Raspberry-Pi-Computer-Vision

Thum Wei Aun Marcus

Abstract

The Raspberry-Pi is has been meticulously assembled with the sourced parts and 3d-Printed External Body Frame. It has an I/O Panel with soldered LED's and a Button.

1. INTRODUCTION

1.1. Background

I initially thought of assembling a Computer Vision Model using a Micro-Processor. I had a Raspberry Pi. Since it was convenient to setup the Raspberry Pi due to the modern E-Commerce platforms, I immediately got to thinking of a use for the Pi. The Operating System can be Setup using an SD-Card and Imager.

1.2. Objectives

The Objectives were to complete a working model of the Raspberry Pi, with a Microphone and Camera. Since it was also possible to setup USB Microphones and Cameras successfully, I instead went with the GPIO approach. I kind of knew this beforehand. It came together very well.

The specific objectives were to:

- Research and read up on performing OS Flashes, Python Coding and GPIO-Microphone Interfacing.
- Discover and Explore Designs to house the components and board. Not to mention, I **added** a **UPS as a Power Source**.
- Disassembly and Reassembly of the components and frame.
- Enable Communication between **GPIO-Headers**, **Microphone** and **UPS**.
- Program Python Code in Arduino to learn fundamentally, how Micro-Controller, connects with various modular Electrical Devices.
- Program, Design and Visualize the Raspberry Pi.

The process of the project runs though Research, Plan, Training, Self-Learning and Practice.

2. PROJECT DESCRIPTION

2.1 Raspberry-Pi-Computer-Vision Specifications

I **sourced** for a **Raspberry-Pi Camera**, **Respeaker Microphone** and **UPS**. The hardware components had to communicate with the **Host Operating System (Raspbian Pi).** It uses the onboard **GPIO Pins** to communicate. The **drivers** and **firmware** had to be downloaded and installed with **Linux Libraries**. **Python** was used for the **hard-coding** to communicate with the **Hardware-Software Driven Parts**.

2.1.1. GPIO Pins

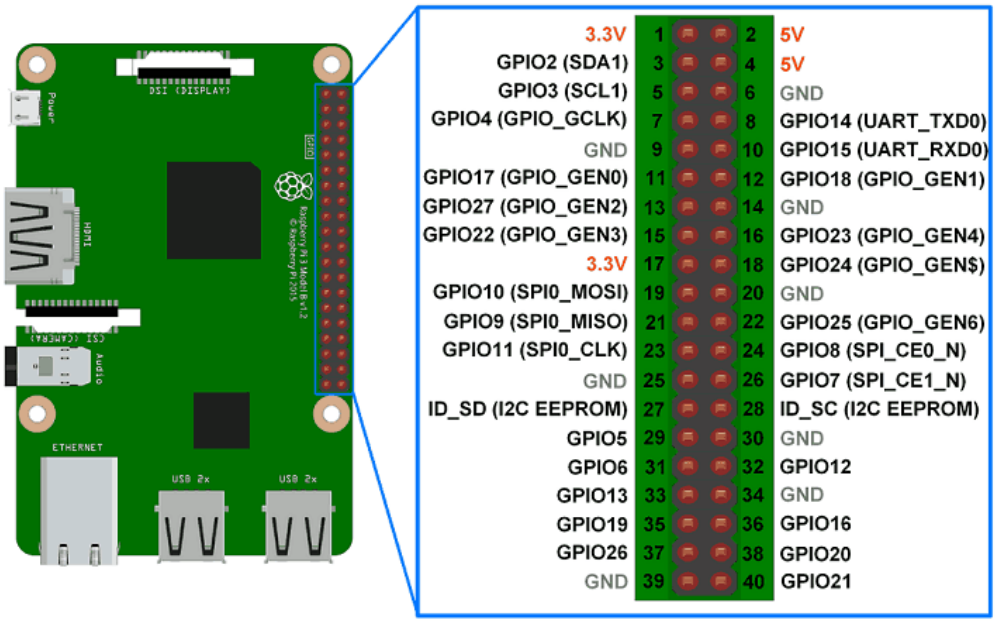

Figure 1: GPIO Pins

Description

The **GPIO Header Pins** above needs to be **handled** with **Care**. **Accidental Electrical Shorts** Can **Spoil/Damage the Board**. The bottom of the board needs to be kept away from contact. Similar occurrences can happen. I've damaged one board since I wasn't careful. You would not want it to happen to you. Otherwise, it's either spending OR/AND wating for another board to arrive. It's not a pleasant experience in the delay and extra costs.

2.1.2. Raspberry Pi Camera

Figure 2: Camera

Description	This kind of **Cameras** come in a small profile **Electrical Board** with a **Camera** and **Long Ribbon Cable**. You ought to be **careful** when **assembling**. I've experienced a few cut off's, but it's actually very resilient. Just Bear in Mind, they're **Exposed Electronics**.

