IOT Smart Mirror with News and Temperature

Submitted in partial fulfillment of the requirements of the degree of

Bachelor of Engineering

by

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CERTIFICATE

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1._____-

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Date: / /2020

Place: Ulhasnagar – Thane

ABSTRACT

In today society information is available to our phones, our Laptops, our Desktop and more. The one that concerns the common Man is now it can be used to make day to do life easier and faster. This project of a “Smart Mirror” can be useful for Home, Industries, and Platforms. This project which would collect Real machine data And Data Would Be transmitted from the machine and managed by the Raspberry Pi Board. This Project is used by Raspberry Pi3 version Model-B. This Smart Mirror Is Latest Version Of Raspberry Pi. This Mirror is developed by multimedia futuristic Smart Mirror. The mirror is implemented as a personalized digital device with peripherals Such as Raspberry Pi, Microphone, Led monitor with reflected one way mirror Provides most basic common such as weather of city, updates of News and Headlines corresponding to location. The mirror is implemented as a personalized monitor with reflected one way mirror provides most basic common such as weather of the city, updates of News And Headlines corresponding to locations. The mirror is implemented as a personalized digital device with peripherals such as Raspberry Pi microphone, And Led monitor with Reflect done way mirror provides most basic common such as weather of the city, Updates of News And Headlines corresponding to locations. This mirror is ability to display date and time the current weather condition outside temperature. This feature of the mirror will be scraped from the internet and implemented using Raspberry Pi

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Chapter 1

INTRODUCTION

Everyone knows what a mirror is. It is an object found in most people homes. In mirrors we see our reflections. But what happens when you combine the idea of a mirror with technology? What possibilities are there and how smart could a mirror be? These are some of the questions that inspired my choice of final year project, a project which aimed to develop a smart mirror and a small operating system to power it. The device was to go beyond an ordinary mirror, to have a screen inside that you would be able to interact with by using voice commands, hand gestures and smart phones or other device

The smart mirror is a popular project among DIY enthusiasts and it usually consists of a one-way mirror with a screen attached to it that displays a static web page. However what I wanted to achieve was something you could interact with. My goal was to learn how a Raspberry Pi worked and to understand how to combine the software and the hardware components to create a multimedia project.

This project has been developed within the context of a time where every day we see more and more connected devices. The Internet transformed our lives by connecting us more easily to information and other people in the virtual world. Mobile phones then became smart phones and since then this concept has erupted and morphed into the Internet of Things, things which connect us to everyday objects. There are no end of objects that could be made smarter, some being more suited to this than others. Mirrors, for example, provide a large surface ideal for displaying information and interacting with. Most people have mirrors at home so the concept of a smart mirror that you can interact with is attractive and has been fantasized in many futuristic moves

Project Goals

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 see temperature ,news, date and time .

The operating system would support a simple API as Third-party developers for the Smart Mirror. The main features of the Smart Mirror would have would be showing basic weather and time information, being able to add reminders or notes in a similar way we stick post it notes on a fridge.

With the project we wanted to learn a lot about the Raspberry Pi as it was the first time we used it. we also hoped to refresh our electronics knowledge as it had been quite some time since we did something with electronics. Up to now there have been many people who have built Smart Mirrors but in our opinion they lack interactivity. The project aims to change this by letting the user interact using different means. It will be one of the first Smart Mirrors you can interact with .

Project Aim and Objective

This project has been developed within the context of a time where every day we see more and more connected devices. The Internet transformed our lives by connecting us more easily to information and other people in the virtual world. Mobile phones then became smart phones and since then this concept has erupted and morphed into the Internet of Things, things which connect us to everyday objects. There are no end of objects that could be made smarter, some being more suited to this than others. Mirrors, for example, provide a large surface ideal for displaying information and interacting with. Most people have mirrors at home so the concept of a smart mirror that you can interact with is attractive and has been fantasized in many futuristic movies.

Smart mirrors, such as Magic Mirror and Home Mirror have recently started to be devel-oped by people in the Maker community, with varying degrees of interactivity. However, so far, the features of these mirrors have been limited. This final year project describes how a smart mirror was built from scratch using a Raspberry Pi for the hardware and custom software built on top of Raspbian, a Linux distribution. The goal of the project was to create a Smart Mirror device that people could interact with but also to further develop the technology so that it would let you install and develop your own applications for it.

Chapter 2

Literature Survey

While implementing a smart mirror, the first question which arrives is what is the need of a Smart Mirror? In the recent years technology has become an integral part in day to day lives. Technology has been incorporated in many electronic devices. But the motive of designing a Smart Mirror is to bring technology in a traditional household mirror and making it smart. This brought in a new definition of a smart mirror: a smart mirror is a mirror with additional features and functions, with the aim of introducing capabilities for human interaction.

There was always a need of designing a device which would help in planning for days 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.

Internet of Things (IoT): 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 research paper 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. We can get access to news or even watch YouTube videos. The machine required for computing is a raspberry pi which does not require large space.

Chapter 3

Context

This project was inspired by a Magic Home Mirror device that we found while browsing the DIY section in a popular website called Hacker House. The Magic Home Mirror is a view sonic LCD screen attached to a one-way mirror. The device has a display with a webpage that shows time and weather information and it looks very futuristic. We liked that project a lot and we thought we could improve on it by adding some means of interaction to the device. we also found a similar project that was built using a Raspberry Pi minicomputer, but again it was a static panel with no interaction.

This inspired me to begin this project and develop a Smart Mirror with an operating system that would let you install apps that anyone could develop just like on Android or iOS. The project has a very broad scope covering some current popular topics in the IT sector such as the Internet of Things, Maker culture and home automation.

Internet of Things

The Internet of Things is a concept defined as a network of connected physical objects (Internet of things, 2016). Its often viewed as the next step for the internet. Recently it has gained a lot of popularity predicting that in the future most everyday objects will be connected to each other and will be able to interact in smart ways. The Smart Mirror will eventually become one of these connected objects in our households and if we think about it being able to communicate with other objects the possibilities become endless.

Home Automation

In my project we will not be focusing on home automation since I don't have access to any smart home devices. However it would be very easy to write an application to turn on and off the lights using voice commands or gestures on the mirror or even an application to change the temperature of the room, for example. These examples are just the tip of the iceberg as there are new connected devices emerging everyday that could interact with the mirror.

