, send and act on data they acquire from their environments. IoT devices share the sensor data they collect by connecting to an IoT gateway or other edge device where data is either sent to the cloud to be analyzed or analyzed locally. Sometimes, these devices communicate with other related devices and act on the information they get from one another. The devices do most of the work without human intervention, although people can interact with the devices -- for instance, to set them up, give them instructions or access the data. The connectivity, networking and communication protocols used with these web-enabled devices largely depend on the specific IoT applications deployed.

IoT can also make use of artificial intelligence (AI) and machine learning to aid in making data collecting processes easier and more dynamic.

1.1.3 IMPORTANCE OF IOT

The internet of things helps people live and work smarter, as well as gain complete control over their lives. In addition to offering smart devices to automate homes, IoT is essential to business. IoT provides businesses with a real-time look into how their systems really work, delivering insights into everything from the performance of machines to supply chain and logistics operations.

IoT enables companies to automate processes and reduce labor costs. It also cuts down on waste and improves service delivery, making it less expensive to manufacture and deliver goods, as well as offering transparency into customer transactions.

As such, IoT is one of the most important technologies of everyday life, and it will continue to pick up steam as more businesses realize the potential of connected devices to keep them competitive.

1.1.4 USES OF IOT

COMMUNICATION

IoT encourages the communication between devices, also famously known as Machine-to-Machine (M2M) communication. Because of this, the physical devices are able to stay connected and hence the total transparency is available with lesser inefficiencies and greater quality.

AUTOMATION AND CONTROL

Due to physical objects getting connected and controlled digitally and centrally with wireless infrastructure, there is a large amount of automation and control in the workings. Without human intervention, the machines are able to communicate with each other leading to faster and timely output.

INFORMATION

It is obvious that having more information helps making better decisions. Whether it is mundane decisions as needing to know what to buy at the grocery store or if your company has enough widgets and supplies, knowledge is power and more knowledge is better.

MONITOR

The second most obvious advantage of IoT is monitoring. Knowing the exact quantity of supplies or the air quality in your home, can further provide more information that could not have previously been collected easily. For instance, knowing that you are low on milk or printer ink could save you another trip to the store in the near future. Furthermore, monitoring the expiration of products can and will improve safety.

TIME

As hinted in the previous examples, the amount of time saved because of IoT could be quite large. And in today's modern life, we all could use more time.

MONEY

The biggest advantage of IoT is saving money. If the price of the tagging and monitoring equipment is less than the amount of money saved, then the Internet of Things will be very widely adopted. IoT fundamentally proves to be very helpful to people in their daily routines by making the appliances communicate to each other in an effective manner thereby saving and conserving energy and cost. Allowing the data to be communicated and shared between devices and then translating it into our required way, it makes our systems efficient.

AUTOMATION OF DAILY TASKS LEADS TO BETTER MONITORING OF DEVICES

The IoT allows you to automate and control the tasks that are done on a daily basis, avoiding human intervention. Machine-to-machine communication helps to maintain transparency in the processes. It also leads to uniformity in the tasks. It can also maintain the quality of service. We can also take necessary action in case of emergencies.

EFFICIENT AND SAVES TIME

The machine-to-machine interaction provides better efficiency, hence; accurate results can be obtained fast. This results in saving valuable time. Instead of repeating the same tasks every day, it enables people to do other creative jobs.

SAVES MONEY

Optimum utilization of energy and resources can be achieved by adopting this technology and keeping the devices under surveillance. We can be alerted in case of possible bottlenecks, breakdowns, and damages to the system. Hence, we can save money by using this technology.

BETTER QUALITY OF LIFE

All the applications of this technology culminate in increased comfort, convenience, and better management, thereby improving the quality of life

CHAPTER 2

2. LITERATURE REVIEW

Philips, in 2003, unveiled a product called Mirror TV. It was developed using similar foundation of the current smart or interactive mirrors. The product was basically 2-way mirror placed in front of a normal Television so that it would appear as a reflective mirror when turned off and when turned on, it would work as a normal television.

Philips, again in 2005, released a research project called My-Heart. It was a mirror that showed vital information about the patient. Unlike the Mirror TV, My-Heart would integrate a display under a mirror which displayed various information and medical statistics.

James Law developed a Smart mirror in 2011 that was sold commercially. The mirror was something very similar to the smart mirrors we have today. It consisted of an LCD-display (32 inches) which was behind a 2-way mirror (37 inches). The screen could show various information such as time, weather, and custom widgets. It could also stream the internet or work as a Television whenever wanted. It had a lot of input devices such as a phone application, remote and also an on-screen keyboard.

Microsoft, in 2016, released details regarding an interactive mirror they were developing. The objective wasn't to sell it commercially but was to help everyone build it. They published all the information to build a Smart Mirror and released the source code on a repository on Github which was available to everyone. Users could now build their own mirror as a personal Do-It-Yourself project.

At the 2017 CES Convention, Griffin Technologies showcased their work on a concept of Smart Mirror. The product was called The Connected Mirror. The company built a lot of smart home appliances which be connected to the mirror and it would work as a hub from where everything at home.

Hannah Mittelstaedt made a home mirror. It was posted on reddit website. The mirror used a smart phone as the display screen. Since it was an android tablet so features of android were used to display time, weather, date, remainders. The software made use of android widgets but can be modified easily as it is open source. Anyone can modify it and develop a new version. Home Mirror is a kind of smart mirror that is easier to build than other mirrors as it requires just two main components, any android mobile phone or a tablet and a mirror. However, this too lacked any kind of intelligence or interaction

Michael Teeuw's was the first to build a smart mirror and first to use a raspberry pi for this purpose. The first smart mirror blog was posted back in 2014; since it was a very new product it gained a lot of attention back then. This mirror is built on raspberry pi 2 and uses monitor as the display. It displayed weather and time importing these from various modules which were linked to real time websites. It was just an information panel which didn't have the capability to interact with the mirror. A module-based interface was created and displayed weather, news, time or daily comic strip

There was always a need of designing a device which would help in planning for a day's activities by doing other household activities. A mirror is one such place where we visit often and thus can get basic details such as time, daily news and events, etc.

The concept of smart mirror revolves around the development of Internet of Things (IoT). IoT is a network of physical devices, having electronic or software functions connected together to exchange data. The main aim of IoT is to create a virtual path for connecting all the devices connected to it. It provides a way of communication between people and things and between the objects itself.

Home automated Smart mirror is another domain which has IoT applications. Though applications of IoT are diverse, but this helps in using IoT for making life easier. The mirror has the ability to display date and time, news updates, weather conditions, to-do lists, reminders, traffic conditions, etc. With the help of IoT, a mirror can be upgraded to perform as browsers. The machine required for computing is a raspberry pi which does not require large space.

CHAPTER 3

3. BUILDING OF SMART MIRROR

3.1 HARDWARE

The Smart Mirror system mainly consists of three parts Raspberry Pi, a two way mirror. two-way mirror is reflective on one side and transparent on the other side. Now to modify our Smart Mirror we added a PIR sensor known as motion detector sensor. A Passive Infrared sensor or commonly known as PIR sensor is used by the mirror to detect if there is any motion in front of it. It acts like a normal mirror when there is no motion and is activated if it detects any motion. A speaker and a Microphone are used externally.

3.1.1 RASPBERRY PI

The Raspberry Pi device looks like a motherboard, with the mounted chips and ports exposed (something you'd expect to see if you only opened up your computer and looked at its internal boards). Still, it has all the components you need to connect input, output, and storage devices and start computing.

You'll encounter two models of the device: Model A and Model B. The only real differences are the addition of Ethernet and an extra USB port on the bit more expensive Model B.

The Raspberry Pi 3 Model B+ is the latest product in the Raspberry Pi 3 range, boasting a 64-bit quad-core processor running at 1.4GHz, dual-band 2.4GHz and 5GHz wireless LAN, Bluetooth 4.2/BLE, faster Ethernet, and POE capability via a separate POE HAT.

The dual-band wireless LAN comes with modular compliance certification, allowing the board to be designed into end products with significantly reduced wireless LAN compliance testing, improving both cost and time to market.

The Raspberry Pi 3 Model B+ maintains the same mechanical footprint as both the Raspberry Pi 2 Model B and the Raspberry Pi 3 Model B.

3.1.1.1 GENERATIONS OF PI

Several generations of Raspberry Pi's have been released. All models feature a Broadcom system on a chip (SoC) with an integrated ARM-compatible central processing unit (CPU) and on-chip graphics processing unit (GPU).

Processor speed ranges from 700 MHz to 1.4 GHz for the Pi 3 Model B+ or 1.5 GHz for the Pi 4; on-board memory ranges from 256 MiB to 1 GiB random-access memory (RAM), with up to 4 GiB available on the Pi 4. Secure Digital (SD) cards in Micro SDHC form factor (SDHC on early models) are used to store the operating system and program memory. The boards have one to five USB ports. For video output, HDMI and composite video are supported, with a standard 3.5 mm tip-ring-sleeve jack for audio output. Lower-level output is provided by a number of GPIO pins, which support common protocols like I²C.

A Raspberry Pi Zero with smaller size and reduced input/output (I/O) and general-purpose input/output (GPIO) capabilities was released in November 2015. On 28 February 2017, the Raspberry Pi Zero W was launched, a version of the Zero with Wi-Fi and Bluetooth capabilities.

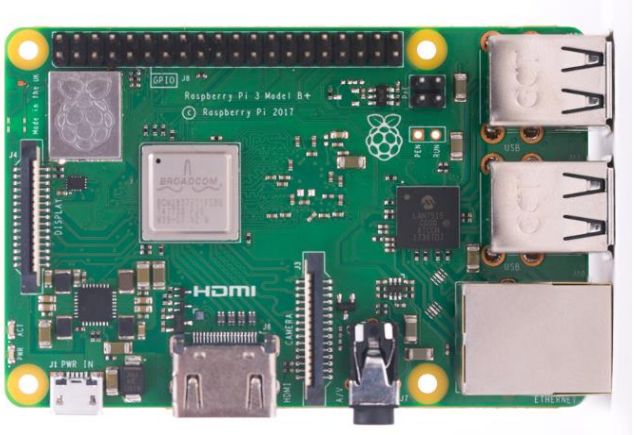


Fig.3.1.1.1: Raspberry Pi 3B

Raspberry Pi 3 Model B was released in February 2016 with a 1.2 GHz 64-bit quad core processor, on-board 802.11n Wi-Fi, Bluetooth and USB boot capabilities. On Pi Day 2018 the Raspberry Pi 3 Model B+ was launched with a faster 1.4 GHz processor and a three-times faster gigabit Ethernet or 2.4 / 5 GHz dual-band 802.11ac Wi-Fi (100 Mbit/s).

