Government College of Arts, Science & Commerce
Quepem - Goa 403 705
(NAAC Accredited with A Grade)

A PROJECT REPORT ON

SMART MIRROR USING RASPBERRY PI

GOVERNMENT COLLEGE OF ARTS, SCIENCE AND COMMERCE
QUEPEM-GOA

Smart Mirror Using Raspberry Pi

A project report submitted in partial fulfilment of the requirement for the degree of

Bachelor of Science

In

Computer Science

By

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DECLARATION BY CANDIDATES

We declare that this project report has been prepared by us and to the best of our knowledge, has not previously formed the basis for the award of any diploma or degree by any other University

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CERTIFICATE

This is to certify that the project work entitled

"**Smart Mirror Using Raspberry Pi**"

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Date:

Project Guide: Head of the Department:

External Examiner:

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We are extremely grateful to our beloved **Principal Dr. Joydeep Bhattacharjee** who has been a constant source of inspiration and motivation to us.

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Chapter 1

INTRODUCTION

1.1 INTRODUCTION

The internet of things means interconnection of computing devices embedded in everyday objects, enabling them to send and receive data. The Internet of Things with its enormous growth widens its application to the living environment of the people by changing a Home to a smart home.
Smart home is a connected home that connects all the digital devices to communicate each other through internet.
This project has been developed with an idea of making home smart to save time. The device which 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.
Smart mirror technology which is also known as magic mirror that provide the best advanced user interface and best user experience for the high-tech futuristic home environment. The mirror offered natural mode of interaction through by which the residents can able to control the home appliances and also experience the AI chat assistant. The user can able to interact with the personnel home assistant through or Alexa chat assistant, this provides the most natural and convenient mode of interaction.

Our team created a smart mirror that allows users to engage with internet services while also displaying real-time data from IoT devices. We attempted to develop a smart home experience, and a smart mirror might play a significant role in a home automation system.

1.2 SCOPE OF PROJECT

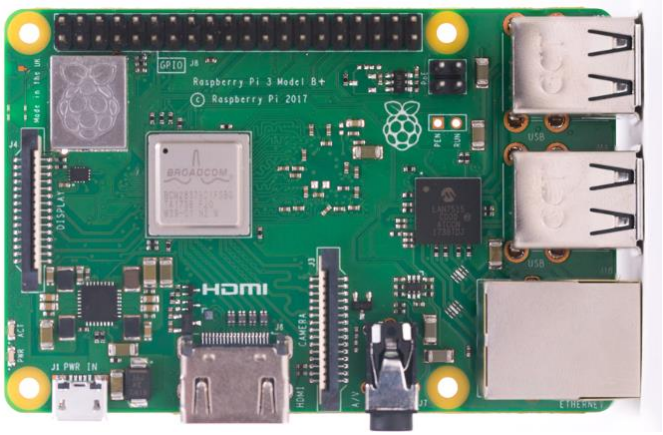
A Smart Mirror is meant as a smart home technology to allow convenient access to media and information that people might be interested in on a daily basis. The mirror will display customized information to the user to allow users to get some basic daily information at a glance. This will save users time in their busy morning routine which will, as a result, relieve stress and help people get out the door on time in the morning. The mirror will display information users may access in the morning via their phone or other technology in a way that is readily available as soon as they walk into the bathroom or as people when Infront of the dressing table to get ready. This will allow the user to plan for their day while simultaneously completing their daily routine in front of the mirror.

The Smart Mirror will merge technology with a mirror to provide users information while they use their mirror. The primary motivation behind the smart mirror is to improve quality of life. Providing information to users in the most convenient way possible is a driving motivation behind the majority of technological development for smartphones and tablets. The smart mirror will provide convenient information to users on their mirror every day. Allowing the user to multitask by consuming media while preparing for the day will save people time nationwide.

Chapter 2:

BOARDS USED

2.1 Raspberry Pi 3 model B+



The Raspberry Pi is a little computer about the size of a credit card. The Raspberry Pi 3 Model B+ is a more powerful variant of the previous Raspberry Pi 3 Model B. The BCM2837B0 system-on-chip (SoC) has a 1.4 GHz quad-core ARMv8 64bit CPU and a powerful VideoCore IV GPU. Snappy Ubuntu Core, Raspbian, Fedora, and Arch Linux, as well as Microsoft Windows 10 IoT Core, are among the ARM GNU/Linux distributions that can be run on the Raspberry Pi.

The Raspberry Pi 3 Model B+ offers a higher CPU clock speed (1.4 GHz versus 1.2 GHz), higher Ethernet throughput, and dual-band WiFi than the Raspberry Pi 3 Model B. With a Power over Ethernet HAT, it also enables Power over Ethernet.

The Raspberry Pi Foundation created the Raspberry Pi to offer a low-cost platform for computer programming exploration and teaching. The Raspberry Pi can do many of the same tasks as a traditional desktop computer, such as word processing, spreadsheets, high-definition video, gaming, and programming. The board's four USB ports may be used to connect USB devices like keyboards and mice. The Raspberry Pi may also be used as a programmable controller in a number of robotics and electronics applications thanks to its 0.1″-spaced GPIO header and tiny size.

Specifications

- ARMv8 64bit quad-core BCM2837B0 CPU
- 1 GB RAM
- VideoCore IV 3D graphics core

• Ethernet connection

• dual-band radio (2.4 GHz and 5 GHz) • Bluetooth 4.2 • Bluetooth Low Energy (BLE) • Four USB ports • IEEE 802.11b/g/n/ac wireless LAN (WiFi)

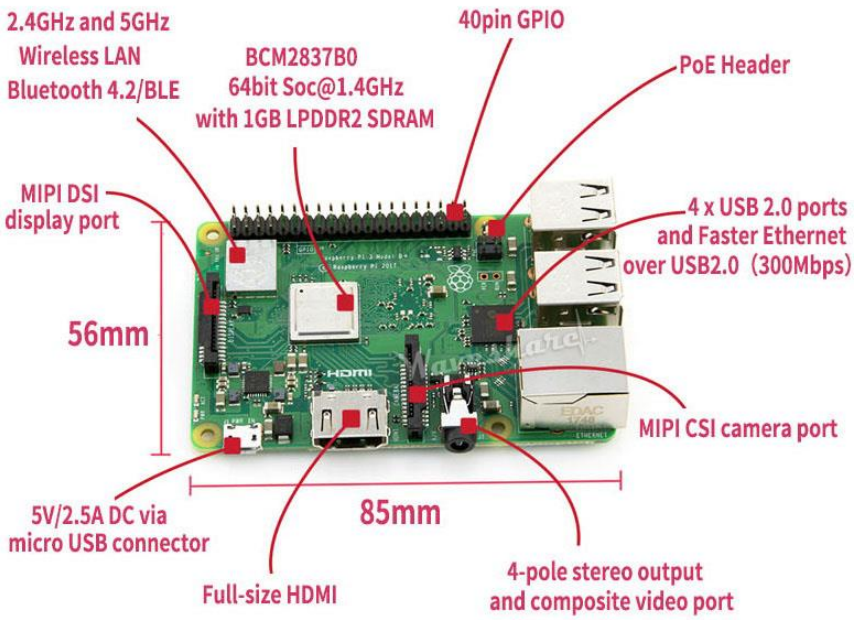
• HDMI output (full-size)

• Audio and composite video outputs on a four-pole 3.5 mm jack

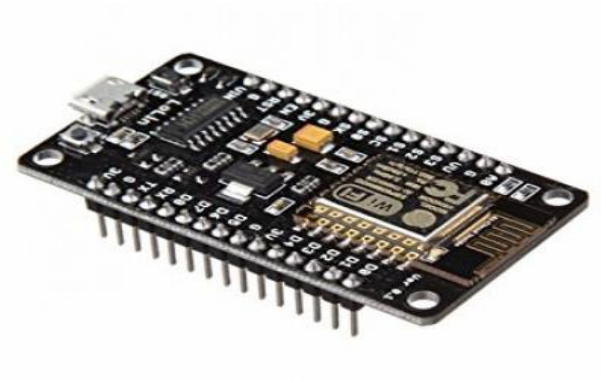
• 40-pin GPIO header with 0.1″-spaced male pins that work with our 220 stackable female headers and female ends of our premium jumper wires.