Chapter 4

Proposed scheme and Block Diagram

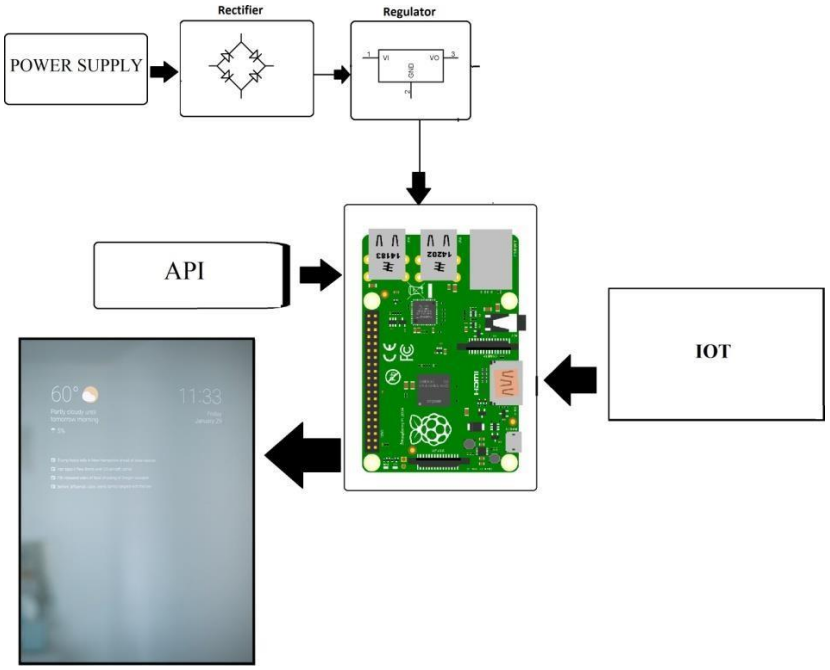


Figure 4.1: Block Diagram

Figure 4.1 shows a schematic view of the proposed smart mirror. The mirror is event u- ally a technologically augmented interaction device. The objective of designing the mirror is to provide a natural interface in the ambient home environment for accessing various services such as location based weather, time, calendar etc. The project includes down- loading the Raspbian operating system based on Debian and extracting the image on SD card, inserting the card in the Raspberry Pi SD slot an then performing the required steps. We plan to deliver a working prototype i.e. design and development of a futuristic Smart Mirror on Raspberry Pi 2w for the ambient home environment as well as for commercial uses in various industries. Most people have mirrors at home, so the concept of a smart mirror that you can interact with is attractive and can be fantasized by anyone. At times no one has time to read the newspaper or switch on the TV right in the morning to check the news headlines or the weather forecast. If a mirror serves to this purpose, one can imagine the amount of time it will save and be of such a great use. The device was to look like a regular mirror but would have a screen inside. The project which would collect real world machine data such as location based latest news and headlines, weather reports, and as well as show us the local time. The data would be transmitted from the machine and would be managed in a central database.

Chapter 5

Working Principle

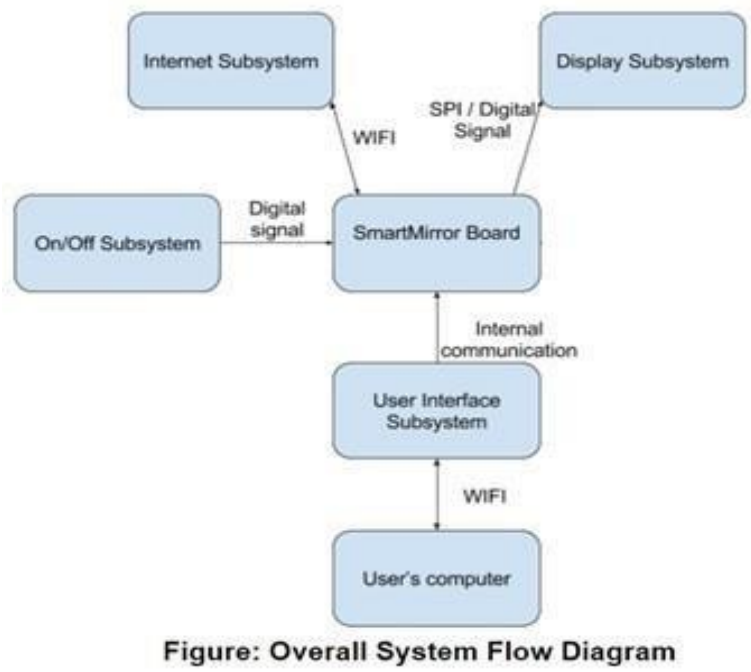


Figure 5.1: Overall System Flow Diagram

The overall system has been broken down into the 4 subsystems: The On/Off Sub-system, Internet Subsystem, User Interface Subsystem, and Display Subsystem. The connectivity of the entire system can be seen in the figure below. The User Interface Sub- system takes user input to determine the SSID, password, zip code, and a news source from which to display the headlines and writes it into nonvolatile memory. This information is read out of memory and is out of memory and passed to the Internet Subsystem. The Internet Subsystem connects to the internet via Wi-Fi and parses the time, weather, and news headlines from the sources selected in the User interface. The data passed by the Internet Subsystem is saved into arrays that can be printed onto the screens by the Display Subsystem.

Internet Subsystem

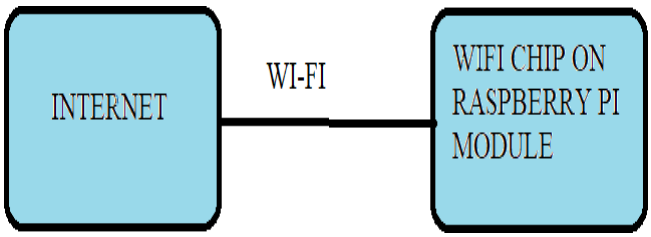


Figure 5.2: Internet subsystem

The internet subsystem deals with being able to retrieve information such as weather, time, news or any other applicable information from the internet to be displayed on the mirror. A Raspberry pi module or similar device will be the device pulling the data over a Wi-Fi signal and communicate to the LCDs on the mirror. We also wanted to retrieve the local weather data, so we decided to use Geeksforgeeks API for any location that is based off the user's inputted zip code. Geeksforgeeks provides a webpage of the data relevant to the user's needs including the location, time, and weather in JavaScript.