3.1.1.2 PHYSICAL STRUCTURE

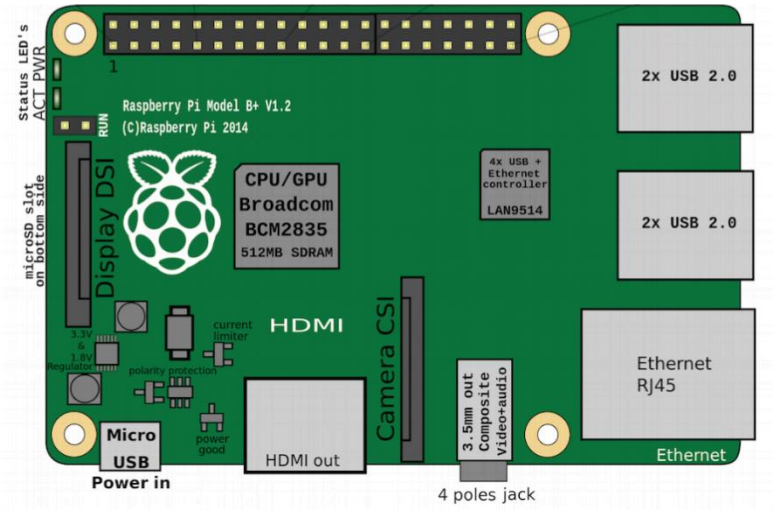


Fig. 3.1.1.2: Structure of Raspberry Pi

3.1.1.3 SPECIFICATIONS:

Processor	Broadcom BCM2837B0, Cortex-A53 64-bit SoC @ 1.4GHz
Memory	1GB LPDDR2 SDRAM
Connectivity	2.4GHz and 5GHz ac wireless LAN, Bluetooth 4.2 BLE Gigabit Ethernet over USB 2.0 4 × USB 2.0 ports
Access	Extended 40-pin GPIO header
Video & sound	1 × full size HDMI MIPI DSI display port MIPI CSI camera port
SD card support	Micro SD format for loading operating system and data storage
Input power	5V/2.5A DC via micro USB connector 5V DC via GPIO header Power over Ethernet (PoE)
Environment	Operating temperature, 0–50°C

3.1.1.4 COMPONENTS OF PI

CPU/GPU -This is a Broadcom BCM2837 System on a Chip (SOC) that's made up of an ARM (Advanced RISC Machine) Central Processing Unit (CPU) and a Video core 4 Graphics Processing Unit (GPU). The CPU handles all the computations that make a computer work (taking input, doing calculations and producing output), and the GPU handles graphics output.

Fig. 3.1.1.4(a): Broadcom BCM2837

RCA -- An RCA jack allows connection of analog TVs and other similar output devices.

Fig. 3.1.1.4(b): Dual purpose 3.5mm jack

Audio Out -- This is a standard 3.55-millimeter jack for connection of audio output devices such as headphones or speakers. There is no audio in.

USB --Universal Serial Busis a common connection port for peripheral devices of all types (including your mouse and keyboard). Model A has one, and Model B has two. You can use a USB hub to expand the number of ports or plug your mouse into your keyboard if it has its own USB port.

Fig. 3.1.1.4(c): USB Ports

HDMI --High-Definition Multimedia Interface connector allows you to hook up a high-definition television or other compatible device using an HDMI cable. HDMI is a proprietary audio/video interface for transmitting uncompressed video data and compressed or uncompressed digital audio data from an HDMI-compliant source device, such as a display controller, to a compatible computer monitor, video projector, digital television, or digital audio device. No signal conversion is necessary, nor is there a loss of video quality when a DVI-to-HDMI adapter is used. The CEC (Consumer Electronics Control) capability allows HDMI devices to control each other when necessary and allows the user to operate multiple devices with one handheld remote control device.

Several versions of HDMI have been developed and deployed since the initial release of the technology, but all use the same cable and connector. Other than improved audio and video capacity, performance, resolution and color spaces, newer versions have optional advanced features such as 3D, Ethernet data connection, and CEC (Consumer Electronics Control) extensions.

Fig. 3.1.1.4(d): HDMI connection of Raspberry Pi

Power -- This is a 5v Micro USB power connector into which you can plug your compatible power supply.

SD card slot -- This is a full-sized Secure Digital card slot. An SD card with an operating system (OS) installed is required for booting the device. They are available for purchase from the manufacturers, but you can also download an OS and save it to the card yourself if you have a Linux machine and the wherewithal.

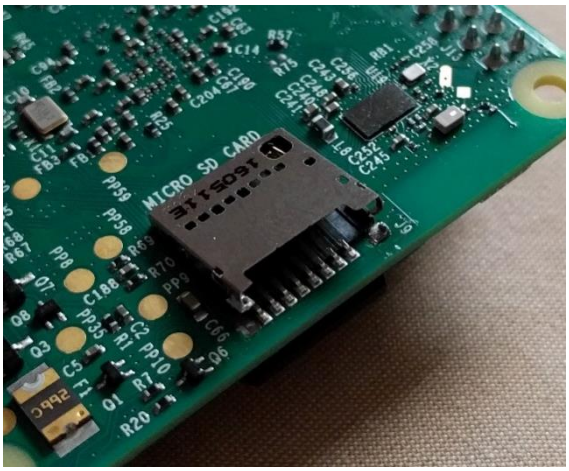


Fig. 3.1.1.4(e): SD Card Slot

Ethernet -- This connector allows for wired network access and is only available on the Model B.

Fig. 3.1.1.4(f): Structure of Raspberry Pi

Many of the features that are missing, such as WIFI and audio in, can be added using the USB port(s) or a USB hub as needed.

GPIO (General Purpose Input Output Pins):

General Purpose Input Output Pins are uncommitted digital signal pins on integrated circuits or electronic circuit boards whose behavior including whether it acts as input or output is controllable by the user at run time.

GPIO pins are digital, meaning they only support high/low or on/off levels. They generally don't support analog input or output with many discrete voltage levels. Some GPIO pins may directly support standardized communication protocols like serial communication like PWM.

The production Raspberry Pi has a 40-pin 2.5mm (100mil) expansion header, marked as PI, arranged in a 2x13 strip. They provide 8 GPIO plus access to UART as well as +3.3 V, +5 V and GND supply lines. Pin one is the pin in the first column and on the bottom row.

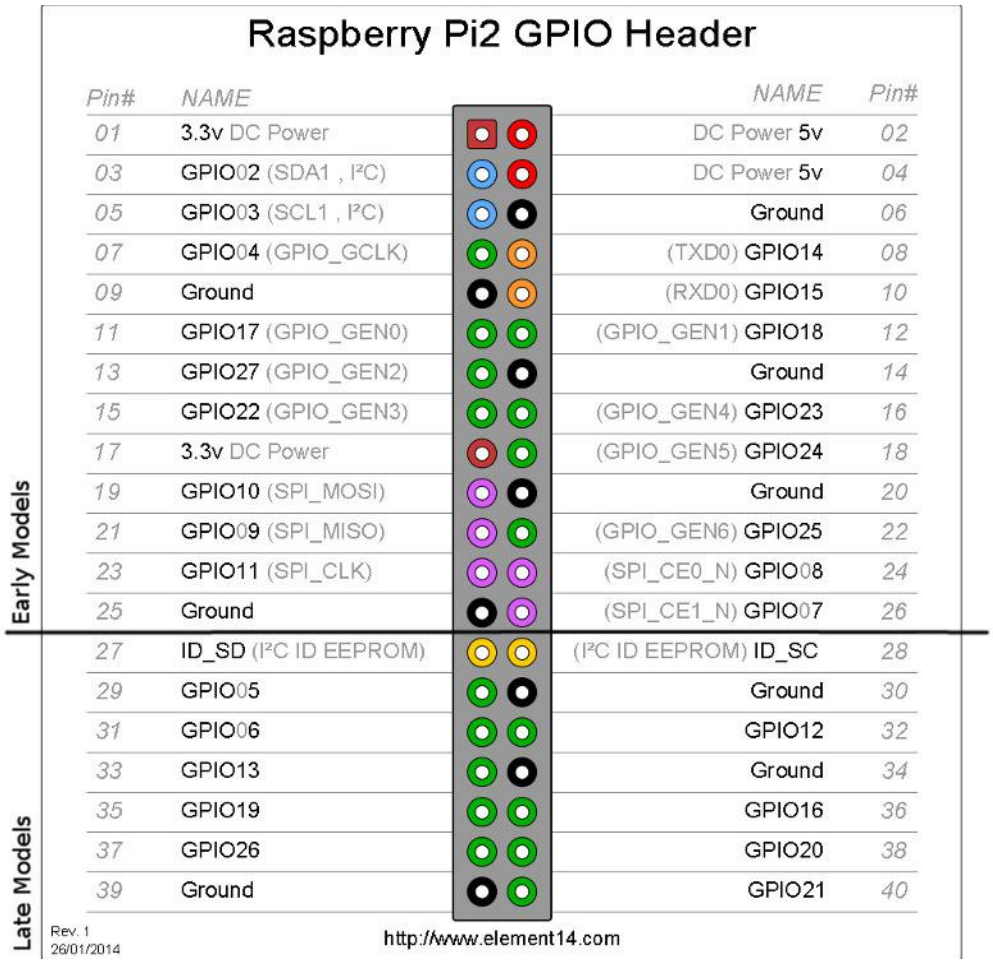


Fig: 3.1.1.4(g): GPIO pins of Raspberry Pi

3.1.2 MONITOR:

A crystal LCD monitor is used. Pretty much any monitor will be suitable for a smart mirror. A HDMI connection is preferable, but as you will see, it's not essential. Smart mirrors don't require high end monitors with high resolutions or refresh rates. A simple monitor with basic features is all you need.

The size of the monitor we choose should depend on how big we want our mirror to be. So we choose the size of 12inches.

Fig. 3.1.2: Basic LED Monitor

3.1.3 TWO-WAY MIRROR (ARCYLIC SHEET):

Acrylic is the preferred choice of hobbyists and professionals for applications in which glass is susceptible to cracking or shattering. However, two-way acrylic can provide great benefits to those who require the highest level of security and strength. In the correct lighting conditions, mirrored acrylic resembles a regular mirror and provides excellent visibility, reflecting the majority of light and allowing only a small amount to pass through for added privacy. This lightweight yet rigid thermoplastic material is ten times as strong as glass, so you can use it without worrying about breakage.

Looks like a normal mirror from the well-lit "lighted" side and see-thru tinted window from the side with little or no light. See-through mirror has a light transmission range of 5 to 20%.The reflectance of the see-through mirror is 60 to 75% see-through.

Two-way acrylic is ideal for commercial surveillance, creating smart mirrors, hiding televisions, or reinforcing home security. There are a broad variety of applications and benefits to be had by choosing mirrored acrylic sheeting for your next project. Whether recording through, creating a

photo booth, or protecting your valuables at home, we can help you achieve your goals. You can also customize our two-way mirrored acrylic to suit any specific application or project by selecting the best thickness, width, and length. We also offer routed edges, radius corners, and an array of hole sizes for an additional cost. Cut-to-size requests can take one to two business days to process, but you can visit one of our 20 store locations to receive your order in less than five minutes from start to finish.