• Micro SD card slot • Camera interface (CSI) • Display interface (DSI)

➢ Specification



2.2 NodeMCU



NodeMCU is an open-source firmware for which open-source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits.

NodeMCU is an open source IoT platform with a cheap cost. It came with software that ran on Espressif Systems' ESP8266 Wi-Fi SoC and hardware that was based on the ESP-12 module at first. Later, the ESP32 32-bit MCU was introduced to the mix.

The ESP8266 WiFi Module is a self-contained SOC with an inbuilt TCP/IP protocol stack that can provide access to your WiFi network to any microcontroller. The ESP8266 may either host an application or offload all WiFi networking functionality to a separate application processor.

The Node-MCU IoT Module is based on the ESP8266 and integrates GPIO, PWM, IIC, 1-Wire, and ADC onto one board.

• 10 GPIO, each GPIO may be PWM, I2C, or 1-wire • USB-TTL integrated, plug&play

The Node-MCU IoT Module has the following features:

• Open source IoT Platform

• Easily Programmable

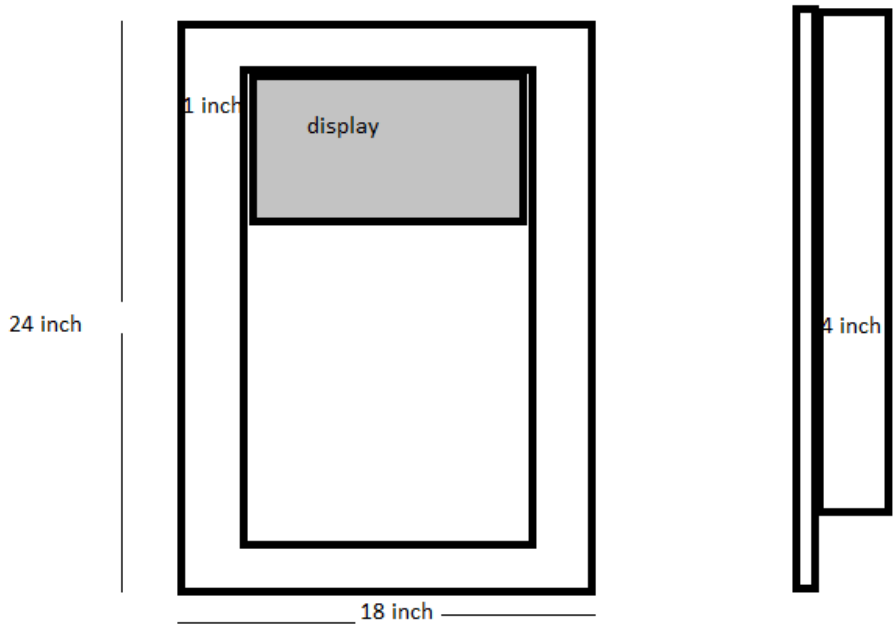
• Low cost & Simple to Implement

• WI-FI enabled

Chapter 3:

LOOK AND DESIGN

3.1 Design of wooden frame:



A smart mirror is a monitor powered by a Raspberry Pi that is hidden behind a double-sided mirror. As if by magic, a largely dark web page enables you to add certain widgets to the mirror's reflection. Widgets for showing the weather forecast, the date/time, and a lovely randomly produced welcome are included in this version.

Prerequisites

• A monitor • A double sided acryllic mirror/two way mirror cut to fit the size of the monitor • A few 2 x 4's to build a case around the monitor • Thin wood to build the forward facing mirror frame, I used 1/8 x 3' board • A Raspberry Pi and all of its required components, such as the power supply, HDMI cable, and a keyboard for initial setup • Basic woodworking tools such as a saw, sander, and screwdriver

3.2 Assembling the Smart Mirror

The smart mirror was constructed by constructing a frame construction out of plywood strips. The back of the smart mirror was covered with another piece of plywood. All sides of the building were then painted black. Then, with the bright side facing forward, the two-way mirror was carefully inserted into the frame (dark side back).

To dismantle the computer display, switch it on and set the brightness to the highest setting. After that, we remove the bottom stand and place it face down on something soft to avoid scratching it.

We next removed the rear panel by popping all the tabs around the exterior using a little flathead screwdriver. This shows a line of little screws along the rear border, which we removed. The front bezel should then be gently removed. The monitor was then put face down on the mirror, with the top of the mirror. We draw around the edges of the monitor using a hot glue gun to bind it to the board.

To put the Raspberry Pi together, first put the memory card in the Pi, then put it in the plastic shell. The power and HDMI cables may then be connected. Also, utilize the USB ports to connect a keyboard and mouse. The Pi is then powered up for the first time. When the operating system is requested to "Install," we just follow the on-screen instructions until the Pi powers up. It then asks us a few basic questions, such as our timezone and whether or not we have access to WiFi.

We can finally put everything into the frame once the software is complete. We begin by connecting the HDMI cable to the 90-degree HDMI adaptor on the back of the display. After that, we'll connect the monitor's power line and tuck it away to the side. Remove the Raspberry Pi from its plastic casing and connect it to the display.

The next step is to carefully route all of the wires so that everything is neat and tidy at the rear. To bind all of the connections to the rear of the frame, we use a mixture of a hot glue gun and Velcro cable ties.

Final look:

Front view

Top view

Chapter 4:

OS/SOFTWARE/ MODULES

4.1 Raspbian OS

Raspbian is a free operating system based on Debian and designed specifically for the Raspberry Pi. An operating system is a collection of apps and tools that enable your Raspberry Pi to function. The Raspberry Pi Foundation has officially released it as the main operating system for the Raspberry Pi line of small single-board computers since 2015. Mike Thompson and Peter Green produced the initial version of Raspbian as a side project.

Raspbian, on the other hand, is more than just an operating system: it includes over 35,000 packages, which are pre-compiled software packages packaged in a convenient style for quick installation on your Raspberry Pi.

Raspberry Pi OS is designed specifically for the Raspberry Pi range of ARM-based single-board computers. Except for the Pico microcontroller, it operates on any Raspberry Pi. Raspberry Pi OS's desktop environment is a modified LXDE with the Openbox stacking window manager and a custom style.

In June of 2012, the first build of nearly 35,000 Raspbian packages, optimized for the Raspberry Pi, was finished. Raspbian, on the other hand, is still being actively developed, with the goal of enhancing the reliability and performance of as many Debian programs as possible.