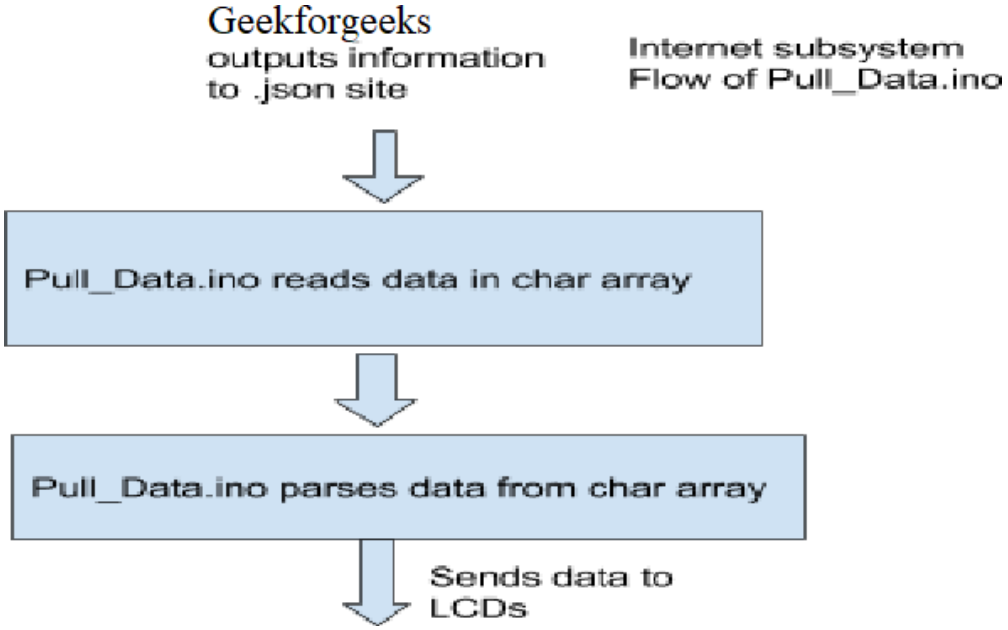


Figure 5.3: Flow Diagram of Software for Internet Subsystem

Display Subsystem

This subsystem takes information retrieved by the Internet Subsystem, creates the appro- priate textual outputs, and sends the desired information via SPI to each of the tft LCD screens. The settings used to organize the display of data will be based on the users last input to the user interface subsystem. The system will continually exchange data with the internet subsystem to update the displays regularly.