Fig. 3.1.3: Two way Acrylic sheet

3.1.4 SPEAKER AND MICROPHONE:

Microphone is the medium of communicating verbally with the smart mirror. Microphone is used to power the voice recognition capabilities of the device. USB microphones had to be used because the Raspberry Pi does not have a regular microphone input.

One mode of interaction with the smart mirror is through microphones. USB microphones is used because the Raspberry Pi does not have a regular microphone input Speaker can easily be connected with the output jack port of the raspberry pi

The first microphone is a cheap simple one connected through a USB sound card to the Pi.

(a) **(b)**

Fig. 3.1.4: (a) Speakers (b) Microphone

3.1.5 PIR (motion detector sensor):

A Passive Infrared sensor is an electronic sensor that measures infrared light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. PIR sensors are commonly used in security alarms and automatic lighting applications. A PIR sensor detects the infrared light radiated by a warm object. It consists of pyro electric sensors which introduce changes in their temperature (due to incident infrared radiation) into electric signal. When infrared light strikes a crystal, it generates an electrical charge. PIR sensor detects a human being moving around within approximately 10m from the sensor. This is an average value, as the actual detection range is between 5m and 12m. PIR sensors are incredible, they are flat control and minimal effort, have a wide lens range, and are simple to interface with. Most PIR sensors have a 3-pin connection at the side or bottom. One pin will be ground, another will be signal and the last pin will be power. Power is usually up to 5V. Sometimes bigger modules don't have direct output and instead just operate a relay which case there is ground, power and the two switch associations. Interfacing PIR with microcontroller is very easy and simple. The PIR acts as a digital output so all you need to do is listening for the pin to flip high or low. The motion can be detected by checking for a high signal on a single I/O pin. Once the sensor warms up the

output will remain low until there is motion, at which time the output will swing high for a couple of seconds, then return low.

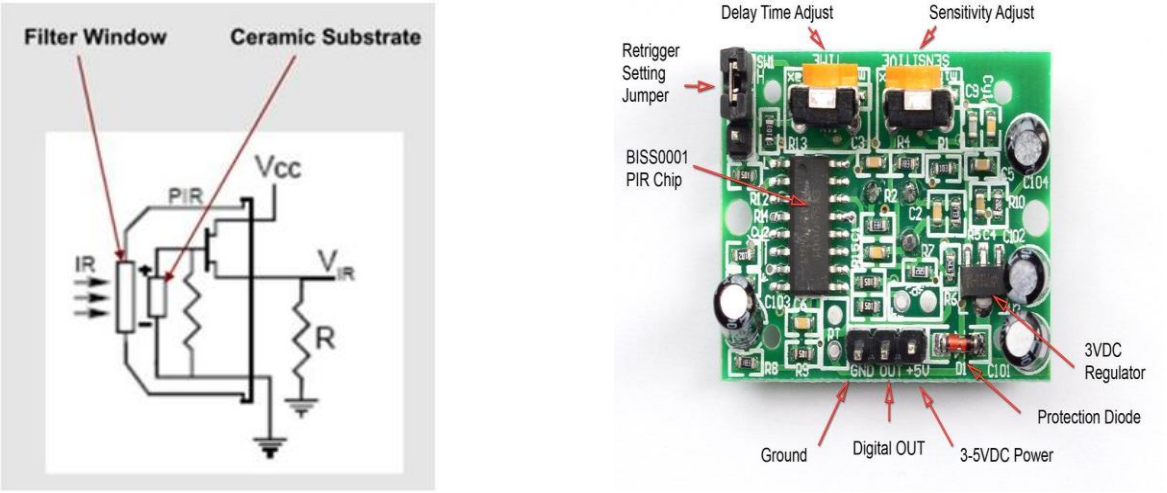
Fig. 3.1.5(a): PIR Sensor

Smart Mirror uses a PIR sensor attached to Raspberry pi's GPIO pins to check for users. After a configured time without any user interaction the display will turn off and hide all modules for economy mode. If you don't have PIR sensor, it can also be used for automatic turn on / turn off screen with the help of Google Assistant.

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors.

Along with the pyroelectic sensor is a bunch of supporting circuitry, resistors and capacitors. It seems that most small hobbyist sensors use the BISS0001 ("Micro Power PIR Motion Detector IC"), undoubtedly a very inexpensive chip. This chip takes the output of the sensor and does some minor processing on it to emit a digital output pulse from the analog sensor.

A Smart Mirror consists of a PIR sensor which senses the presence of human being and sends pulses to the microcontroller which controls the motor driver by sending appropriate pulses to its input pins and enable pin.



(b) (c)

Fig. 3.1.5.: (b) Working Principle of PIR sensor (c) Components of PIR sensor

3.1.5.1 PIR PINS:

PIR sensor has 3 pins. If we see the pins from the right most side they are VCC, Vout and ground. Connecting the Vout (sensor pin) to pin number 21, setting the delay to 30 (ms).Once the sensor detects NO MOTION , then with the help of Alert module a notification will pop-up saying that "Monitor will be turn Off the PIR module".

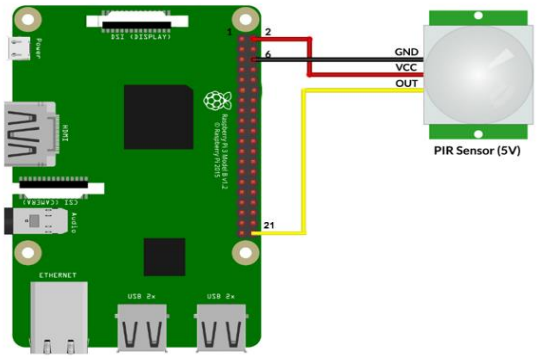


Fig. 3.1.5.1: PIR sensor connection to Raspberry Pi via GPIO pins

3.1.5.2 WORKING OF PIR SENSOR:

PIR sensors are more complicated than many of the other sensors explained in these tutorials (like photocells, FSRs and tilt switches) because there are multiple variables that affect the sensors input and output. The PIR sensor itself has two slots in it; each slot is made of a special material that is sensitive to IR. The lens used here is not really doing much and so we see that the two slots can 'see' out past some distance (basically the sensitivity of the sensor). When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor which causes a positive differential change between the two halves.

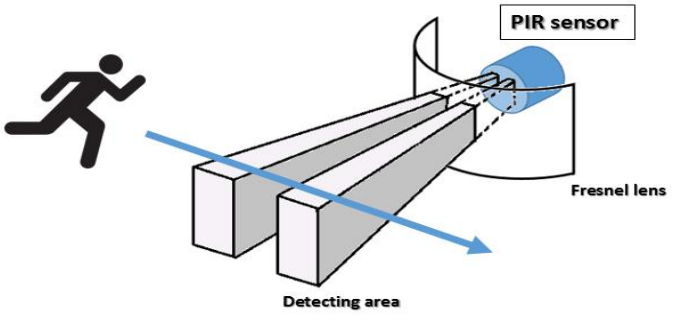


fig:3.1.5.2 :working of pir sensor

When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change. These change pulses are what is detected.

The IR sensor itself is housed in a hermetically sealed metal can to improve noise/temperature/humidity immunity. There is a window made of IR-transmissive material (typically coated silicon since that is very easy to come by) that protects the sensing element. Behind the window are the two balanced sensors.The Fresnel lens condenses light, providing a larger range of IR to the sensor.

3.1.6 JUMPER CABLES:

A jump wire (also known as jumper wire, or jumper) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. Though jumper wires come in a variety of colors, the colors don't actually mean anything. This means that a red jumper wire is technically the same as a black one. But the colors can be used to your advantage in order to differentiate between types of connections, such as ground or power.

Jumper wires typically come in three versions: male-to-male, male-to-female and female-to-female. The difference between each is in the end point of the wire. Male ends have a pin protruding and can plug into things, while female ends do not and are used to plug things into. Male-to-male jumper wires are the most common and what you likely will use most often. When connecting two ports on a breadboard, a male-to-male wire is what you'll need.

Fig. 3.1.6: Jumper Cables

3.1.7 CONSTRUCTION:

Once everything is ready,we can set it up. A raspberry pi is used at the back end of the Smart Mirror. A LCD monitor will be mounted on top of this on which an Arcylic sheet or a two way mirror is stuck. A double tape can be used to stick up the raspberry pi to the monitor and the arcylic sheet on the monitor. The PIR sensor is stuck on top of the LCD monitor which is connected to the Raspberry pi.

Fig. 3.1.7: Construction of Display

3.1.8 WORKING

For the architecture, a Dell computer monitor, a two-way mirror, a Raspberry Pi model 3B, USB microphones, jack speaker and a PIR sensor are used. Everything was put together using glue and double tape. The device so that it can be hung on a wall. The forward portion of the box type structure is made using the glass which is made to fit entirely in front the screen. The major components that are used (the two-way mirror glass, display, Raspberry Pi, microphones, proximity sensors and frame). The working part is quite simple the Smart Mirror is on when the PIR sensor detects any motion and is off when there is no detection. Once the mirror is on you can see the news, weather forecast, time, date and the calendar, word of the day, u can even set up the alarm. Above all Google Assistant is set up to talk to. The input is the microphone and the output is the speaker.