Raspberry Pi OS resembles several popular desktop operating systems, such as macOS and Microsoft Windows. The top-level menu bar provides an application menu as well as shortcuts to Terminal, Chromium, and File Manager. A Bluetooth menu, a Wi-Fi menu, volume control, and a digital clock are all located on the right.

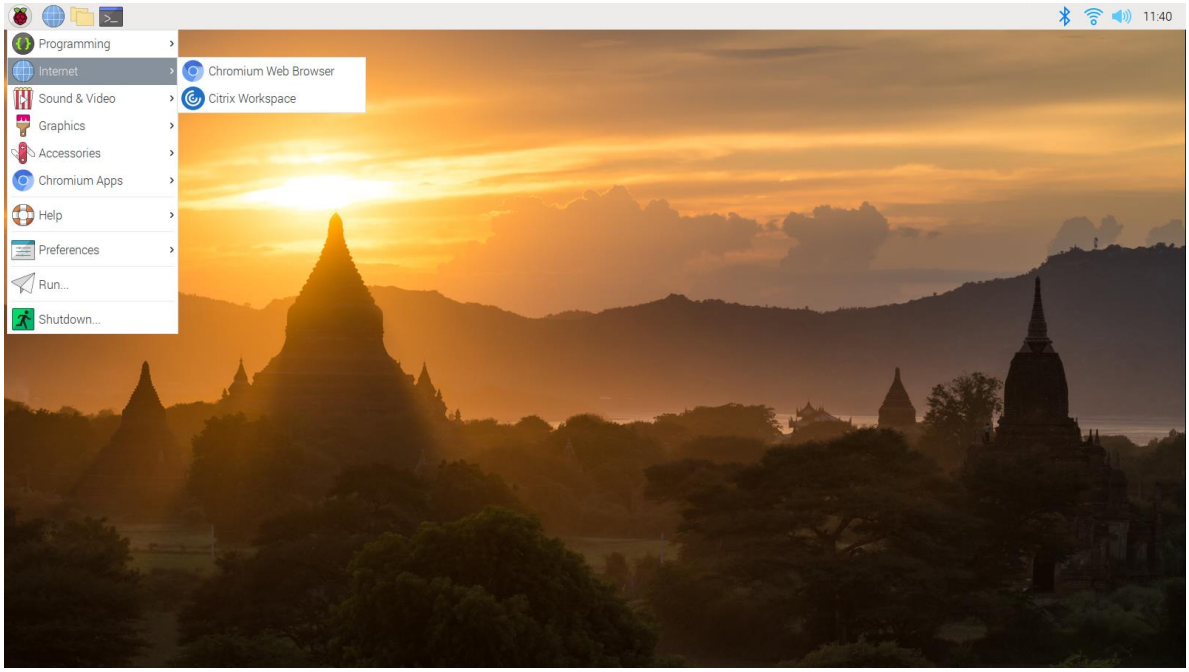
Raspberry Pi OS Lite, Raspberry Pi OS, and Raspberry Pi OS Full are the three installation choices available.

The Raspberry Pi OS Lite is the smallest version of the operating system, and it comes without a desktop environment.

The Pixel Desktop Environment is part of the Raspberry Pi OS.

Additional productivity applications are pre-installed on the Raspberry Pi OS Full.

.img disk image files are used to deliver all versions. These files may then be flashed into microSD cards, which are used to run the Raspberry Pi OS. The Raspberry Pi Foundation also released the Raspberry Pi Imager in March 2020, a custom disk flasher that enables users to install Raspberry Pi OS as well as alternative operating systems for the Raspberry Pi, such as RetroPie, Kodi OS, and others.



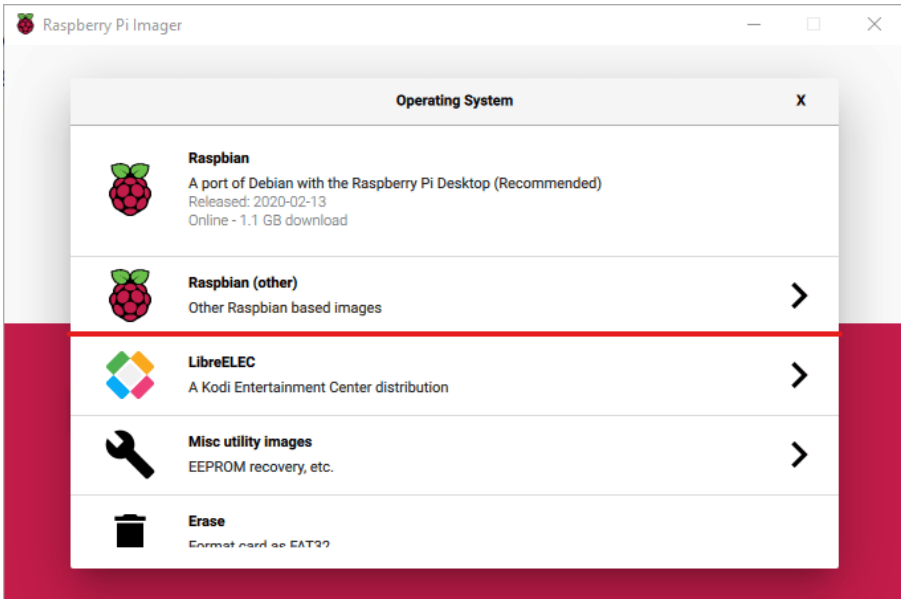
Installing Raspbian OS

- Download the latest version of Raspberry Pi Imager and install it.

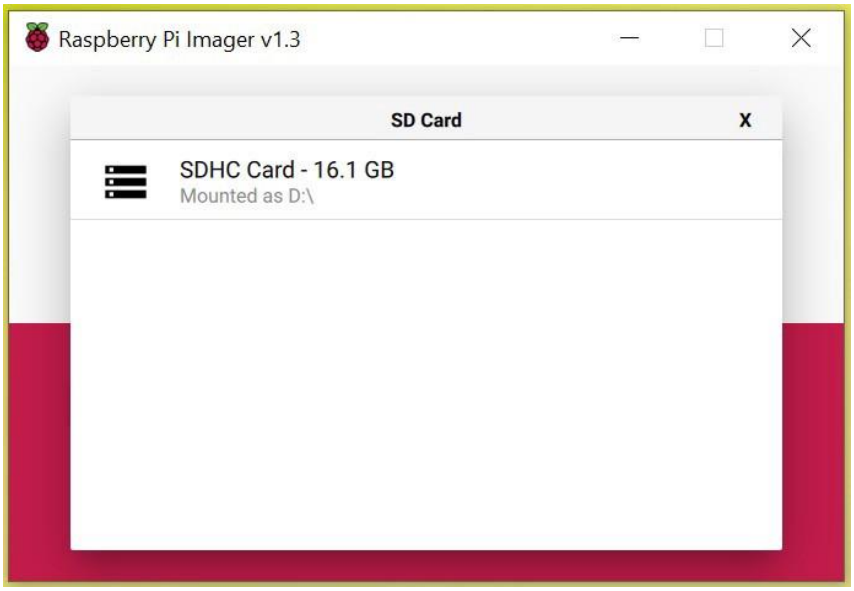
Or use Raspberry Pi Imager on the Raspberry Pi itself, install it from a terminal using sudo apt install rpi-imager.

- Connect an SD card reader with the SD card inside.

- Open Raspberry Pi Imager and choose the required OS from the list presented.