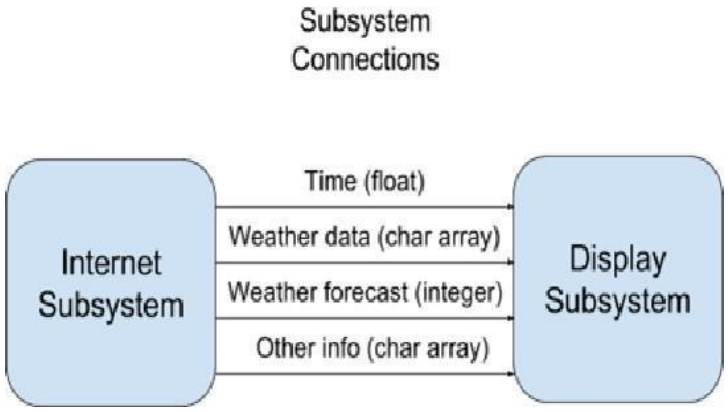


Figure 5.4: Subsystem Connection

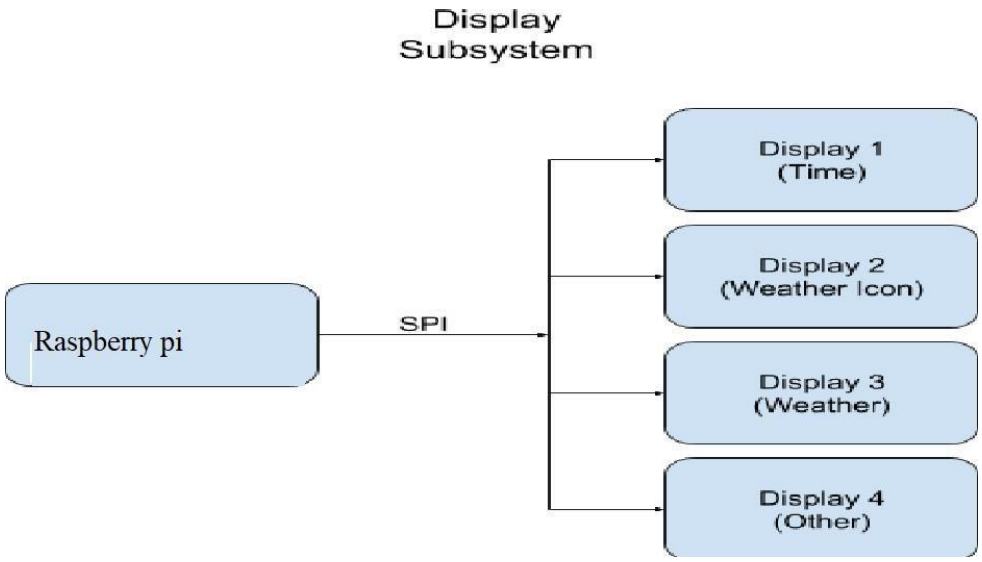


Figure 5.5: Display Subsystem

Chapter 6

Hardware

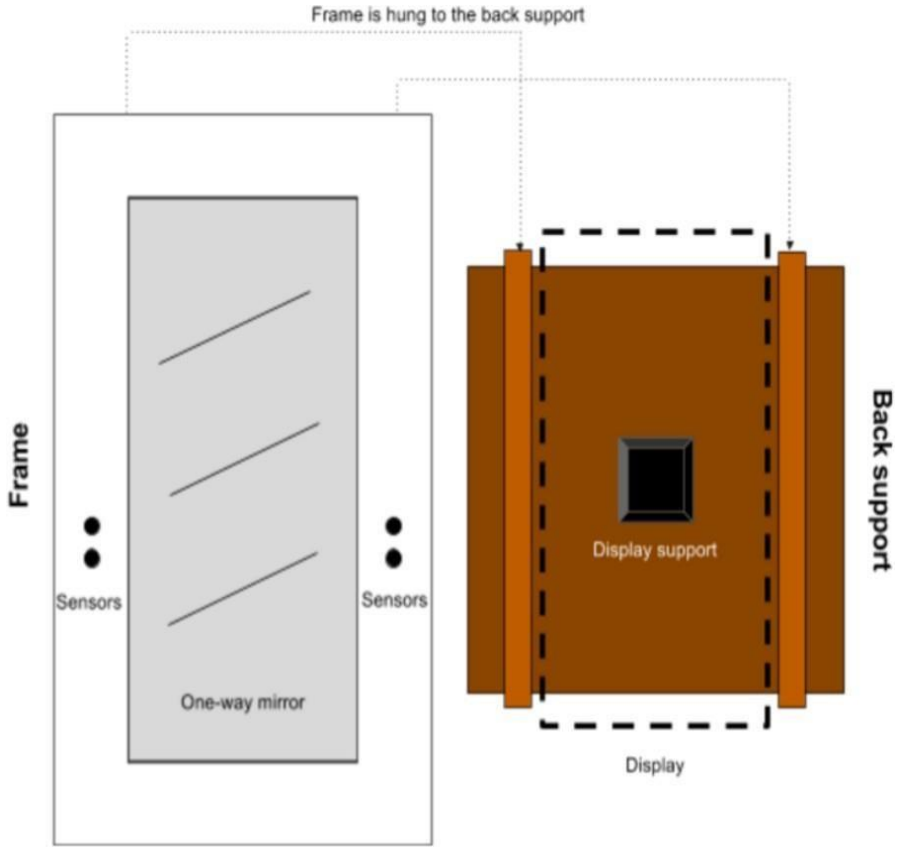


Figure 6.1: Building of Smart Mirror

For the hardware I used a 18 inch computer monitor ,a one-way mirror a Raspberry Pi 0 w, . Everything was put together in a wooden frame. These are the final sketches for the hardware design, the hardware design required for the smart mirror are: The device has two wooden parts. The back part holds the display and the Raspberry Pi and is used to support the device so that it can be hung on a wall. The frame is attached to the glass by two small wooden slats and it has four holes, two on each side, that contain the ultrasound sensors. The frame can be attached and detached from the back part so its easy to change the glass or even the whole frame. A breakdown of each of the main parts of the smart mirror (the oneway mirror glass, display, Raspberry Pi 2, microphones, ultrasonic sensors and frame) and how they were used is described in the following sections:

One-way Mirror

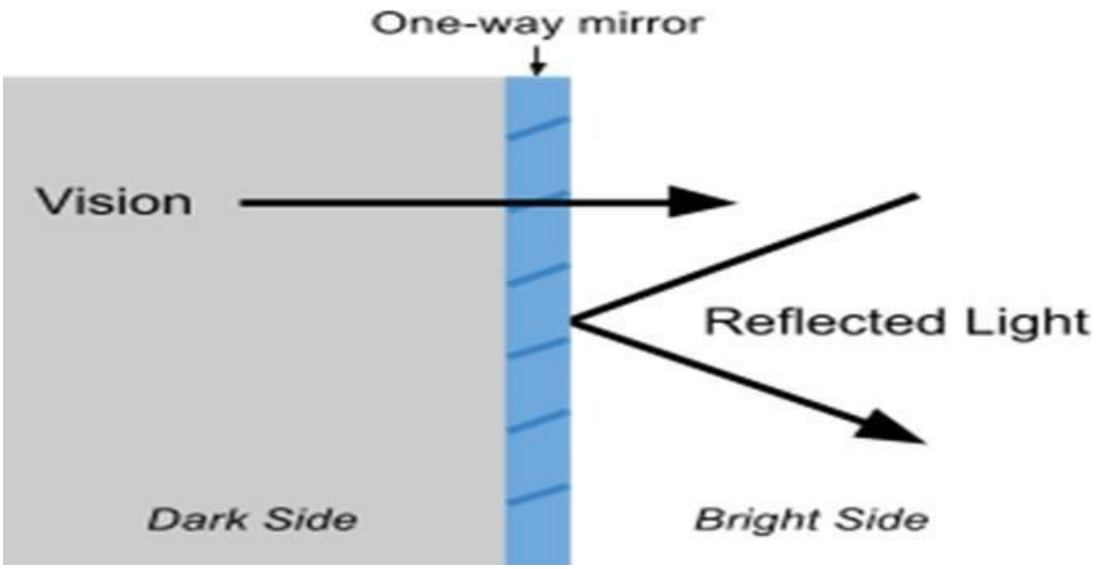


Figure 6.2: one-way mirror

This is probably the most important part of the hardware because its responsible for creating the futuristic effect and is the biggest part of the smart mirror. Wikipedia provides the following definition: A one way mirror, sometimes called two way mirror, is a mirror t hat is partially reflective and partially transparent. When one side of the mirror is brightly lit and the other is dark, it allows viewing from the darkened side but not vice-versa In the case of this project this essentially means that the dark or black parts of the screen will be seen as a reflection and the light parts will be seen normally. So if there is white text over a black background the white text will be seen as an overlay with the user reflected in the background. This was the most difficult component to find because of these technical requirements, but a one-way mirror was eventually found at a nearby glass store. The one that was bought was unfortunately not very reflective so sometimes you can see the interior of the device. This is not ideal but in the right conditions it works well and it can always be replaced with better quality glass in the future.