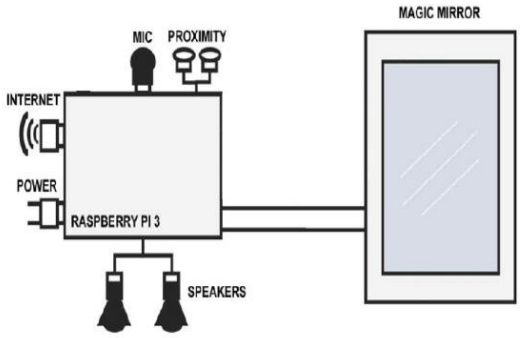


Fig 3.1.8 (a): block diagram of Smart Mirror

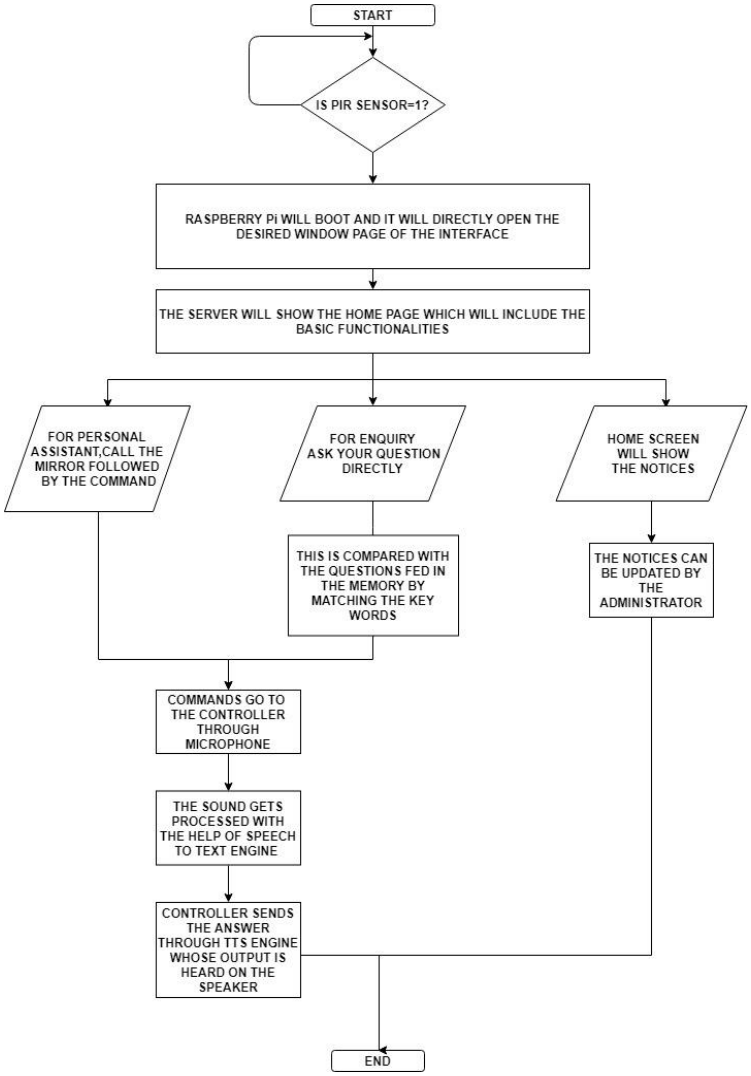


Fig 3.1.8 (b): flow diagram of Smart Mirror

The software structure of the system is implemented and built using the web socket communication protocol. The architecture is modular and works on the basis of function designated modules which can be incorporated together on a single platform. With this, we can club many features such as clock, calendar, current weather, newsfeed etc., and many other third-party functionalities. The server module leads all the operations: interaction with the user through the sensors and the mirror user interface (UI), information visualization through the mirror UI etc.

Fig 3.1.8 (a) shows us the block diagram of a Smart Mirror. A PIR sensor can be used in place of proximity sensor. Smart Mirror only works in the presence of internet connection. Without is it IOT wouldn't exist. A voltage supply is a must. Microphone and speakers are attached to the raspberry pi using a USB converter. This is then connected to the LCD screen where acrylic sheet is mounted on top of it.

The flowchart of the smart mirror system is as shown in Fig3.1.8 (b). Initially the mirror will be in sleep mode acting like a normal mirror reflecting. The mirror is designed such that it can be accessed only by users. The whole process how the Raspberry Pi is activated is clearly shown in the flowchart.

To begin with a single sided mirror is used such that it is semi-transparent acting as a mirror when the screen is black and a glass window when information has to be displayed. This mirror is mounted on a 17' LCD monitor as it is relatively cheap and with simple touch buttons. Later the control panel of this monitor is connected and placed in the casing with raspberry pi 3 model attached to it using a HDMI cable. The pi model runs on raspbian operating system with its Wi-Fi configured through which mirror is connected to internet. The main advantage of using pi is that is allows the users to develop and test the interface on usual Personal Computer.

3.2 SOFTWARE:

All the software runs on the Raspberry Pi 3 and there are many operating systems to choose from. Raspbian which is the official Linux distribution from the Raspberry Pi Foundation is used because it has a lot of support. Raspbian is highly optimized for the Raspberry Pi line's low-performance ARM CPUs. Raspbian uses PIXEL, Pi Improved X-Window Environment, Lightweight as its main desktop environment as of the latest update.Raspbian is the recommended operating system for normal use on a Raspberry Pi. Raspbian is a free operating system based on Debian, optimized for the Raspberry Pi hardware. Raspbian comes with over 35,000 packages: precompiled software bundled in a nice format for easy installation on your Raspberry Pi.

3.2.1 TYPES OF SOFTWARES IN RASPBERRY PI

The Raspberry Pi supports several Operating Systems and as such usually comes without one. However, Raspberry Pi Foundation has provided two default Operating Systems that support the Raspberry Pi among which the user can choose as per his/her expertise. They can be downloaded from the official website of Raspberry Pi. They are:

3.2.1.1 RASPBIAN

Raspbian is a Debian-based (32 bit) computer operating system for RaspberryPi. There are several versions of Raspbian including Raspbian Buster and Raspbian Stretch. Since 2015 it has been officially provided by the Raspberry Pi Foundation as the primary operating system for the family of Raspberry Pi single-board computers. Raspbian was created by Mike Thompson and Peter Green as an independent project. The initial build was completed in June 2012. The operating system is still under active development. Raspbian is highly optimized for the Raspberry Pi line's low-performance ARM CPUs.

Raspbian uses PIXEL, **P**i **I**mproved **X**-Window **E**nvironment, **L**ightweight as its main desktop environment as of the latest update. It is composed of a modified LXDE desktop environment and the Open box stacking window manager with a new theme and few other changes. The distribution is shipped with a copy of computer algebra program Mathematica and a version

of Minecraft called Minecraft Pi as well as a lightweight version of Chromium as of the latest version.

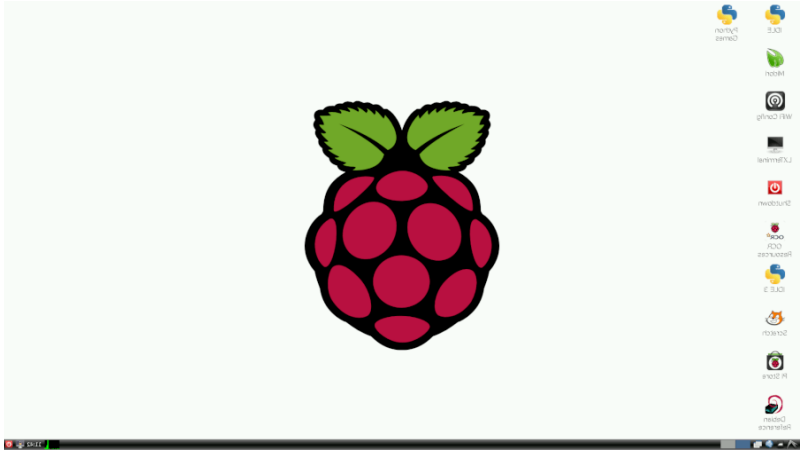


Fig.3.2.1.1: Rasbian OS

3.2.1.2 NOOBS

The Raspberry Pi itself doesn't come with an operating system. For that, you need NOOBS, short for "New Out of the Box Software". It's an operating system manager that makes it easy to download, install, and set up your Raspberry Pi. When you first boot up NOOBS, you'll get a selection of OSes to choose from. Which operating systems are available depends on which model of Raspberry Pi you are using. For this guide, we'll stick to the most common Operating Systems available on the newest models of the Raspberry Pi. Right now, that's Raspbian, OSMC, OpenELEC, Windows IoT Core, and RISC OS.

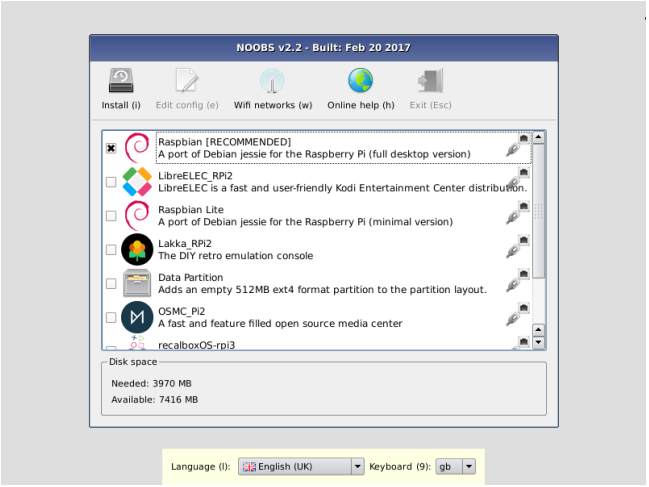


Fig.3.2.1.2: NOOBS OS

Even though Raspberry Pi Foundation has default OS, it has also allowed a lot of third party Operating Systems to expand limits and the functioning of Raspberry Pi. There a lot of third-party Operating Systems, however we have mentioned only a few of them:

3.2.1.3 OSMC

OSMC (open source media centre) is a free, simple, open-source, and easy-to-use standalone Kodi OS capable of playing virtually any media format.

It features a modern beautiful minimalist User Interface and is completely customizable thanks to the several built-in images that it comes with. Choose OSMC if you run the Raspberry Pi for managing media content.

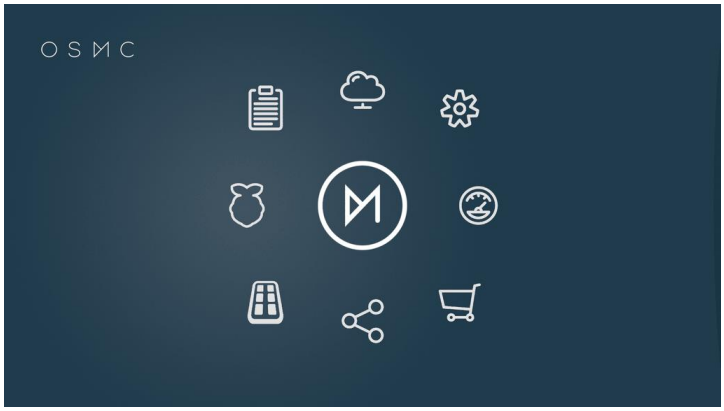


Fig.3.2.1.3 OSMC Operating System

3.2.1.4 OpenELEC

OpenELEC (Open Embedded Linux Entertainment Center) is a small Linux-based JeOS (Just enough Operating System) developed from scratch to turn PCs into a Kodi media center.

Fig.3.2.1.4: OpenELEC Operating System

3.2.1.5 Ubuntu Core

Ubuntu Core is the version of Ubuntu designed for Internet of Things applications. Ubuntu is the most popular Linux-based Operating System in the world with over 20+ derivatives and given that it has an active and welcoming forum, it will be easy to get up and running with Ubuntu Snappy Core on your Raspberry Pi.