- Choose the SD card you wish to write your image to.



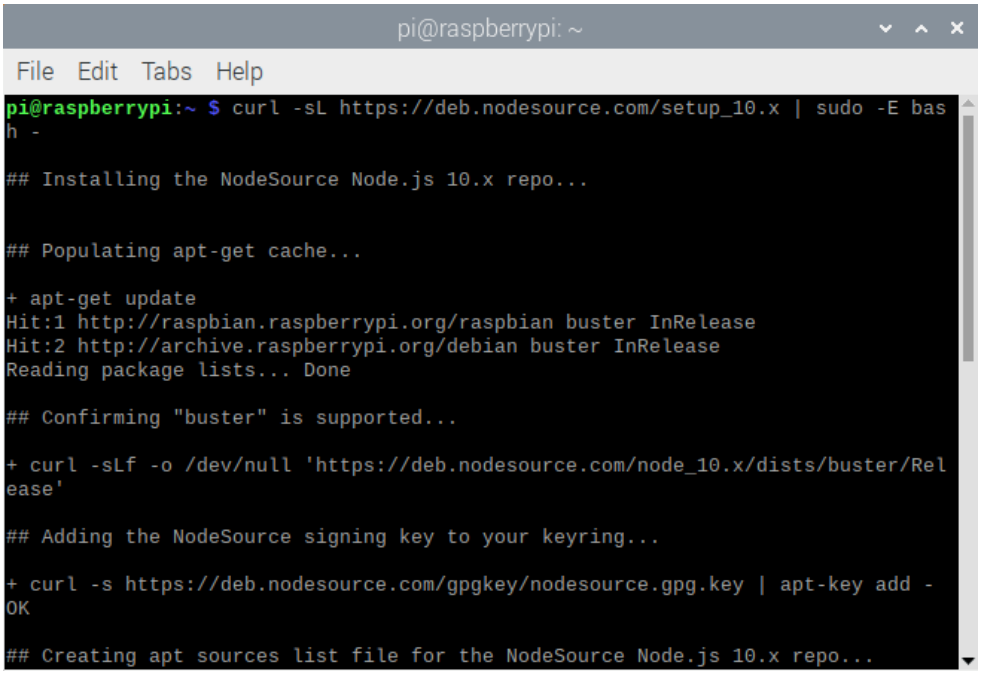
- Review your selections and click 'WRITE' to begin writing data to the SD card.

4.2 Installing Magic Mirror on Raspberry Pi

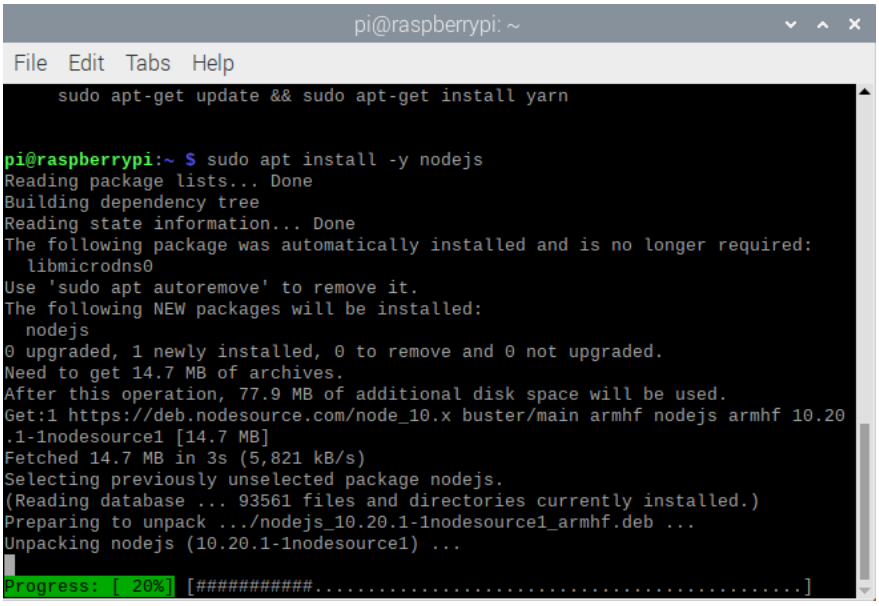
Manual Installation

- Download and install the latest Node.js version:

curl -sL https://deb.nodesource.com/setup_10.x | sudo -E bash –

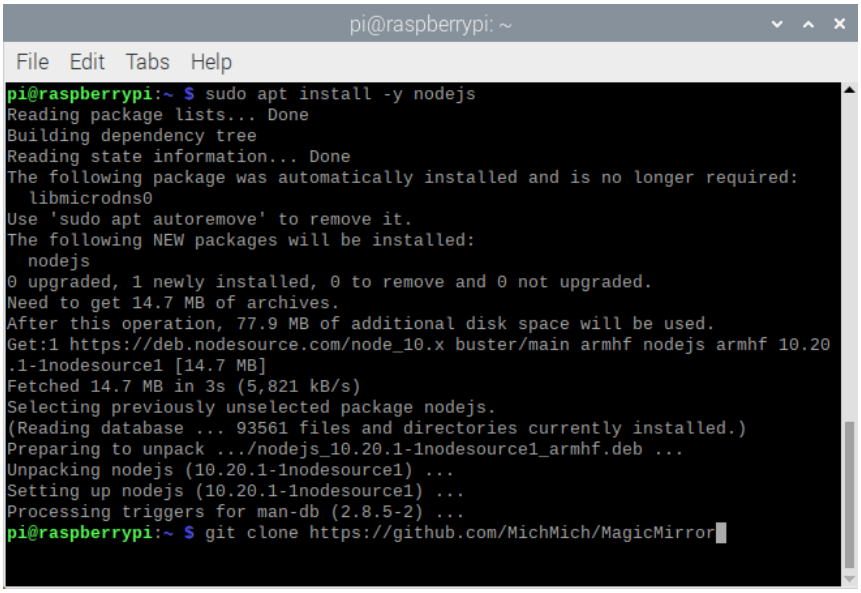


sudo apt install -y nodejs



- Clone the repository and check out the master branch:

git clone https://github.com/MichMich/MagicMirror

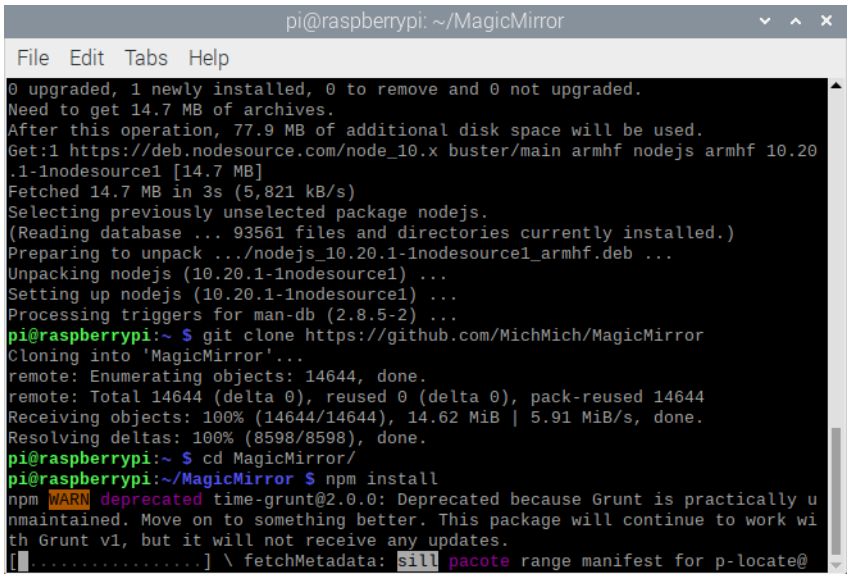


- Enter the repository**:**

cd MagicMirror/

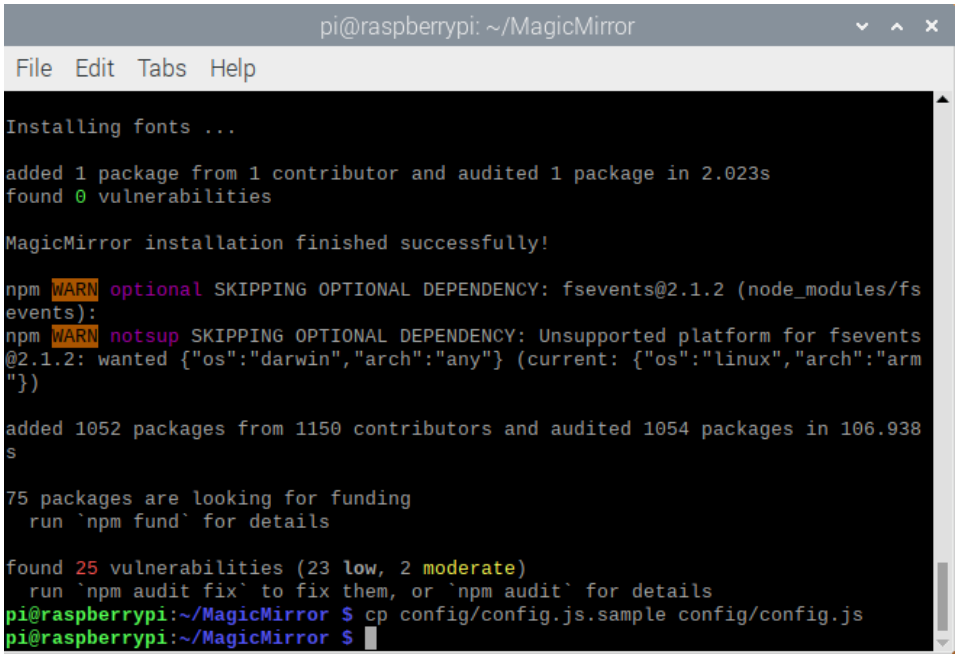
- Install the application:

npm install

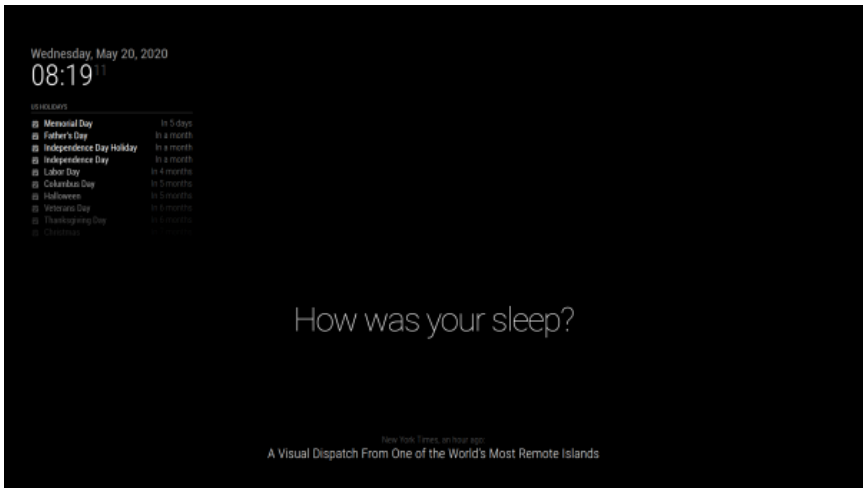


- Make a copy of the config sample file:

cp config/config.js.sample config/config.js



- Start the application:
  npm run star



- For Server Only use:

npm run server .

config.js file is essentially the brains of the operation. This is where you layout how you want your Magic Mirror to look. We can add modules, delete modules, move modules, and customize content.

4.3 Different modules used in magic mirror:

1. Covid_19 information module.
2. Spotify module
3. Share market module
4. Hue lights modules
5. Calender modules
6. Air quality module
7. Alexa
8. Traffic module
9. Weekly shedule module
10. Opening hours module
11. Notification trigger module
12. Automation
13. Quote of the day
14. Wifi connection
15. Daily news
16. Weather forecast

❖ Covid19 Information Module

Magic Mirror Module to display stats on Covid19. Data is provided by https://covid19api.com/ . The data shown in the table displays the total numbers (top) and the difference between today's numbers and the day before numbers (bottom).

Live COVID-19 numbers (provided by https://covid19api.com/)

Country	Active	Recovered	Deaths	Confirmed
World	-	44,992,928	1,750,474	79,828,488
	-	290,732	8,306	465,684
Germany	363,009	1,253,285	29,946	1,646,240
	-4,179	17,317	366	13,504
Italy	580,941	1,386,198	71,620	2,038,759
	1,055	9,089	261	10,405
HK	-	-	-	-
	-	-	-	-

❖ AVStockmodule

This module shows the stock prices with Alphavantage API. There are 5 modes in which we can show the stock prices and they are as follows:

- `mode: table`

- `mode: ticker`

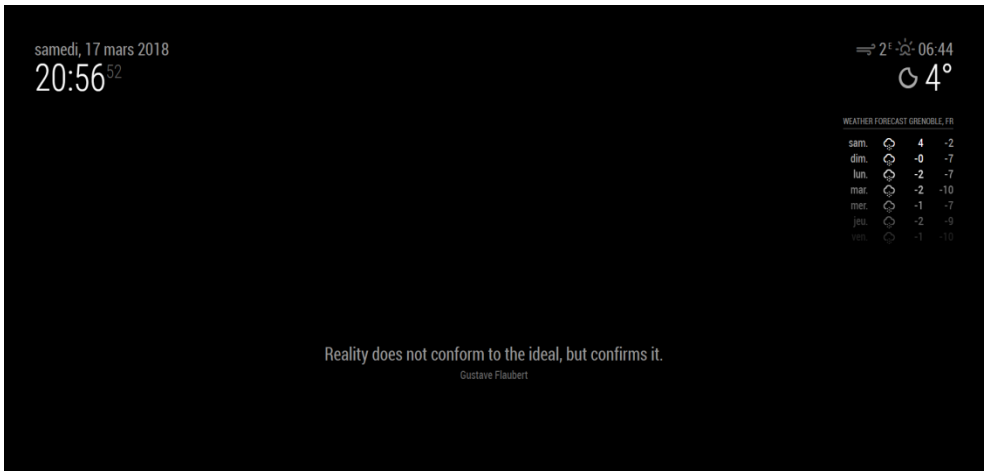
- `mode: grid` with `direction: 'row'`

- `mode: ticker with own purchase prices`

- `mode: ticker with own purchase prices and total performance compared to the purchase price`

❖ Quote-of-the-day

Magic Mirror module to show a random quote from an online collection of quotations by authors, celebrities, and newsmakers. This module is based on the Forismatic API. Quotes are only available in English but they can be translated on the fly in the language of your choice. The translation is based on the Google API. The quote is renewed following a configurable update interval.