Mirror Display

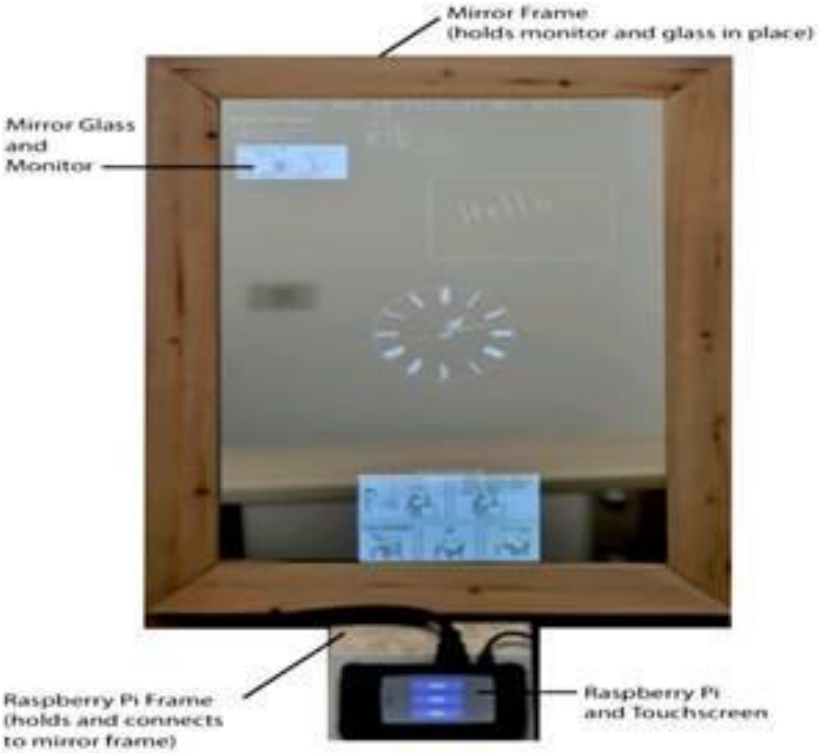


Figure 6.3: mirror display

For the display a 18 inch View sonic monitor was bought, which also has built in speakers and comes with a remote control which is useful to easily turn off the devices screen. The monitor is much smaller than the mirror so a black sticker was used to cover the parts of the glass which are not covered by the display. An HDMI cable was used to connect the display to the Raspberry Pi for video and audio. We followed typical smart mirror building instruction to implement our prototype. As shown in figure a plane of glass with a mirror film on one side is encased in frame and placed on top of a monitor.

The mirror acts in as similar way that a one way mirror works. When there is nothing displayed on the monitor (i.e. the monitor is black), users can see their own reflection in the mirror. When a non-black color is displayed on the monitor color appears to come through the glass from the monitor to best utilize this touch screen, we have mounted the unit to the bottom side of the mirror. Our platform uses a web browser to display information due to its built in support for various media formats: global and plug-in. The global user space is what the server uses for injecting and removing JavaScript, CSS, and HTML resources for each plug-in, as well as for creating a container for each plug-in. The plug-in user space is made available for each plug-in to modify and update itself without interfacing with other plug-in spaces.

Raspberry pi3B+

Figure 6.4: Raspberry pi3B+

The Raspberry Pi is a single board computer developed by the Raspberry Pi foun- dation in the UK. It has become the most popular computer of its kind thanks to great support and a big community behind it as well as an inexpensive price. The Pi does not work out of the box. It lacks a hard drive and it does not come with a pre installed operating system. To install an OS you need a micro SD card prepared with an OS image. And because the software that will be running on the mirror will be coded on the same device at least a screen, a keyboard and a mouse are required.

Specifications of Raspberry Pi 3B+

- CPU type/speed: ARM Cortex-A53 1.4GHz
- RAM size: 512 mb SRAM
- Integrated Wi-Fi: 2.4GHz and 5GHz
- Ethernet speed: 300Mbps
- Bluetooth: Bluetooth

Advantages of Raspberry Pi 0w

- Power over Ethernet (PoE) is available.
- Gigabit Ethernet is supported providing"Fast Ethernet".
- It is clocked at 1.4 GHz which provides better performance.

Applications of RaspberryPi

There are endless applications where RaspberryPi can be used few of them are as follows;

- Media streamer
- Arcade machine
- Tablet computer
- Home automation
- Internet radio
- Controlling robots
- Cosmic Computer
- Hunting for meteorites

HDMI Cable

Figure 6.5: HDMI cable

HDMI (High-Definition Multimedia Interface) 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. HDMI provides an interface between any audio/video source, such as a set-top box, DVD -player, or A/V receiver and an audio and/or video monitor, such as a digital television (DTV), over a single cable. HDMI supports standard, enhanced, or high-definition video, plus multi-channel digital audio on a single cable. To connect an Android phone or tablet to a TV you can use an MHL/Slim Port (via Micro-USB) or Micro-HDMI cable if supported, or wirelessly cast your screen using Chrome cast. In this article we'll look at your options for viewing your phone or tablet's screen on the TV.

Adapter

Figure 6.6: adapter

An AC adapter, AC/DC adapter, or AC/DC converter is a type of external power supply, often enclosed in a case similar to an AC plug. Other common names include plug pack, plug-in adapter, adapter block, domestic mains adapter, line power adapter, wall wart, power brick, and power adapter. Assuming the polarity is correct, plugging in a 12V input to a device requiring 15V won't do any damage, however if you under volt an amplifier, you may get clipping or other distortion. I'd try Amazon for an adapter that has 15V output, possibly a universal type.

Chapter 7

Software

Python

Python works on different platforms (Windows, Mac, Linux, Raspberry Pi, etc).Python has a simple syntax similar to the English language. Python has syntax that allows developers to write programs with fewer lines than some other programming languages. Python runs on an interpreter system, meaning that code can be executed as soon as it is written. This means that prototyping can be very quick. Python can be treated in a procedural way, an object- orientated way or a functional way. The most recent major version of Python is Python 3, which we shall be using in this tutorial. However, Python 2, although not being updated with anything other than security updates, is still quite popular. Python was designed to for readability, and has some similarities to the English language with influence from mathematics. Python uses new lines to complete a command, as opposed to other programming languages which often use semicolons or parentheses. Python relies on indentation, using white space, to define scope; such as the scope of loops, functions and classes. Other programming languages often use curly brackets for this purpose.

Development Tools

Taking advantage of the fact that I already had an operating system running on the Pi, I gave myself the challenge of writing all the code for the Smart Mirror on the same device. I installed Geany, which is a very lightweight IDE, and I used it to write all the HTML, Java script, CSS and Python code. In the end, the entire coding for the software was done on the Raspberry Pi and I only used my Windows laptop to create icons and designs with Illustrator and Photoshop. It turned out to be very convenient to be able to easily test the software directly on the Smart Mirror.

Mirror OS

Mirror OS is the software we created for the Smart Mirrors interface and it runs on top of Raspbian and on top of Electron. In the following figure you can see the layers of the software stack. The OS was designed to be very simple and lightweight as it already runs on top of many layers of software. Its written in HTML, JavaScript and Python and it is basically a framework for web apps that provides API's for listening for gestures, voice input and smart phone interaction and for displaying messages to the user in a consistent way.

User Interface

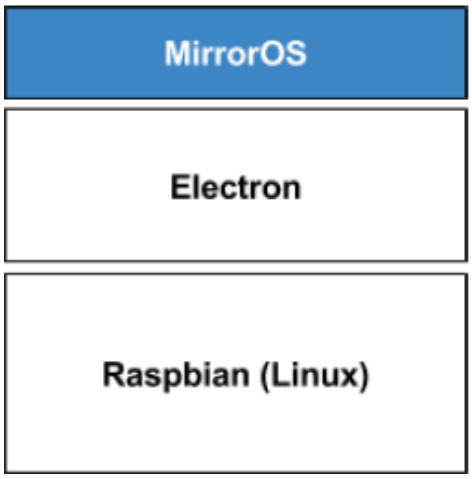


Figure 7.1: Layers of Software Stack of Mirrors

The user interface for the OS is clean and simple. It has an overlaid status bar on the top with the time on the right corner, the IP address of the socket server on the left corner and a status message in the center. The status bar is dynamic and changes depending in the context: it can be hidden in case we want watch something in full screen or expanded to show important information.