2.1.3. (Seeed) Respeaker Microphones

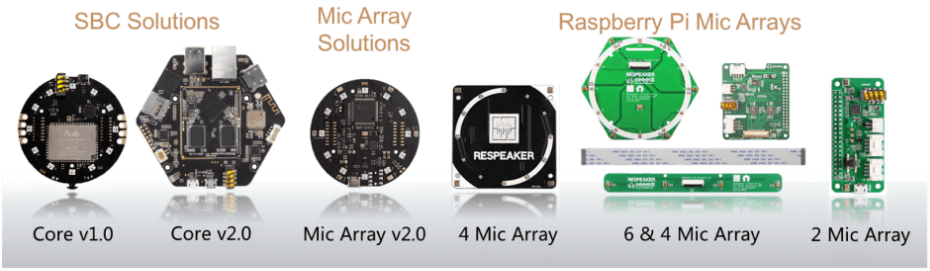

Figure 3: Microphones

Description	These **Microphones** are great for **Development Projects/Experiments**. I bought the **4 Mic Array Module**, however, Seed provides all kinds of **Microphone HAT/IO Boards**

2.1.4. Uninterruptable Power Supply

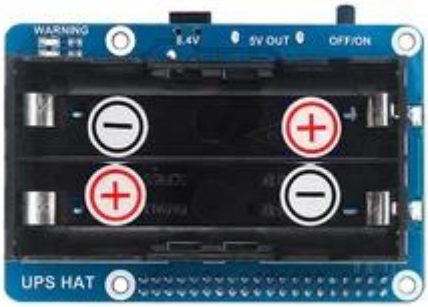

Figure 4: UPS

Description

This **UPS** is very useful as a **Working Battery,** since it offers **Uninterruptable Power Supply** when turned on. This means that **charging** and **powering** the Pi is **seamless**. The board would not **intermittently cut off** when powering and charging.

2.1.5. IO Board

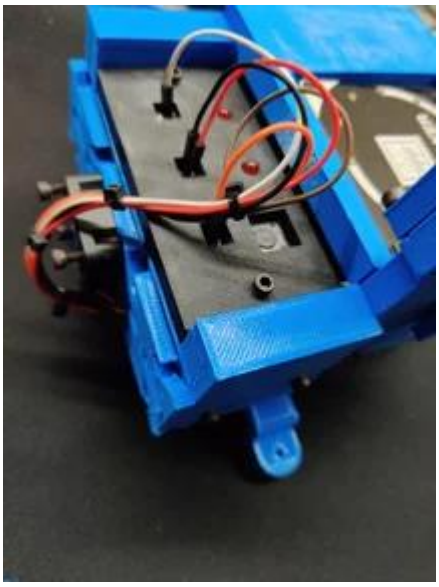

Figure 5: IO Board

Description	From **Figure 5**, the **IO Board** consists of **2 Red LED's** and **1 Working Button**. This will come in handy when using it to run **Functions** and **Scripts**. The **Board Interfaces** with the **GPIO Header Pins** on the Pi.

2.2 Process Description

2.2.1. Source the Parts

The **Camera**, **Microphone** and **UPS** needed to be bought **Online**, from **E-Commerce Platforms**. **I'** completely absorbed all the **Costs** and **Setup**.

2.2.2. Design the Frame Body

CAD Tools can used to **Design**. The **Body** can be **3d Printed**.

2.2.3. Test and Evaluate

The **Board's Connections** needed to be ensured it's **integrity** so that the **Program** can **communicate with the Host** and **Electronics**.

2.2.4. Visualize the Final Product

Once the **Program** and **IO's** have been verified to be in working condition. It's time to **Visualize the Completed Product**, in it's Final Phase.

3 PROJECT DEVELOPMENT

3.1 Stages of Development

3.1.1. Get the Microphones to Work

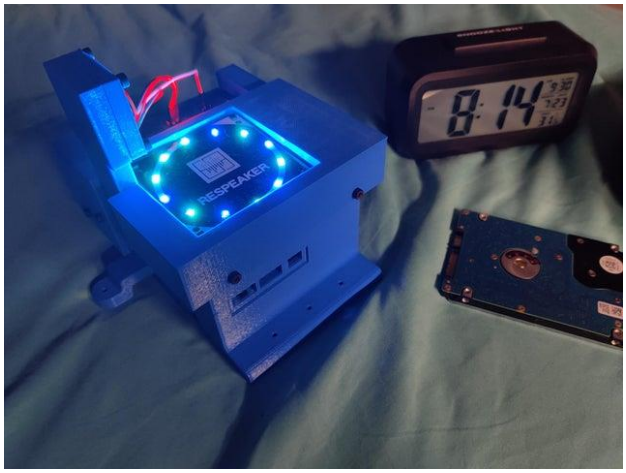

Figure 6: The Dispenser makes it Faster

Microphone

The **Seeed 4 Mic Array HAT Module** depended on it's **Kernal** and **dependencies** to work on **the Latest Version of Raspbian OS**. Once it's done **setup**, there are **Example codes** in **Python** to get the **Microphone** to record and the **LED's** to Respond.