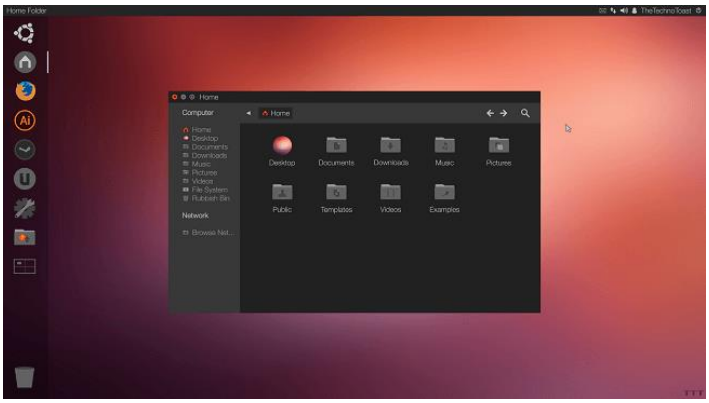


Fig.3.2.1.5: Ubuntu Core

3.2.2 Smart Mirror

Smart Mirror is an open source modular smart mirror platform. With a growing list of installable modules, the Smart Mirror allows you to convert your hallway or bathroom mirror into your personal assistant. Smart Mirror focuses on a modular plug-in system and uses “Electron” as an application wrapper. So no more web server or browser installs necessary. Even the Latest Version of Node.js is also required for the better functioning.

Smart mirror is a wall mounted mirror which displays weather, time, news and other areas of interests. In recent years more and more devices are connected to the internet. The internet has played an important role in connecting more and more people across the world. Devices started to become smarter smarter, mobile phones became smart phones and most importantly internet was connected to a variety of devices and the concept came to be known as the ‘Internet of Things’. Our project aims at exploring other fields where this technology can be used. It aims at

including this technology in a mirror, because in general people spend a considerable amount of time in front of a mirror. We have seen clocks mounted on the wall, we have also seen displays at the airports, and similarly we aim at bringing this technology to our homes. Another advantage of this device is to provide face recognition, which we have done using Open CV. This helps the user with security benefits. Smart mirror can also be useful for getting quick view of your Google feeds or accessing Gmail accounts by using face recognition. The smart mirror would help in developing smart houses by using artificial intelligence and finally finding a place in industries.

The goal of the smart mirror is to provide an access point for a person to receive all the information that could affect how they plan for the day. For getting news updates and weather updates, a person will always have to switch on the television which is time consuming. To get rid of these problems, the concept of smart mirror is introduced. All the necessary information like weather and news can be accessed from one location. The problem of a secured user authentication technique can also be corrected by this system. Through the use of LCD displays and a one way mirror, weather, time and date, news, and other useful information programmable through the smart mirror app would be available at a glance.

3.2.3 Modules

1. weather Forecast
2. Time and clock
3. Calendar
4. compliments
5. News
6. MMM-hotword
7. Google assistant
8. word of the day
9. Al arm
10. Remote Control
11. System statistics
12. PIR motion detector sensor

1. Weather Forecast

Weather forecasting is the application of science and technology to predict the conditions of the atmosphere for a given location and time. People have attempted to predict the weather informally for millennia and formally since the 19th century. Weather forecasts are made by collecting quantitative data about the current state of the atmosphere at a given place and using meteorology to project how the atmosphere will change.

There is a vast variety of end users to weather forecasts. Weather warnings are important forecasts because they are used to protect life and property. Forecasts based on temperature and precipitation are important to agriculture, and therefore to traders within commodity markets. Temperature forecasts are used by utility companies to estimate demand over coming days. On an everyday basis, many use weather forecasts to determine what to wear on a given day. Since

outdoor activities are severely curtailed by heavy rain, snow and wind chill, forecasts can be used to plan activities around these events, and to plan ahead and survive them.

You can get a list of all the Weather Stations that are currently online, using a simple URL. This is because the database that all the Weather Stations upload data to has restful API. This is a method by which you can write code that uses simple HTTP requests (just like a browser) to fetch the data.

1. Open, https://openweathermap.org/api
2. Sign up and generate your own API keys(you will receive a mail with a generated API key)
3. We can access the weather database of OpenWeather with the help of that key and extract information which we need.
4. 4. A link will be provided in which the details of all the cities which are registered in the website will be shown.
5. 5. We can search for our city and copy the “Coordinates” and the “Location ID” and insert them in our code.

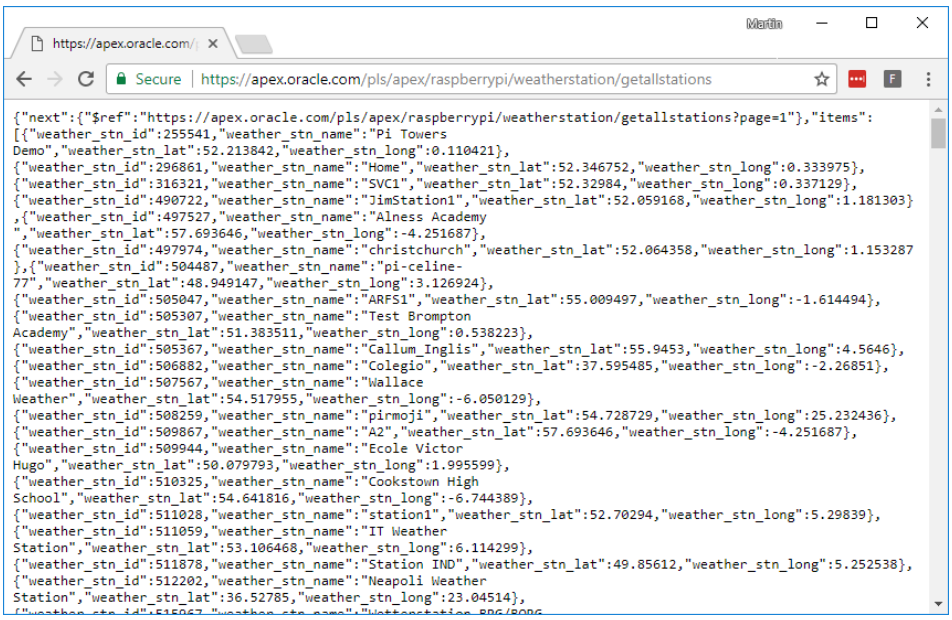


Fig 1 open weather source

2. Time and clock

Time helps us to make a good habit of organizing and structuring our daily activities. ... Time plays a significant role in our lives. If we better understand the time value, then it can gain experience and develop skills over time. Time can also heal things whether external wounds or feelings.

The clock is one of the simpler components of this project and we want it to be as customizable as possible. The user will be able to choose the location of the clock to match their needs and desires. Users will also be able to select from a list of fonts and colors for the clock display, allowing them to make the mirror individual to their personal tastes.

A clock is a device used to measure, keep, and indicate time. The clock is one of the oldest human inventions, meeting the need to measure intervals of time shorter than the natural units: the day, the lunar month, and the year. Devices operating on several physical processes have been used over the millennia.

This module displays the current date and time. The information will be updated real time. It displays time in 24-hour time format. The time zone Asia/Kolkata is used for displaying time.

The clock module is one of the default modules of the Smart Mirror. This module displays the current date and time. The information will be updated real time. We can customize the clock as per our requirements. We can make it either Digital or Analog. We can set either “12 hours” or “24 hours” format.

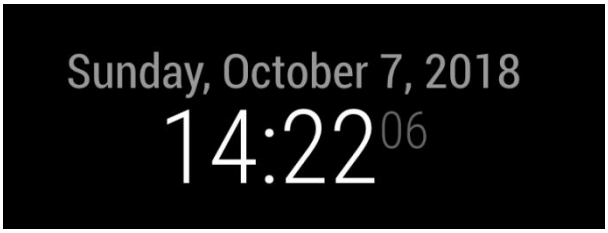


Fig 2 time and clock

3. CALENDAR

A calendar is a system of organizing days for social, religious, commercial or administrative purposes. This is done by giving names to periods of time, typically days, weeks, months and years. A date is the designation of a single, specific day within such a system. A calendar is also a physical record (often paper) of such a system. A calendar can also mean a list of planned events, such as a court calendar or a partly or fully chronological list of documents, such as a calendar of wills

The calendar module is one of the default modules which are supported by Smart Mirror. It displays events from a public and can be combined with multiple calendars.

We can even integrate our own personalized Google Calendar into the Smart Mirror to update and organize our schedule. We are extracting news from the following website https://www.officeholidays.com/ics/india/andhra-Pradesh.

The data which is being extracted is in "**.ics**" format which stands for Internet Calendaring and Scheduling (ics). The **Internet Calendaring and Scheduling** Core Object Specification is a **MIME** ("Multipurpose Internet Mail Extensions") type which allows users to store and exchange calendaring and scheduling information such as events, to-dos, journal entries, and free/busy information.

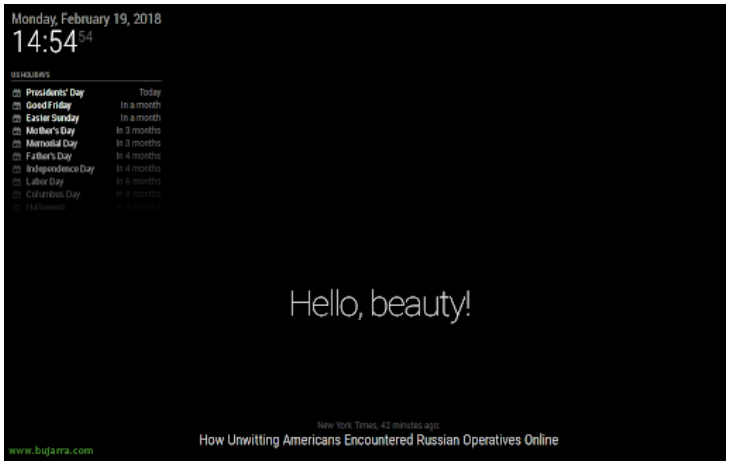


Fig: 3 Calendar

4. COMPLIMENTS

The Compliments module displays Compliments to the users. This is placed at lower center. The display of Compliments can be categorized and set accordingly. The start and end time of specific Compliments can also be set.

You can customize your own new compliments. This is to start the day with a positive note.

Fig 4: compliments

5. NEWS

This module gives the latest technology news when asked by the user. Technology News is a social news website that caters to programmers and entrepreneur, delivering content related to computer science and entrepreneurship. Times of India news will notify the user about the top 10 stories.

This module displays news headlines based on a really simple syndication (RSS) feed. Scrolling through news headlines happens time-based (update Interval), but can also be controlled by sending news feed specific notifications to the module. An array of feed URLs are used as source. The URL of the feed is used for headlines.

News is information about current events. This may be provided through many different media: word of mouth, printing, postal systems, broadcasting, electronic communication, or through the testimony of observers and witnesses to events.

The newsfeed module is one of the default modules of the Smart Mirror. This module displays news headlines based on an RSS feed.

Scrolling through news headlines happens time-based (updateInterval), but can also be controlled by sending news feed specific notifications to the module. This is placed at bottom centre.

News varies from city to city, state to state and country to country. So, for one's convenience one can change news accordingly. You can see the date published, Source name and the language. Language can be customized accordingly.

In Smart Mirror the news is taken the source from:

http://timesofindia.indiatimes.com/rssfeedstopstories.cms

The news gets updated every 15 minutes. If you want to see some particular countries news, then you can change the URL for that particular country.

6. MMM-HOTWORD

MMM-Hotword is a hotword detector using snowboy. You can use this module to wake another voice assistant or to give a command to other module.