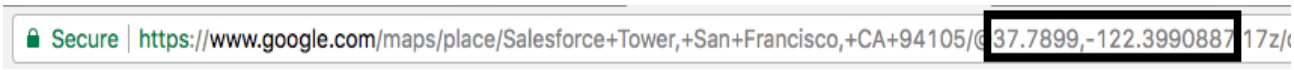
❖ AirQuality

A module for the MagicMirror, to display the current air quality index of a certain location.

❖ GoogleMapsTraffic

A Raspberry Pi MagicMirror module that displays a map, centered at provided coordinates, with Google Maps Traffic information.

Coordinates
The easiest way to obtain latitude and longitude coordinates is via Google Maps. Type an address, location, or center the map where you'd like it centered. The coordinates will appear in the address bar as seen below.



❖ Weather Forecast

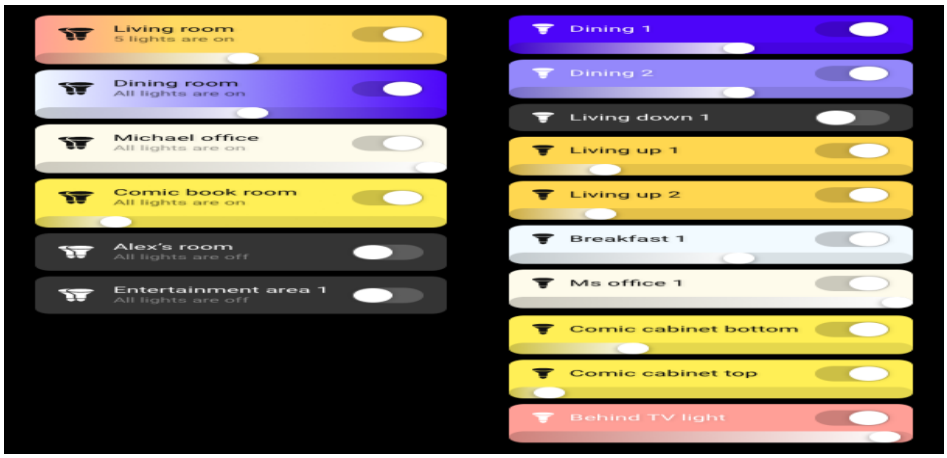
Custom weather module based off of the MagicMirror default weatherforecast module. This edit allows the days to be shown across the screen with added icons.

❖ Calendar_monthly

The calendar_monthly module is a simple month-view calendar created for the MagicMirror project by Michael Teeuw (https://github.com/MichMich/MagicMirror). The modules refreshes its timer every hour however it will only update the calendar display once a day, at midnight.

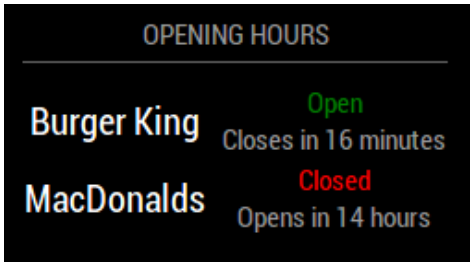
❖ Hue-lights

This module displays the status of your Philips Hue lights and light groups on your Magic Mirror and supports multiple view types and modes.
There are two types of way to display them grid and list views.



❖ OpeningHours

This is a Magic Mirror module that displays places opening hours.



❖ NotificationTrigger

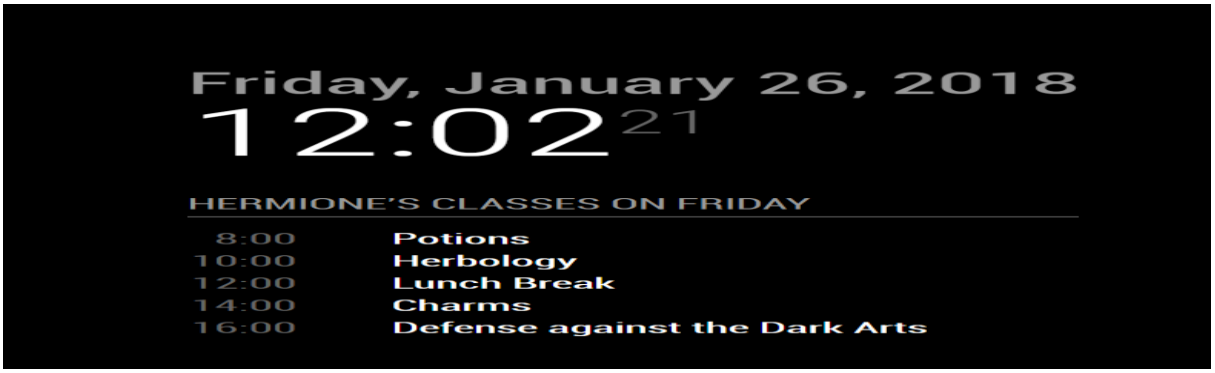
NotificationTrigger is a simple notification relay. NotificationTrigger is a simple notification relay which can convert notifications from TRIGGER_NOTIFICATION to FIRE_NOTIFICATION Many MagicMirror modules have their own incoming and outgoing notification messages. But most of them are not compatible. This module can translate notifications among other modules. You can use this module to chain modules to work together. This works in background, so there is no screenshot.

❖ WeeklySchedule

Module for MagicMirror which shows a weekly timetable. Might be helpful for students/teachers/parents to show class schedules, weekly gym courses, sports training sessions, and general weekly recurring events. This a module for the MagicMirror. It displays

today's timetable from a weekly recurring schedule. It is intended for regular weekly schedules, which have a low update frequency and thus can be maintained manually.

Examples are:
Kid's school classes
Student lectures
Teacher's teaching schedule
Gym training classes
Household chores
Opening hours of bakery, post office, supermarket

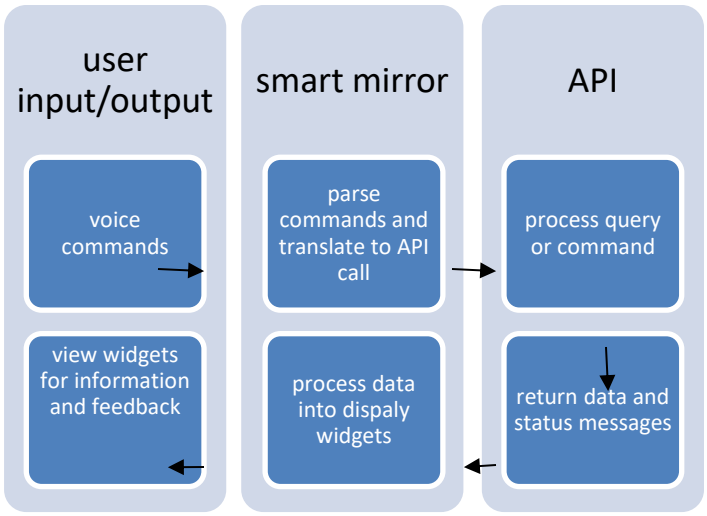


❖ Automation

Automation is, unsurprisingly, one of the two main characteristics of home automation. Automation refers to the ability to program and schedule events for the devices on the network.

❖ Voice assistance

Diagram below illustrates the sequence in which the voice assistant takes an input voice command and gives the desired output in an audio-visual format.