3.1.2. Connecting the IO Board

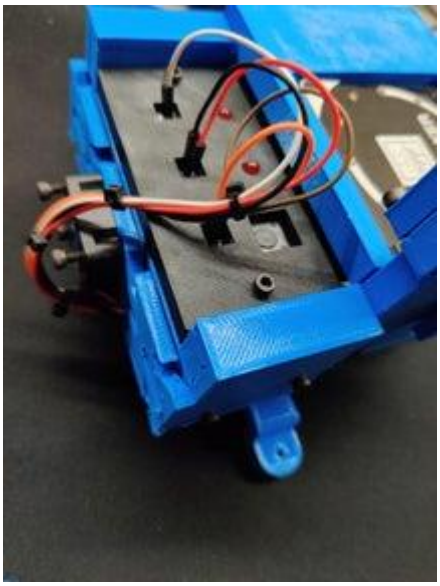

Figure 7: IO Board

IO Board

They were Soldered by Hand on a Prototype Electric Board. The integrity of the joints and connections are not promised to work reliably. Sometimes, connection issues are quite an uncommon occurrence**. Remember to enable GPIO Pins in Raspberry-Pi Configuration Settings**.

3.1.3. Setup Camera

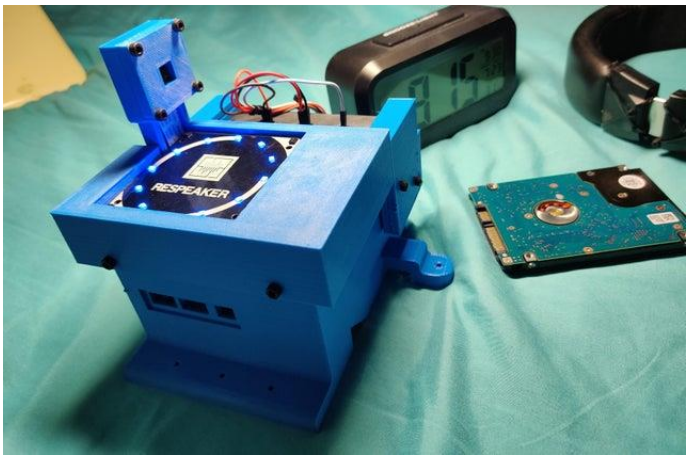

Figure 8: Camera

Camera

The camera can be used to take Pictures using Python. I wasn't able to use Pi-Camera or it's inbuild command/modules to work for the camera. The method I used is lightweight and only requires the use of a python's "pip install" command. **Just Note that the camera is unusable when it's used for Video Recording**. The projects that uses the Camera for Video Recordings are showing the capability and possibility for ARM microprocessors, with only 1gb RAM and barely any computing power. Android phones on the other hand, are very capable ARM Processors. **Remember to enable Camera in Raspberry-Pi Configuration Settings.**

4. Results

4.1 Final

4.2.1. Final Visualised Outputs

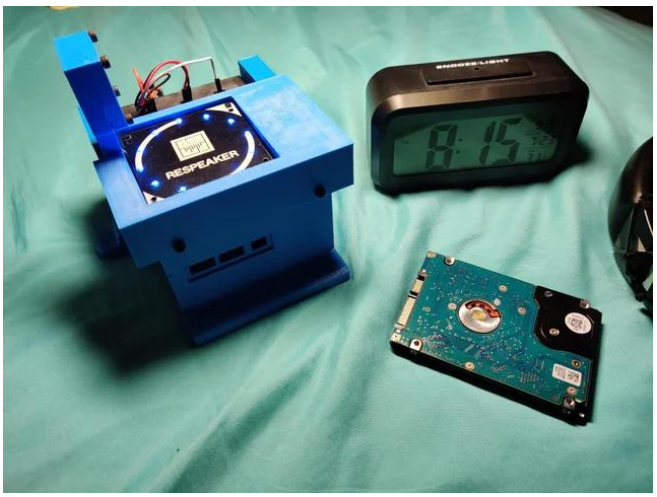

Figure 9: Final

Figure 10: Quality of Camera (1080P Resolution)

Introduction

Here is the completed product in all it's Glory. The Camera's Quality is very good. It is comparable to a Phone's Camera. It makes for a very capable camera. Other Raspberry-Pi Projects showcases it's possibility in AI Recognition or Robotics. However, expect it's speed to be underperforming. Anyways, who can argue for such compact computing?