API

Mirror OS provides a simple API for developers to perform actions in a consistent way. The API works by making use of the inter process communication (IPC) system provided by Electron. This system enables you to communicate through process using JavaScript.

Chapter 8

Implementation Of Hardware

Selecting Monitor

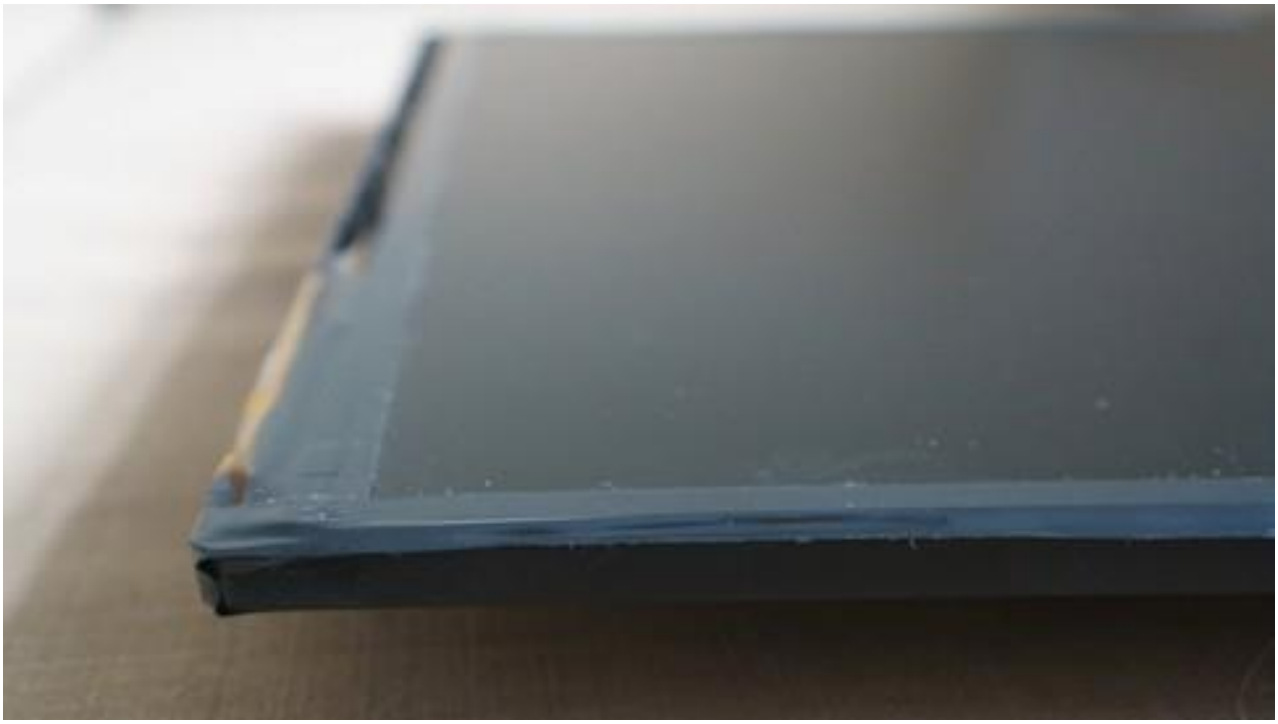


Figure 8.1: LCD monitor

We specifically chose the View sonic 18 inch monitor due to its low cost, ability to fit in the pre-built medicine cabinet, and its downward-facing ports. It also turned out to be pretty easy to remove the monitor's bezel, without even having to open the casing. First, remove the single screw on the back of the monitor. Then, pop off the bezel using a flat-head screwdriver or similar implement. Next, cover the exposed display frame with black electrical tape. The monitor will now be able to sit flush with the mirror.

Preparing Cabinet

Figure 8.2: The Monitor, ready for installation in the cabinet

First, disassemble the door of the medicine cabinet, removing the mirror from the frame. The staples holding the frame together can be pulled out with needle-nose pliers. Replace the mirror with the two-way acrylic and re-assemble the frame. (I was able to re-use the staples, but added some wood glue to be safe) Next, tape over the bottom 1 3/4" of the back of the acrylic with electrical tape, masking off the area not covered by the monitor.

- Add a strip of wood at the bottom of the frame to support the monitor. Attach an eye-hook to each end of the strip. Attach an eye hook in the top corners of the frame. Also, you might want to drill ventilation holes. I added three to the top of the cabinet
- Due to the tight fit of the monitor, I was not able to use the magnetic closure that came with the cabinet. Instead, I installed a small latch