❖ Alexa

Voice control is enabled with a speaker, a microphone, and a built-in app powered by the Alexa voice assistant. In turn, Alexa has a set of skills for the management of smart mirror components, such as widget data and settings.
Turn your MagicMirror into an 'Amazon Echo', activated when said "Alexa".

Features

Wake word support
Custom wake word
Very easy set up
Easy config tool
All-in-one solution
visualization

Support wake words

Alexa
Smart mirror
Snowboy
Computer
Jarvis

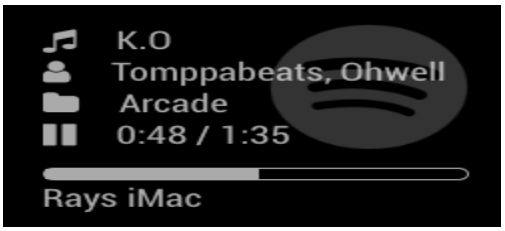
❖ NowPlayingOnSpotify

How it works
After installing the module and configuring and setting up the Spotify app the module displays the song you are currently listening to on Spotify. It shows on which of your devices you're playing the song. If you like you can also display the album cover.

To be able to display the currently playing song the module must connect to the Spotify service and query your private data. For obvious reasons this is not possible for arbitrary apps – or for that matter MagicMirror modules. There are third party solutions which will enable access to your Spotify data. This module is designed to be independent from third party services. Everything you need is in this module respectively is created by yourself.

Nothing is playing

A song is playing and showCoverArt is set to false.



A song is playing and showCoverArt is set to true.

4.4 Alexa Home Automation System Using NodeMCU & Relay Module

You can easily control light, fan, and other home appliances with the voice commands using the NodeMCU and Relay module.

We created the Alexa Smart Home Automation system using the NodeMCU ESP8266 and Relay Module in this IoT project. With the voice command, you can simply manage your lights, fans, and other household equipment. We merely used the Amazon Alexa app to link the smart mirror to the NodeMCU.

Assemble the hardware as shown in the figure below (in chapter 6) on your breadboard for Voice-Based Home Automation with NodeMCU & Alexa .

Step 1: Setup Arduino Preference for NodeMCU

- Go to the file of Arduino IDE and select Preferences.

Step 2: NodeMCU Board Installation

- Go to Board Manager and Instal NodeMCU Board version 2.3.0 It's very important otherwise Alexa doesn't discover devices.

Step 3: Board Selection

- Select Your NodeMCU board with the correct model

Step 4: Adding Libraries

- You need to download 3 different libraries and add them to Arduino IDE Library. The libraries are:

    1. fauxmoESP Library

    2. 2. ESPAsync TCP Library

    3. 3. ESPAsync Web Server Library

Step 5: write the code and Add your network credentials and upload it to the node mcu.

- After uploading the led-on node mcu will blink and it will be ready to connect to the wifi available.

Step 6:connect the node mcu with the relay module as shown in the diagram.

- connect the appliances with relay module.

Step 7: Once you've completed the circuit and uploaded the code to your ESP8266 or ESP32, you'll need to ask Alexa to find gadgets. After that, ask Alexa to switch on or off the lights. On the Serial Monitor, you'll also get information on the condition of the bulbs.

After you've double-checked that everything is in working order, you may make your circuit permanent.

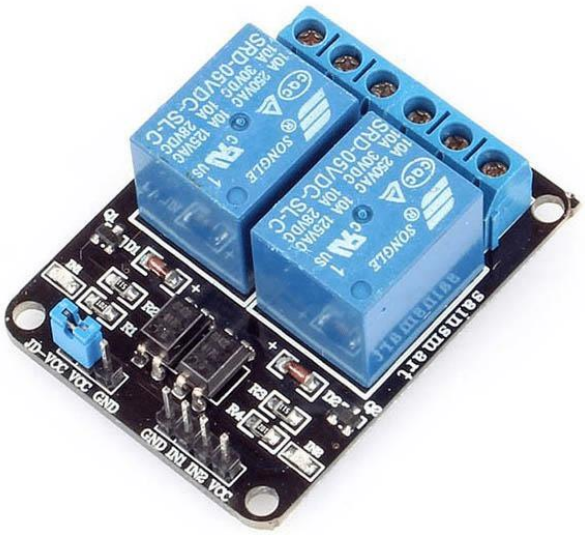
Chapter 5:

SENSOR DESCRIPTION

5.1 RELAY MODULE:

The relay is the mechanism that opens or shuts the contacts, causing the other electric controls to operate. It detects an unpleasant or unpleasant state in a designated region and sends orders to the circuit breaker to turn off the power to that region. As a result, the system is protected against harm.

Relays are switches that are used to close and open circuits both electrically and electromechanically. It regulates the opening and shutting of an electrical circuit's circuit connections. The relay is not energized with the open contact when the relay contact is open (NO).



This is a 2-channel isolated 5V 10A relay module for Arduino PIC ARM with an optocoupler. It may be utilized to regulate a wide range of appliances and other high-current devices. A microcontroller may control it directly with 3.3V or 5V logic signals (Arduino, 8051, AVR, PIC, DSP, ARM, ARM, MSP430, TTL logic). The 14 (2.54mm pitch) pin header on this relay is used to connect power (5V and 0V) and operate the two relays.

5.2 MIC AND SPEAKER

Microphone:

The Raspberry Pi USB Plug and Play Desktop Microphone is a USB microphone that works with any plug-and-play enabled Raspberry Pi Model B+, 2 Model B, Raspberry Pi 3, as well as PC and Mac computers, and is handy for sound recording.

We utilize it to capture speech and to control the smart mirror with voice commands. This microphone will be linked to the Raspberry Pi's USB connection and put on the back side of the mirror, where the voice of someone issuing orders will be heard.

Speaker:

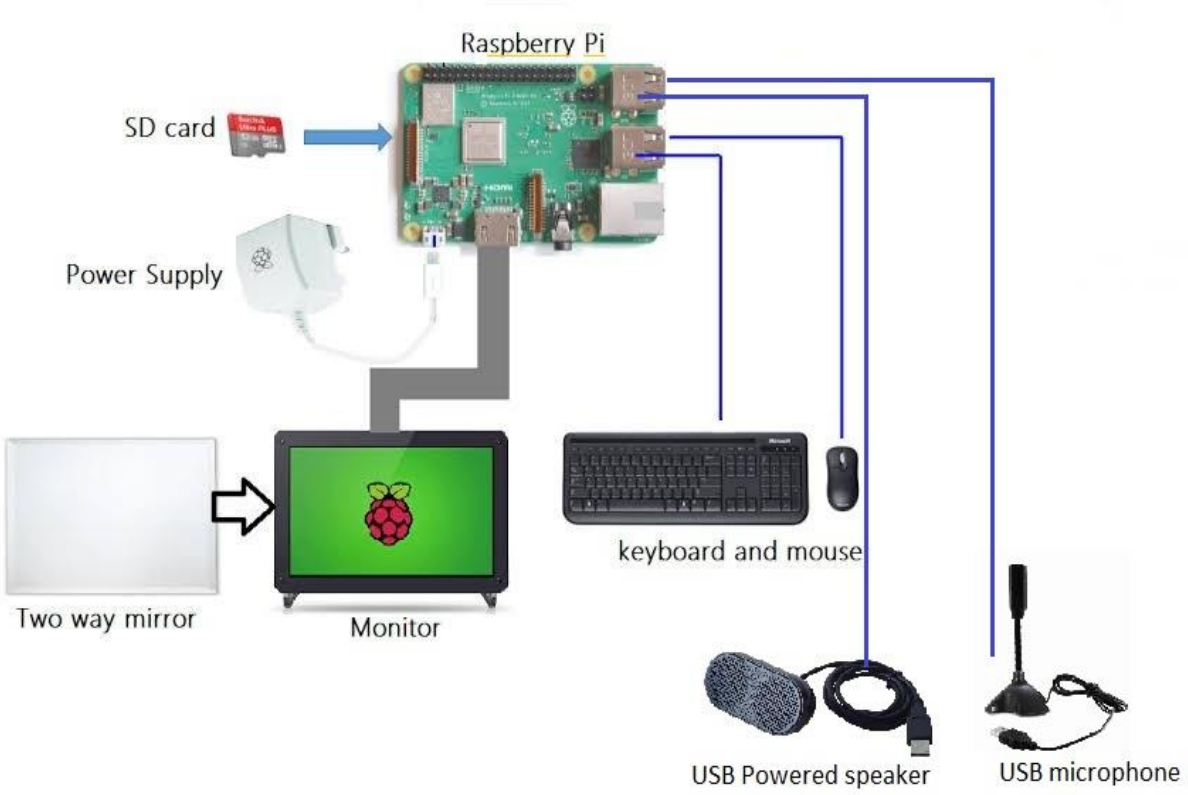
We use USB powered devices that are compatible with Windows, Mac OS X, and Linux.