4.1.2 PSU

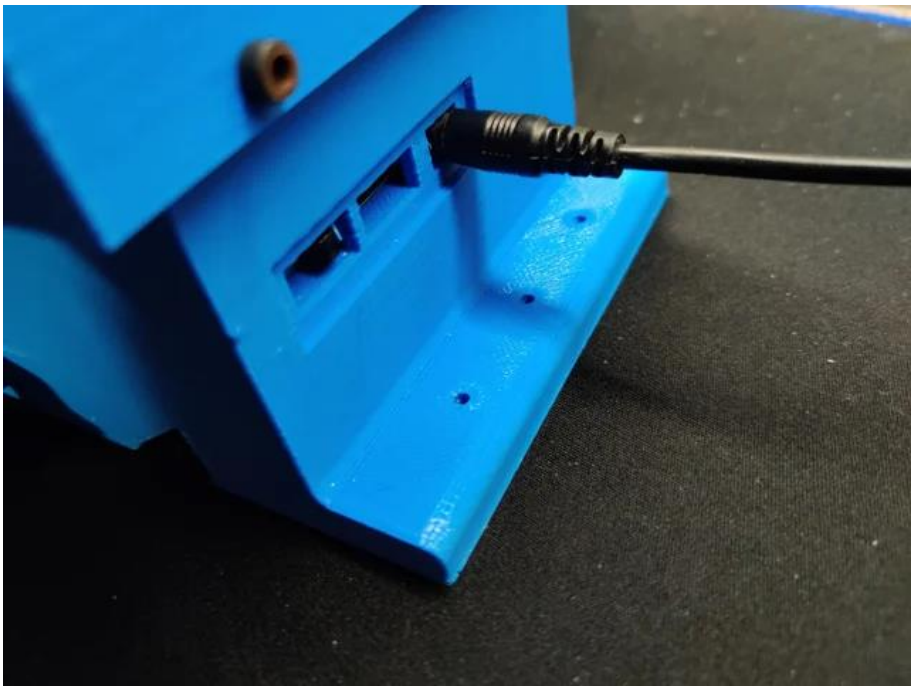

Figure 11: Completed UPS Charger

PSU

The Power Supply and Raspberry PI have been assembled in the Case. The Power Switch and Power Outlet is now accessible through this Panel. Take care when assembling the components. Accidental Electrical Shorting can also happen. I accidentally burnt one of my SD-Card and another Raspberry PI Board by accident. Although the UPS is rated as Uninterruptable. It could still spoil Memory Devices. I once tried using a Hard-Drive, and it also got burned. That was also when, I used only a Battery.

4.2 Components List

4.2.1 BOM List

Bill Of Materials For Rapberry-Pi-Computer-Vision - Thum Wei Aun Marcus

Marcus Thum

BOM Table was Generated by Marcus Thum for the Raspberry-Pi-Computer-Vision Micro-Processor Project on 30/07/2021

NO.	Item Description	Qty.	Amount ($)	Link (HTML)
1	Raspberry Pi B+	1	$ 59.90	https://shopee.sg/product/165760599/2641900835?smtt=0.107637913-1627611838.3
2	Raspberry PI Camera Module	1	$ 6.80	https://shopee.sg/product/321673055/4656957317?smtt=0.107637913-1627611864.3
3	Seeed Respeaker 4 Mics Array	1	$ 32.71	https://s.lazada.sg/s.ZiYql
4	Uninterruptable Power Supply	1	$ 55.54	https://shopee.sg/product/240817503/4646072706?smtt=0.107637913-1627611945.3
4	GPIO Expansion Board	1	$ 3.87	https://shopee.sg/product/89124187/1869053342?smtt=0.107637913-1627612314.3
4	Fan	1	$ 3.12	https://shopee.sg/product/301752246/9227910104?smtt=0.107637913-1627612349.3
	Total		$ 161.94	

Sourcing

The BOM List has been generated for the Raspberry-Pi-Computer-Vision

I sourced it from,

1. Shopee,
2. Lazada

5. CONCLUSION

I have finally created a working use of a Computer Vision Model using Raspberry Pi.

6. Acknowledgements

This is Marcus Thum’s own Personal Project. Do feel free to reach out to me on my Social Media.

7. References

All materials are linked to External Sources.

8. Appendices

The report has been stylised to make reading easier. All the Referenced Content and Text have been written with focus and intent. I hope you piece it together and enjoy the writeup as much as I do. Thank you for your understanding.