MMM-Hotword is a wake-word detector. Hotword is a detection toolkit that recognizes your voice, runs in real time and on Raspberry Pi. This module can be used to wake Google Assistant and start its functioning. The sensitivity is set to 0.5 (which is customizable) the hot-word that we have used is "Smart Mirror". Such that only after hotword "Smart Mirror "is detected, the Google Assistant is triggered and starts to work. It always runs in the background to detect the hotword in real-time.

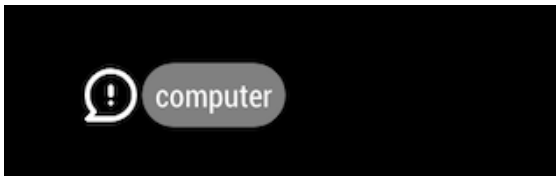


Fig.6 (a) example

Fig.6 (b) MMM- Hotword

7. MMM-AssistantMK2 (Google Assistant):

Google Assistant is an artificial intelligence-powered virtual assistant developed by Google that is primarily available on mobile and smart home devices. Unlike the company's previous virtual assistant, Google Now, the Google Assistant can engage in two-way conversations.

Google Assistant module for your Magic Mirror.

You can now ask questions to your Magic Mirror powered by Google Assistant.

All this module does for now is show the following logo –

Fig 7(a): logo of Google Assistant

MMM-AssistantMk2 is an embedded Google assistant on Smart Mirror. It works similarly to the Google Assistant in our mobile devices. Using MMM-Hotword module, this is triggered and starts functioning. It initially records the commands given by the user. Then Text- to Speech conversion is done. Relevant Results and responses based on the query are displayed and played. But in order to make sure that the Google Assistant responds precisely,
we have to create credentials and authenticate it to access our profiles and
data accurately.

Fig 7(b): Google Assistant

Get Auth and credentials to make profile.

Step 1: Create or open a project in the Actions Console

Step 2: After creation, Enable Google Assistant API for your project in the Cloud Platform Console

Step 3: Return to Actions Console and Register a device model

Step 4: You can download your credentials.json for OAuth. Carefully store it in MMM-AssistantMk2 directory.

Step 5: In the terminal, now run auth-tool for authentication.

Step 6: After confirmation, some code (4/ABCD1234XXXXX....) will appear in the browser. Copy that code and paste in your console's request (Paste your code :)

Step 7: On success, Prompt Type your request will be displayed. Type anything for testing assistant. (e.g.; Hello, How is the weather today?)

Step 8: Now you can find token.json in your MMM-AssistantMk2 directory. Move it under profiles directory with rename default.json. This will be used in module as default profile.

8. WORD OF THE DAY

Magic Mirror Module to show the Word of the day from Oxford's dictionary. This is placed on the top right position. We can change the frequency of display of new word. Eg: We have set the frequency interval to 120000 ms, which means the word gets updated a new word pops up.

Fig 8: word of the day

9. ALARM CLOCK

An Alarm Clock module for Smart Mirror where we can modify the number of alarms, sound, volume, format, timer and can customize it as per our choices. This is placed on top left. We can customize the tone of the alarm; we have selected “alarm.mp3”. We can set out alarm daily at a particular time or even for particular intervals of time. You can even customize your own message.

Fig9: Alarm clock

10. Remote Control

An Electronic, a remote control or clicker is an electronic device used to operate another device from a distance, usually wirelessly. A mobile can act as a remote control. Once u lock your house and you forget to turn the Smart Mirror off, u can do it by using your mobile. You can also edit the modules you want to.

This module for the Smart Mirror allows you to quickly shutdown your mirror through a web browser. The website should work fine on any device. Since we all want our SD cards to live a long and prosper life we properly shut down before pulling the power plug every time. Additionally you can hide and show modules on your mirror and do other cool stuff.

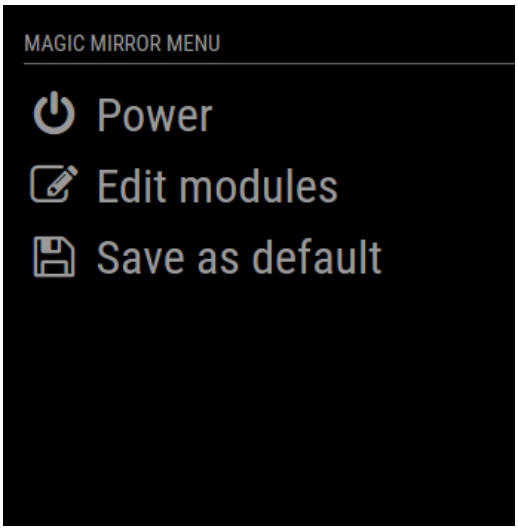


Fig 10(a): remote control

The Remote Control can be accessed by any device on the same network as the pi by entering http://<ip address of pi>:8080/remote.html. You can control all the modules of the magic mirror from this remote. You can even control the brightness of the monitor. For security reasons, the Smart Mirror (and therefore the Remote Control) is not reachable externally. We have to configure address, and ipWhitelist in config.js .For example change address to “0.0.0.0” to listen on any interference. ["127.0.0.1", "::ffff:127.0.0.1", "::1"] which allows loopback devices We have set the ipWhitelist to : [ ] so that all of devices irrespective of the ip address.

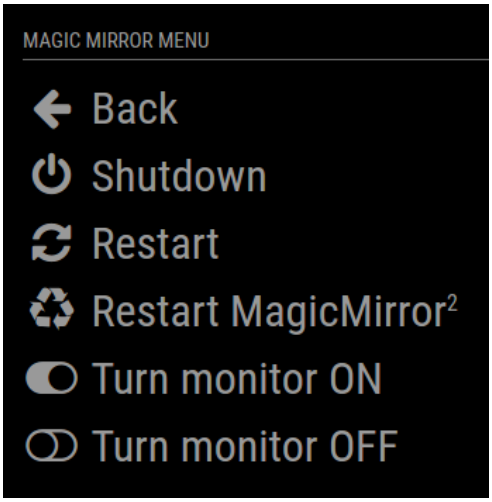


Fig 10(b): remote control

11. MMM-System Stats

System statistics describe the system's hardware characteristics, such as I/O and CPU performance and utilization, to the query optimizer. This module gives information regarding the status of the mirror like in which platform it is running, its current CPU utilization, current memory utilization etc. This Smart Mirror module, shows the System Statistics of the running Raspberry Pi like

1. Processor Temperature

2. System Load

3. Available RAM

4. Uptime

5. Free disk space.

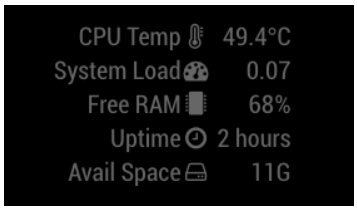


Fig 11: System statistics

CHAPTER 4

APPLICATIONS USED

4.1 IOT

Internet of Things (IOT) is a concept and a paradigm that considers pervasive presence in the environment of a variety of things/objects that through wireless and wired connections and unique addressing schemes are able to interact with each other and cooperate with other things/objects to create new applications/services and reach common goals. In this context the research and development challenges to create a smart world are enormous. A world where the real, digital and the virtual are converging to create smart environments that make energy, transport, cities and many other areas more intelligent.

Fig 4.1 IOT

In this world everyone needs a comfort life. Modern man has invented different technology for his purpose. In today's world, people need to be connected and they are willing to access the information easily. Whether it is through the television or internet, people need to be informed and in touch with the current affairs happening around the world. The Internet of Things means interconnection via the internet of computing devices embedded in everyday objects, enabling them to send and receive data. The Internet of Things with its enormous growth widens its applications to the living environment of the people by changing a home to smart home. Smart home is a connected home that connects all type of digital devices to communicate each other through the internet. Our lifestyle has evolved in such a way that optimizing time is the most important thing. Our work is based on the idea that we all look at the mirror when we go out, so why wouldn't the mirror become smart. A common approach for building a smart mirror is to

use a high quality two-way glass, a LCD monitor, s and monitor, and a web browser with python to provide the software features and drive the display.

This project has been developed with the idea of making home smart to save time. The Internet transformed our lives by connecting us more easily to information and other people in the virtual world. The state of innovation currently is to provide more information with less interaction to get it. The device that has been researched and designed is called Smart Mirror. It is a wall mounted mirror which displays relevant items to the user such as weather, time, date, temperature, humidity and news and other fields of interest. IOT emerged the idea of remotely monitoring objects through the Internet.

Smart mirrors have many potential applications in both personal and social settings. In personal settings, smart mirrors can be used to display relevant information, control household appliances, and provide emotional support to users. In bathrooms, smart mirrors could prove to be a valuable application for many people. As people prepare for their day, their hands are typically busy, but they typically stand in one spot performing low cognitive task. People could have their email messages, trending tweets or Face book posts, and breaking news show up on their smart mirrors seamlessly. Smart mirrors can facilitate communication within a family. Many homes have a mirror in their entrance or foyer. A smart mirror in this location could act as a central hub for family scheduling, which would increase awareness of each other's activities within the family. Built right into the mirror, a digital calendar can be synced with users' calendar on their phone. Digital notes left for other users would not fall off from people walking by or opening the front door. In public locations, smart mirror applications would be generalized, perhaps acting as conduits for information much like information kiosks, but provide physical and design benefits over implementing a kiosk. For mirror, however, could display kiosk information, advertisements, and emergency alerts, all while utilizing the space that is already allocated for mirrors.

4.2 GOOGLE ASSISTANT

Another application that we have used in Smart Mirror is Google Assistant. It can be a lot more fun and interesting when you're Smart Mirror communicates and has a conversation with you. Here the user interacts with the Smart Mirror through a microphone and the Smart Mirror responds with the help of a Speaker. The Google Voice Kit turns this mirror into Google Home. This mirror can do everything that Google's Assistant can do.

Google Assistant is an artificial intelligence artificial powered virtual assistant developed by Google that is primarily available on mobile and smart home devices. Unlike the company's previous virtual assistant, the Google Assistant can engage in two-way conversations.Users primarily interact with the Google Assistant through natural voice. Now, the Assistant is able to search the Internet, schedule events and alarms, and many more.

Fig.4.2: AI Assistant powered by Google

4.2.1 DEVELOPER SUPPORT

Google launched "Actions on Google", a developer platform for the Google Assistant. Actions on Google allow 3rd party developers to build apps for Google Assistant. In March 2017, Google added new tools for developing on Actions on Google to support the creation of games for Google Assistant. Originally limited to the Google Home smart speaker, Actions on Google was made available to Android and ioS devices in May 2017, at which time Google also introduced an app directory for overview of compatible products and services.

In April 2017, a software development kit (SDK) was released, allowing third-party developers to build their own hardware that can run the Google Assistant. December 2017 to add several features that only the Google Home smart speakers and Google Assistant Smartphone apps had previously supported.