Figure 8.3: installing monitor in wooden frame

Figure 8.4: Interior Cabinet

Chapter 9

Software and Program

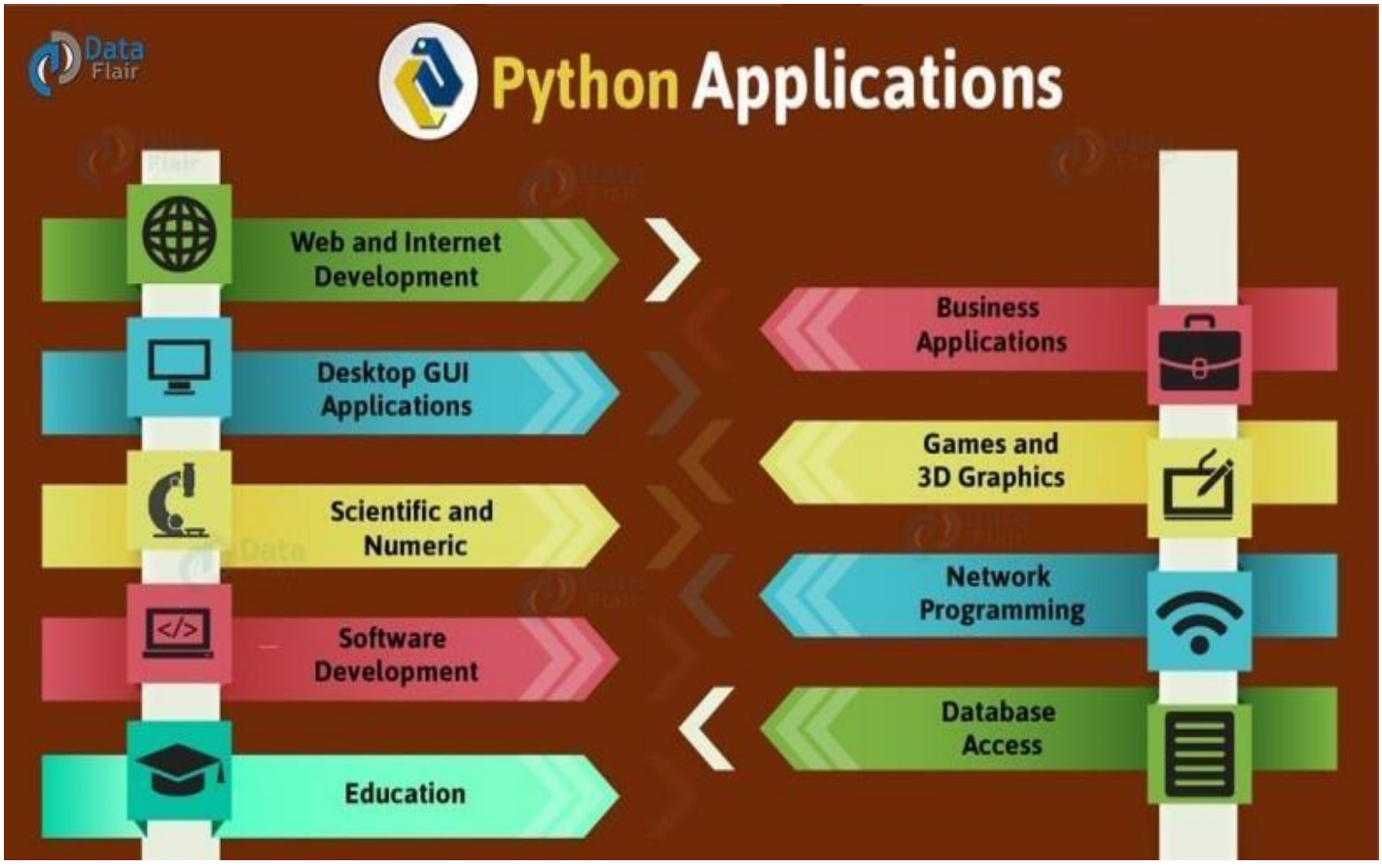
Python

Python was conceived in the late 1980s by Guido van Rossum at Centrum Wiskunde Informatica (CWI) in the Netherlands as a successor to the ABC language (itself inspired by SETL), capable of exception handling and interfacing with the Amoeba operating system. Its implementation began in December 1989. Van Rossum's long influence on Python is reflected in the title given to him by the Python community: Benevolent Dictator for Life (BDFL) a post from which he gave himself permanent vacation on July 12, 2018.

Python 2.0 was released on 16 October 2000 with many major new features, including a cycle-detecting garbage collector and support for Unicode.

Python 3.0 was released on 3 December 2008. It was a major revision of the language that is not completely backward-compatible. Many of its major features were back ported to Python 2.6.x and 2.7.x version series. Releases of Python 3 include the 2to3 utility, which automates (at least partially) the translation of Python 2 code to Python 3.

Figure 9.1: Application of python



Program Script

```
import tkinter as tk

import requests

import datetime

import time from newsapi

import NewsApiClient root = tk.Tk() root.geometry("1920x1080") root.configure(bg="black")

colorbg='black' textcolor='white'
    def NewsFromBBC():

    BBC news api


    main_url = "https : //newsapi.org/v1/articles?source = bbc  - newssortBy =

topapiKey = 4dbc17e007ab436fb66416009df b59a8"

fetching data in json format


    open_bbc_page = requests.get(main_url).json()

    getting all articles in a string article article =
    open_bbc_page["articles"]


    empty list which will

    contain all trending news

    results = []

    for ar in article:

    results.append(ar["title"])

    return results

    class dt():

    def mydate():

    t=datetime.datetime.now().date() return t

    def mytime():

    time_string = time.strftime("

    return time_string

    class Weather(): def temp(): x="39"+chr(176)+"C" return x
```

```
w = tk.Label(root, text=dt.mydate(), bg=colorbg, fg=textcolor,font=(”Liberation Serif”, 26))

w.pack(fill=tk.Y, pady=10,anchor=’e’) w = tk.Label(root,text=dt.mytime(), bg=colorbg, fg=textcolor,font=(”Liberation Serif”, 26))

w.pack(fill= tk.Y,pady=10,anchor=’se’) w = tk.Label(root, text=Weather.temp(), bg=colorbg, fg=textcolor,font=(”Liberation Serif”,  26))

w.pack(fill=tk.Y, pady=10,anchor=’e’) w = tk.Label(root, text=”Breaking NEWS ”, bg=colorbg, fg=textcolor,font=(”Liberation Serif”, 26))

w.pack(fill=tk.Y, pady=10,anchor=’s’) sam=NewsFromBBC() for i in range(len(sam)):
temp=sam[i]

w= tk.Label(root, text=””+temp, bg=colorbg, fg=textcolor,font=(”Liberation Serif”, 26))
w.pack(fill=tk.Y, pady=10,anchor=’s’,side=’bottom’)
w.mainloop()
```

Chapter 10

Advantages, Application, Result

Advantages

- Attractive Light Box: Ordinary light box is simply a board. Magic mirror motion display light box is not just a board for propaganda. Images are dynamic and, it is also a mirror. Almost all people are attracted by mirror. When mirrors suddenly converts to images, it draws more attention.
- Adjustable Images Switching Time: Display duration between sequential display im- ages is adjusted according to requirement. It could be shortened or lengthened. For example, if the image is full of information, duration between images is lengthened to allow more time for attention.
- Fast Easy Images Replacement: It takes just few minutes to replace images. It is fast and easy. Time consuming between this device and other devices is very less.
- Very Low Power Consumption: Digital electronic rectifier controls energy saving light source. It consumes very low power.
- Easy to communicate: It allows the user to interact using different means.
- User-friendly: It will be one of the first Smart Mirrors you can interact with and also one of the first smart mirrors to let you install apps as per our choie. 7.Voice input: It also includes the voice recognition feature in MirrorOS uses an online API made by Google. The API is not officialy supported and it has a 50 query a day limit but it is the best one available. To use the API you need to make an HTTP POST request to the APIs url with a mono FLAC audio file with a 16000 bitrate.