The Smart Mirror receives voice instructions through the microphone, and the output is transmitted through the speakers as well as shown on the Smart Mirror.

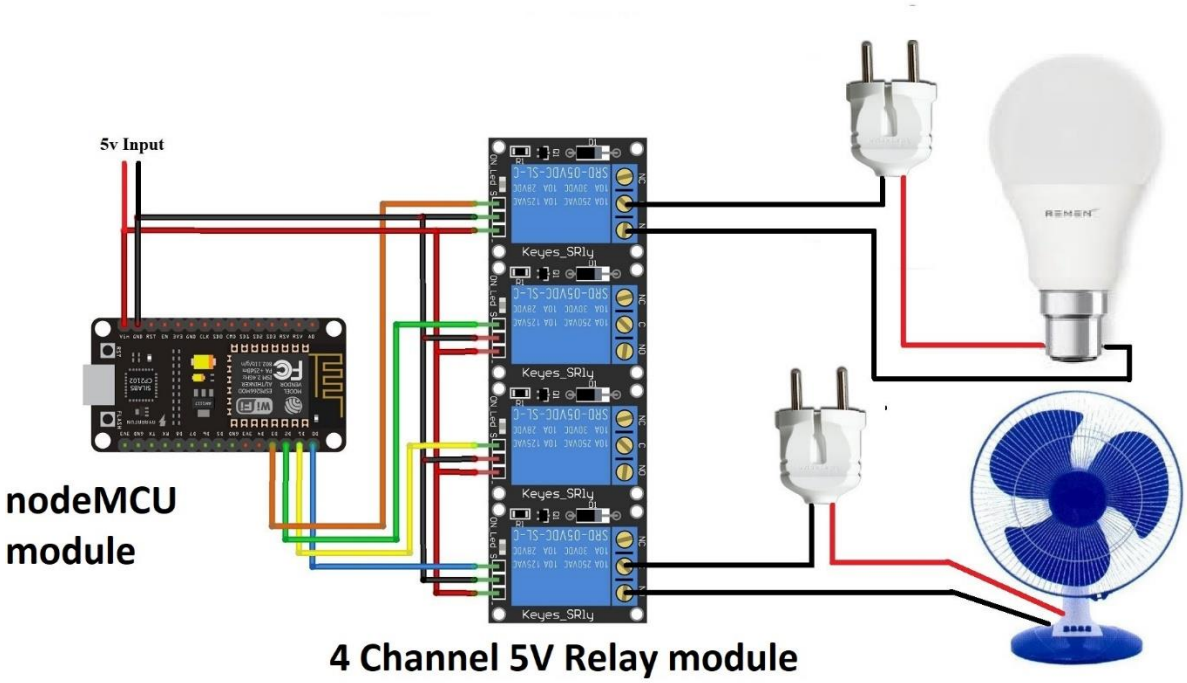
Chapter 6:

SCHEMATICS

6.1 Block diagram



Circuit diagram for Alexa control on lights and fan using Relay and nodeMCU:



Chapter 7:

CONCLUSION AND BIBLIOGRAPHY

Limitation

This report contains whatever we were proposed to do but due to unprecedented circumstances caused by the Covid-19, we are unable to finish this project on due time. As the state had imposed complete lockdown, we could not reach resources properly. In this pandemic situation we could not get together and wok for our project. Still dedicated to this project we tried our best to finish it. At the start of this project some work was done in the college when we were allowed to visit the college. Some part was done individually and consulting each other and our project guide through online modes.

We unfortunately could not include two main modules, Alexa module and home automation module, also linked to the Alexa module. The model we made briefly describes how the modules would function in our Smart Mirror.

7.1 Conclusion

Our smart mirror system included the idea and approaches that have been utilized in many current systems. It's a unique way of building a smart interaction system. We have been focused on an interactive system for home in this interactive system since it is dependable and simple to use. There are several advantages to using a smart mirror. The development and deployment of the different services has been modified to a service-oriented design, with the mirror interface and news feeds all using Web service communication protocols. We can cut power usage by using a sensor since the mirror will only show information when a person is present.

The future prototype has a lot of promise and is likely to be functionally sound. Voice commands are used to move between views, while gestures are used to interact with the material. We may apply the functionality to a glass material rather than being limited to a dwelling. So that it may be utilized in a variety of situations, such as setting up this feature on a glass table in the workplace. This will allow him to see alerts from several sites at once on a single screen. Another use for this feature is that it may be put up in public locations.

Depending on the user's preferences, smart mirrors come in a range of sizes and positions. A large mirror on the wall or a little mirror on a table, for example, might improve the room's overall appearance.

7.2 Future scope

The goal of this research is to come up with an efficient and cost-effective method for developing a Smart Mirror that will lessen, if not eliminate, the need for the user to check their PC, tablet, or smartphone for the information they need throughout their daily morning or night routine. The mirror will deliver information with little to no effort on the user's part, with the purpose of not being a burden. The mirror would be an addition to the frequent usage of mirrors in most contemporary bathrooms, rather than a new activity.

The user won't have to think about anything since the mirror will do it for them. It will first turn itself on and off. The user's calendar, to-do lists, Twitter, news, and weather will all be updated at that point. The information would be presented on the borders of the mirror, not directly in front of the user, so that the user could still utilize the mirror. Weather, news, Twitter, and timetables are all available in the mirror, which most people check on their smartphones or tablets for. While getting dressed in the morning or at night, people may read, contemplate, and plan their days.

By adding modules to the operating system, such as fire alarm, intruder alarm, cctv access, and so on, a smart mirror with home automation function may eliminate unnecessary device settings.

Incorporating AI and machine learning principles may also provide consumers with a more intelligent and futuristic experience. For example, it may act as a designer wardrobe by providing alternatives for what to dress, using facial recognition security and talkback.

7.3 Bibliography

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