The features include:

1. Letting third-party device makers incorporate their own "Actions on Google" commands for their respective products
2. Incorporating text-based interactions and more languages
3. Allowing users to set a precise geographic location for the device to enable improved location-specific queries.

On May 2, 2018, Google announced a new program on their blog that focuses on investing in the future of the Google Assistant through early-stage startups. Their focus was to build an environment where developers could build richer experiences for their users. This includes startups that broaden Assistant's features, are building new hardware devices, or simply differentiating in different industries.

4.2.2 VOICES

Google Assistant launched using the voice of Kiki Baessell for the American female voice, the same actress for the Google Voice voicemail system since 2010. On October 11, 2019, Google announced that Issa Rae had been added to Google Assistant as an optional voice, which could be enabled by the user by saying "Okay, Google, talk like Issa".

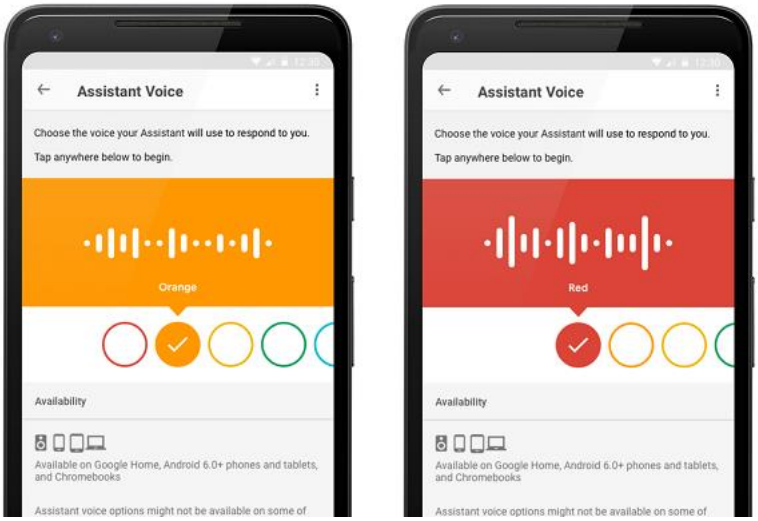


Fig.4.2.2: AI Assistant powered by Google

4.2.3 INTERACTION

Google Assistant, in the nature and manner of Google Now, can search the Internet, schedule events and alarms, adjust hardware settings on the user's device, and show information from the user's Google account. Unlike Google Now, however, the Assistant can engage in a two-way conversation, using Google's natural language processing algorithm. Search results are presented in a card format that users can tap to open the page. In February 2017, Google announced that users of Google Home would be able to shop entirely by voice for products through its Google Market, Costco, Walgreens, PetSmart, and Bed Bath & Beyondat launch, and other retailers added in the following months as new partnerships were formed. Google Assistant can maintain a shopping list; this was previously done within the note taking service Google Keep, but the

feature was moved to Google Express and the Google Home app in April 2017, resulting in a severe loss of functionality.

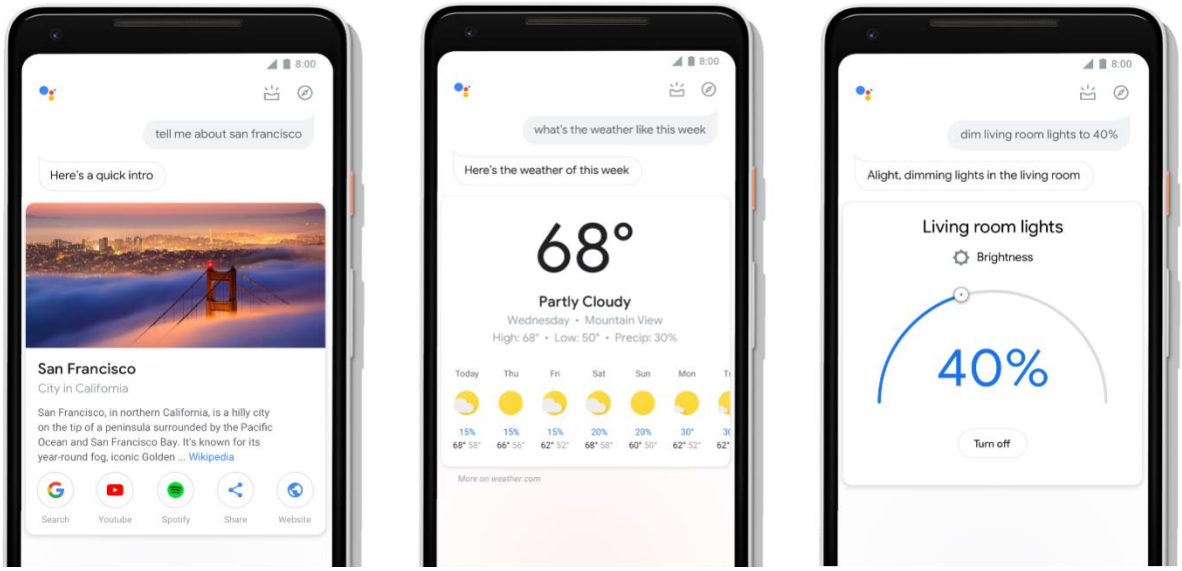


Fig.4.2.3: Interaction with Google Assistant

Smart Mirrors may have potential applications in both personal and social settings. In personal settings, smart mirrors can be used to display relevant information, control household

CHAPTER 5

CODE AND RESULT

5.1 CODE

```
var config = {
                address: "0.0.0.0",
                port: 8080,
               ipWhitelist: [],
              language: "en",
             timeFormat: 12,
            units: "metric",
                modules: [
                 {
                       module: "alert",
                },
                {
                          module: "clock",
                          position: "top_left"
                    },
                {
                           module:"compliments",
                            position:"lower_third"
```

```
  },
{
        module: "calendar",
        header: "Holidays",
        position: "top_left",
        config: {
              calendars: [
        {
          symbol: "calendar-check",
        url: https://www.officeholidays.com/ics/india/andhra-pradesh
          }
                          ]
        }
},
{
        module: "currentweather",
        position: "top_right",
        config: {
              location: "Gajuwaka",
             locationID: "7302833",
             appid: "50ad0030047c9790e7bfdb4cb6a19d80",
```

```
                }
        },
        {
                module: "weatherforecast",
                position: "top_right",
                header: "Weather Forecast",
                config: {
                        location: "Gajuwaka",
                        locationID: "7302833,
                        appid: "50ad0030047c9790e7bfdb4cb6a19d80",
                    }
        },
{
                module: "newsfeed",
                position: "bottom_bar",
                config: {
                        feeds: [
                        {
                        title: "News",
                        url: http://timesofindia.indiatimes.com/rssfeedstopstories.cms
                         }
```

```
                                ],
                                showSourceTitle: true,
                                showPublishDate: true,
                                broadcastNewsUpdates: true
                        }
                },
{
  module: "MMM-AlarmClock",
   position: "top_left",
  config: {
 alarms: [
 {time: "11:15", days: [1,2,3,4,5,6], title: "Good morning", message:"Time to wake up!", sound: "alarm.mp3"},
    ],
   }
},
      {
      module: "MMM-PIR-Sensor",
           config: {
                        sensorPin:21,
                        sensorState:1,
                        powerSaving:true,
                        powerSavingDelay:60,
                        powerSavingNotification:true,
                        powerSavingMessage:"Monitor will be turn Off by PIR module",
```

```
                }
        },
        {
                module: 'MMM-SystemStats',
                position: 'bottom_left',
                config: {
                                        updateInterval: 10000,
                                        align: 'right',
                                        header: 'System Stats',
                                        units: 'metric',
                                        view: 'textAndIcon',
                        },
        },
{
    module: "MMM-Remote-Control",
    position: "bottom_left",
    config: {
     customCommand: {},
     customMenu: "custom_menu.json",
     showModuleApiMenu: true,
        }
        },
        {
            module: "MMM-MWWordOfTheDay",
             position: "top_right",
```

```
            config: {
                        updateInterval: 120000,
                        headerText: "Word of the day"
                          }
         },
 {
        module: "MMM-Hotword",
        position: "bottom_left",
        config: {
                           recipes: ["with-AMk2v3_smart-mirror.js"],
                          chimeOnFinish: null,
                mic: {
                           recordProgram: "arecord",
                         device: "plughw:1"
                         },
               }
},
{
        module: "MMM-AssistantMk2",
        position: "bottom_right",
        config: {
                           recipes: ["with-MMM-Hotword.js","with-MMM-NewPIR.js"],
                         ui: "Classic",
                         assistantConfig: {
                                                latitude: 17.686815,
```

```
                longitude: 83.218483,
            },
                record: {
                    recordProgram : "arecord",
                    device  : "plughw:1",
                    },
        notifications: {
                    ASSISTANT_ACTIVATED: "HOTWORD_PAUSE",
                    ASSISTANT_DEACTIVATED: "HOTWORD_RESUME"
                },
        profiles:       {
                    "default" : {
                    lang: "en-US"
                }
        },
    }
},
    ]
}
```

5.2 RESULTS

The output of the Smart Mirror has a black output screen which displays weather, news and time. The top left corner of the screen displays time which is present in the Raspberry Pi. It makes use the calendar for displaying the day and date along with time. The top right corner of the screen displays weather conditions and also current weather. The weather API which is used in this project is available on ‘forecast.io’. Weather condition update changes every hour and is displayed on the screen if there is a change in temperature else the temperature remains unchanged. Lower bottom shows the compliments. Right bottom shows the word of the day. Left bottom shows alarm clock. Fig 5.2(a) shows the front view of the Smart Mirror. Fig 5.2(b): show the clear view in front view of the Smart Mirror. Fig 5.2(c) shows the back view of the Smart Mirror. Fig 5.2 (d) acts as a normal mirror, happens when motion is not detected.