Application

The need for smart mirrors in the automotive sector has led to active growth for its market; the presence of embedded electronics makes smart mirrors more popular.

Highly functional mirrors can be tagged as smart mirrors, which are successfully be- ing used in the automotive industry. Smart mirror technologies comprise of self-dimming capability, along with other features such as self-cleaning and self-repairing ability.

According to an intelligent report available on Market Research Reports Search En- gine (MRRSE), the demand for smart mirrors has enhanced due to the rising focus on improved road safety drives. Also, with the incorporation of new electronic functionalities to the automotive mirrors, this market is expected to cross new milestones in the near future.

The implementation of activated light sensors, and electro chromic self-dimming smart mirrors have surely improved road safety by increasing response times along with reducing driver fatigue. Digital smart mirrors are considerably gaining momentum due to various factors like comfort/convenience and design/style. Moreover, the growing in- vestment in RD activities on smart mirrors as well as new technology penetration are also listed among the major factors boosting the smart mirror market on a global canvas.

Smart mirrors are effectively being utilized in applications such as advertising, health- care, consumer and others. For instance, in January 2011, Clear Channel Airports (CCA) along with Mirrus Corporation formed a collaboration on a pilot program of deploying 150 smart mirrors consisting of advertising displays in all restrooms at the Chicago O'Hare airport.

Presently, the industrious geographical sections which manage active markets for smart mirrors include North America, Latin America, Europe, Asia Pacific along with Middle East and Africa. Out of these, the profitable countries are found to be Germany, the United States, Mexico, Brazil, China, and India.

Some prominent top players from the smart mirror market are Gentex Corporation, ACEP France SA, Magna International Inc., Panasonic Corporation, Samsung Electron- ics, Seura Solutions, Dension, S.L., Keonn Technologies and Mirrus Corporation.

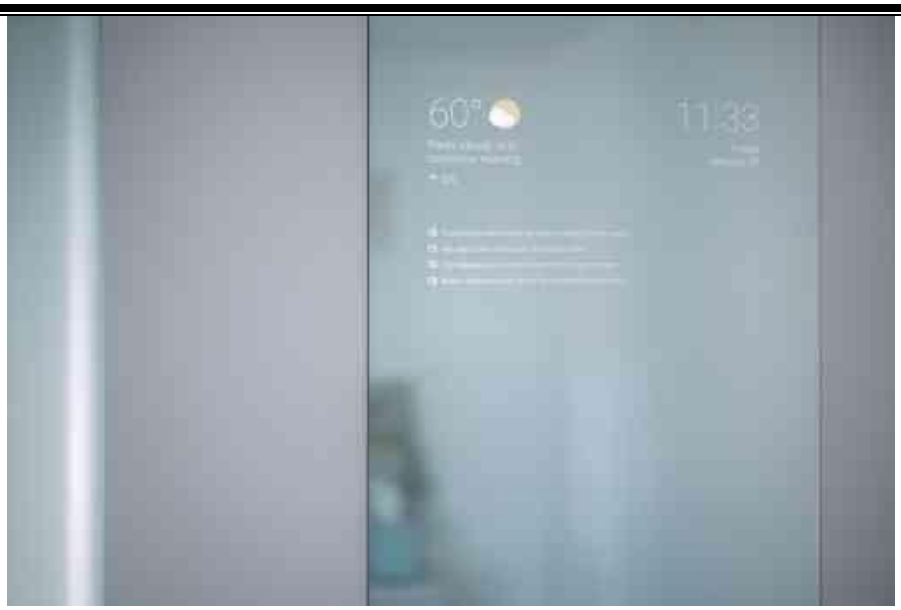


Figure 10.1: Smart Mirror

Result

Figure 10.2: Result 1

Conclusion

A completed and functioning Smart Mirror is now ready for presentation. As the preceding section has shown, the project has wrapped up behind schedule but well under budget, having met most of the goals laid out in our original Scope Statement.

At minimum, the project set out to have a mirror that could display a dynamic date and time. This was our minimum criteria for success, and we are happy with the display that resulted. We were also able to include a weather display, though unfortunately that particular element is not as visible as the other display items. We were also disappointed at not being able to incorporate an infrared sensor into our mirror, which would have let us program a motion-activated start. Unfortunately, time and the difficulty of programming the other elements forced us to shelve this particular feature. Knowing what we know now, we would be excited to attempt this in the future.

However, aesthetically the mirror looks exactly as we had envisioned it, and the trim we ended up using (for both function and decoration) was in fact better than the original design. Our only regret in this area is that the project is very heavy and bulky. Future versions would need to work on reducing weight and slimming down the product.

Overall the project met most of its goals and we are happy with its success. We have now identified numerous areas of slack and inexperience (such as scheduling delays and cost underestimations) that would have improved our overall progress, but we nowconsider these lessons that we will carry forward to achieve success in future projects.

10.6 Future scope

The topic of intelligent mirrors is a huge topic. Future work could aim to implement any of the unused scenarios, such as adding gesture control, communicating with the mirror by voice or integrating the intelligent mirror into an already existing smart home economy. The face detection and face recognition methods tested in this thesis are only a small sub-set of all research done in the field. Future work could explore if other methods are able to provide satisfactory results on an embedded device. Additionally other embedded device options beside the RPI should be explored. Until the RPI is upgraded to include a basic GPU able to run a feed-forward on deep neural networks, or neural network implementations has been optimized for the NEON SIMD instructions used by RPIs ARM processor, we should look to other embedded device possibilities. The current login system is naive in the sense that if a user was logged in, it would never revert this decision until the defined logout interval has passed. If later predictions suggests that the initial login decision was wrong, the system should be able to revert the original decision and login what is later believed to be the true user, without having to wait for the originally believed user to be logged out before the correct one can be logged in.

As discussed, face detection is the most time consuming step. The background sub-traction step was under-prioritized in this thesis. The experiment results suggest that

a robust background subtraction system can greatly reduce the execution time of face detection methods. This step should be researched further in the setting of intelligent mirrors. Running the user recognition system on an embedded devices is all about reduce computation time wherever possible. Future projects should consider replacing the camera with a full-on night vision camera so the camera is able to provide valid footage for the user recognition system regardless of lighting conditions. Current face recognition methods is intended for use with grey scale images, but experiments should be done to examine if night vision images is compatible with current algorithms.


Health Check
Weather
News
72
89
99
16


10:05

10.6 References

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