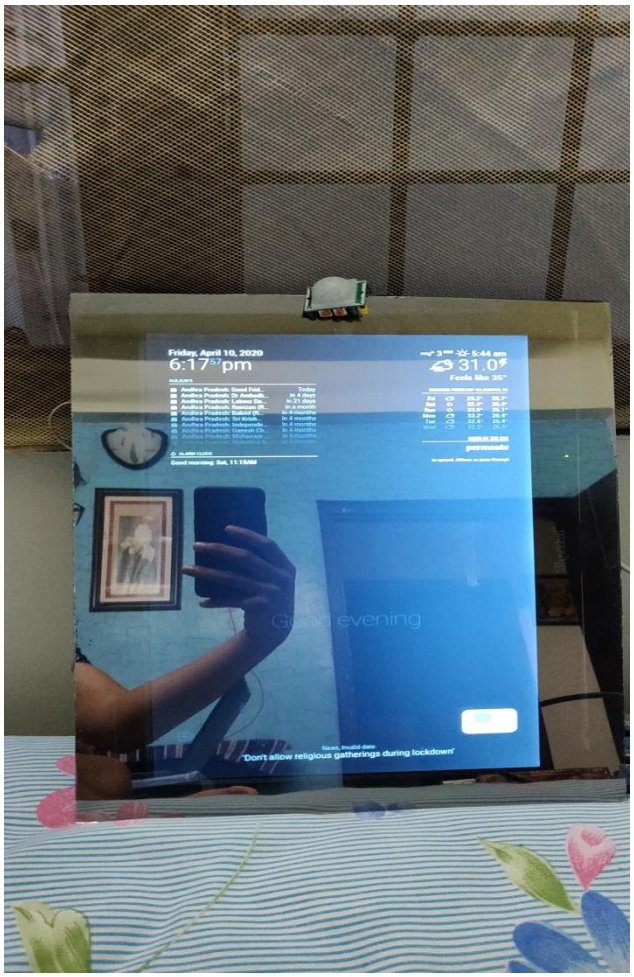


Fig 5.2 (a): front view Smart Mirror

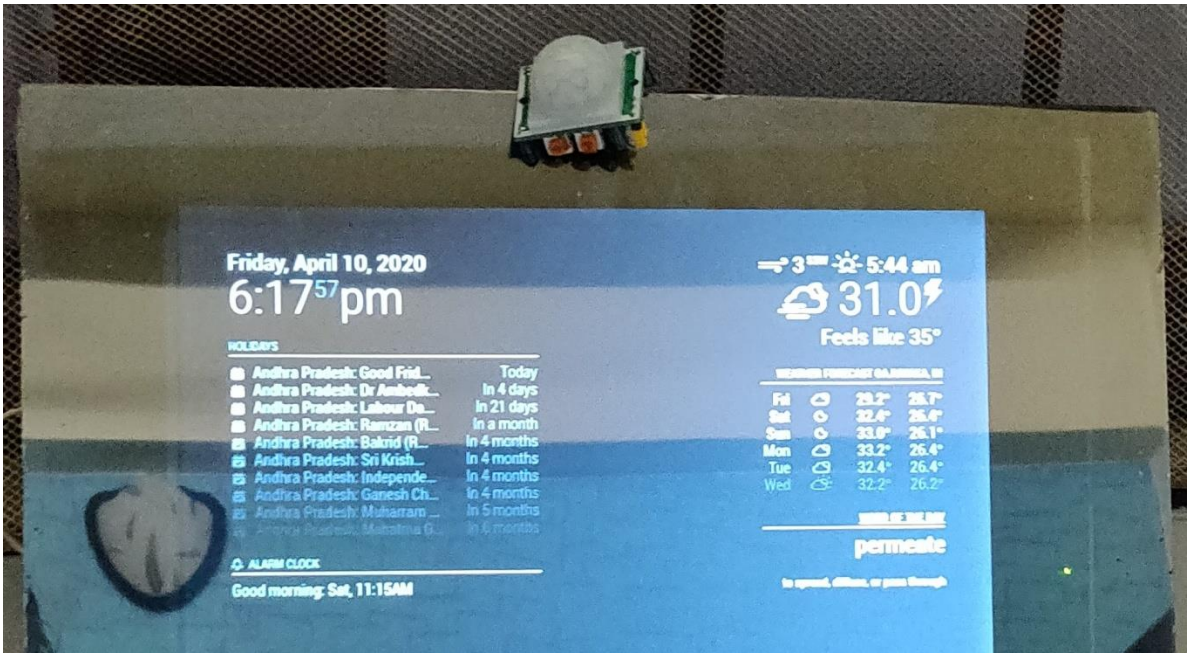


Fig 5.2 (b): clear view of the Smart Mirror

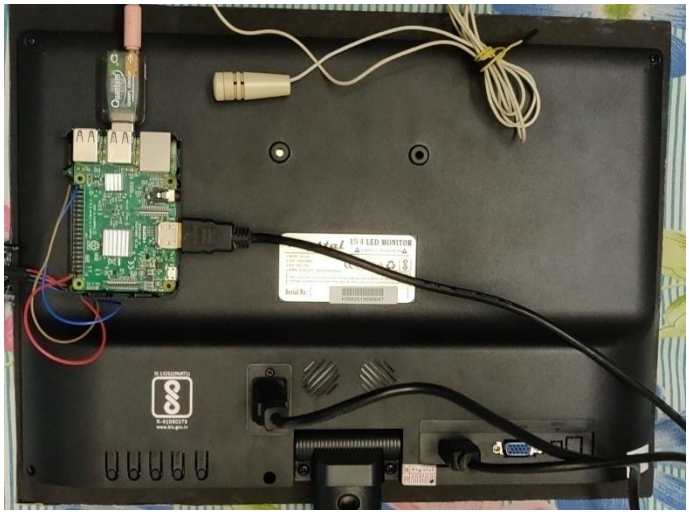


Fig 5.2 (c): back view of the Smart Mirror

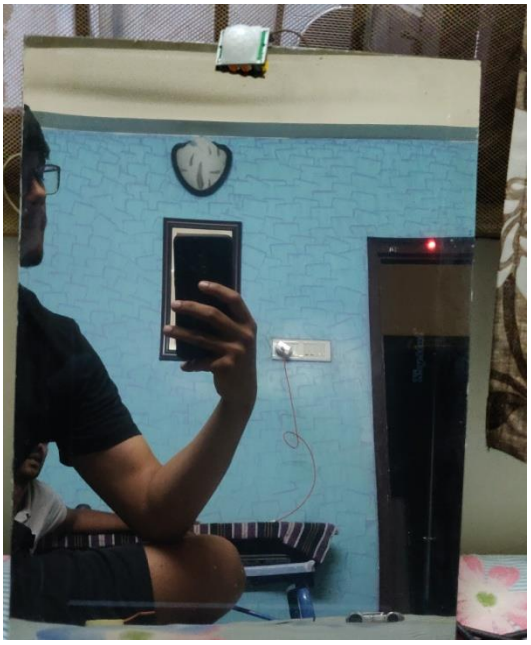


Fig 5.2(d): normal mirror

Back view of the Smart Mirror has an LCD screen attached with a Raspberry pi which further connects to PIR sensor, speaker and microphone. The mirror acts as a Smart Mirror when any motion is detected and simply acts as a normal mirror when PIR sensor doesn't detect any motion. The Smart mirror would turn off itself, even if there is any movement of birds or unwanted objects other than humans because of the sensitivity given to the PIR sensor. This definitely helps in saving the energy of the Smart Mirror when not in use. The Smart Mirror responds to us only when a hotword such as "Smart Mirror" is heard to it. Any word other than "Smart Mirror" , the mirror does not respond. The output is given by a speaker.

CHAPTER 6

FUTURE WORK

Nothing is perfect and complete and there is always a scope of improvement in each and every product. Everything needs to be updated or upgraded on a timely basis to cope up with the current technology. Apart from up gradation there can be many other features as well which could add up to the proficiency and ability of our smart mirror. There are many future scopes for this paper and hopefully it will emerge into biggest benefit in the field of artificial intelligence. The most basic feature can be smart mirror-based home automation which will provide a natural means of interaction by which we can control the household appliances like switch on/off light and fans through basic voice commands. Majorly, since we are using this mirror in college environment, basic functionalities like barcode scanner or finger print sensor can be integrated to fulfill basic tasks such as college attendance or program registrations etc. This could include registering in programs by scanning of ID cards.

In today's society, information is available to us at a glance through our phones, our laptops, our desktops, and more. But an extra level of interaction is required in order to access the information. As technology grows, technology should grow further and further away from the traditional style of interaction with devices. In the past, information was relayed through paper, then through computers, and in today's day and age, through our phones and multiple other mediums. Technology should become more integrated into our lives - more seamless and more invisible.

As for future work, many new opportunities are now available with the ability to access external hardware. It would be nice to explore various ideas using motion detectors, temperature and light sensors, gesture recognition, voice commands, and some form of proximity detection, such as detecting the closest phone in range. There are features that can improve the usability of Smart Mirror.

This Smart Mirror can be used in college premises, those who are new to the campus can easily get information from the mirror such as location of each campus, courses available, and

accommodation etc. this is a very useful application. This one application would help not only the college administration but also the humans.

Another enhancement would be to add a priority system for processing API calls. Currently, with wireless internet and network interference, there can be a delay in sending API calls. This delay causes the API calls to get cached on the server and then executed as the call queue is processed. With a priority system in place, non-important API calls could be dropped completely as to clear up the API call queue faster and try to alleviate the delay. Having prioritized API calls would benefit interactive processes that require real-time user input/output, such as rearranging a location in the mirror.

With the help of this literature survey we aim at designing a smart mirror that provides an ambient environment between users and the internet. It will help the users in their daily activities. The smart mirror can also be implemented in various industrial and home applications. Hence IoT proves out to be an important technology for making household appliances smart. The facial recognition technology used in the smart mirror proves out to be an important means of security. Smart mirrors can be connected to home appliances and smart phones. The mirrors can detect face and provide access to personalized services. The mirror can also be implemented to recognize emotions. With the help of emerging technologies, smart mirrors can be advanced to touch screen modes. The mirrors can be better enhanced to be deployed in beauty parlors, cloth shops, hotels, etc. with better advancements in technology; mirrors can be used in many other fields.

CHAPTER 7

CONLUSION

The project is aimed at smart mirror, mirror form a smart futuristic provide natural interaction between mirror and the user. Smart mirrors are provided by 2-way mirror (acrylic sheet) and a display monitor that shows all the important data that is useful to the user. "Smart Mirror" is also equipped with voice services such as “Google Assistant” capable of giving something unusual. There is a two-way communication between the user and the mirror itself. It allows users to see relevant information effortlessly. It saves a lot of effort and time that is needed to access such information by displaying all in one place.

The smart mirror which acts as a smart home control platform is a futuristic system that provides users with an easy-to-use mirror interface, allowing users access to customizable services in a highly interactive manner, while performing other tasks simultaneously. The main strengths are that this is a new kind of smart device that people don’t see every day and it looks very spectacular. The mirror works both as a normal mirror as well as a mirror showing daily notifications to the authorized user.

At minimum, the project set out to have a mirror that could display a dynamic date and time. This was the minimum criteria for success, but then the user could include a weather display along with weather forecast. User can change accordingly. Not only that the user can add compliments, to start a day with Positive note. For making it more fun Voice command (“Smart Mirror”) was added from Google Assistant. This was way more fun than we thought. It could answer to any of your questions. User could add different items to your To-do list by just talking to the Smart Mirror. Just to remember a new word everyday which would make our vocabulary better “WORD OF THE DAY” was added, user would be able to learn a new word every day. Then to make sure that your Smart Mirror is absolutely fine, system statistics was added, where one can see the RAM, memory etc. This could also be controlled by one’s mobile if you wish to. This mobile acts as a remote controller. Above all this a PIR motion detector sensor was added. The Smart mirror would just be a mirror if there is no motion detected and it would be a digital mirror if motion is detected. This is also a digital mirror and is named as Smart Mirror.

CHAPTER 8

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