



LONG BEACH STATE
UNIVERSITY
College of Engineering



Blue Jay

Individual Report

California State University Long Beach
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CECS-490B : Senior Design Project II

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Introduction

In people's lives, they have little time to check whether certain foods are nearing expiration until it is too late. Therefore, our objective is to track food expiration and alert the owner of the spoiled food. First we tried to check the expired food as a team but I came up with the idea upon adding a Refrigerator which will be including sensors for tracking the food whether it will expire or not. I believe it is important to add the idea upon the refrigerator since we all store our food in the fridge and we also mostly forget to check whether food is expired or not is only when they are in the fridge.

Also as we are working on Senior Design and due to the limited amount of time, I decided to build a small fridge which is easy to demo and also save time.

Best Aspect from COVID-19

Since we are under the unpresidential time due to COVID-19, our product is the best product to use during this difficult time since no one needs to do the physical contact to check the temperature and also what is inside the fridge. Especially our product is a great product to those who are working at hospitals and also store the food and also medical devices inside the fridge. We really feel proud of our product since it can not only help people at home from work but also people at the hospital in order to practice social distancing.



About Yamin

My name is Yamin Yee, I am current Senior Computer Engineering and I am graduating this May 2020. I really enjoy working on projects which will be environment friendly and also home friendly. Therefore when I started taking the senior design project, me and my team decided to work on a project which will help home friendly and will make people feel convenient using the product. In this project, I focused on firmware engineering and also graphic design roles which included setting up the Hardware wires, hardware design and also creating the logo of our product. I also drilled the fridge and also I handled the wiring for the DHT11 temperature sensor and also the wires.

Main Role

I came up with an idea upon Refrigerator, I mainly focused on hardware and also the embedded system which was utilized inside the fridge in order to check the temperature and sensor of the expired food. Previously I set up the RaspberryPi 3B+ on my computer since Pi will be the heart of the project. I finished working on setting up the pi camera inside the fridge by sending the recorded data on camera to the server . So my role is the firmware role since I focus both on Firmware, Hardware and software of taking pictures and sending the data from pi to server.

My YouTube Playlist for Blue Jay

https://www.youtube.com/watch?v=9xwS_OhBQzs&list=PLjgpXIN9Qpry69h3K84NoOPf0RO84nB22

Challenging Aspect

During the first time I was working on the pi, the SD card we are using for pi was broken when we were moving around. Camera wasn't capturing the entire fridge and so I had to figure out what would be the best way to take the entire fridge inside. I had to replace 3 times with different cameras but at the same we also needed to figure out how to capture inside the fridge since the camera won't show anything since the fridge's inside will be dark. So we needed to order the wide angel pi camera that came with Night Detected light.

Main Challenge during quarantine

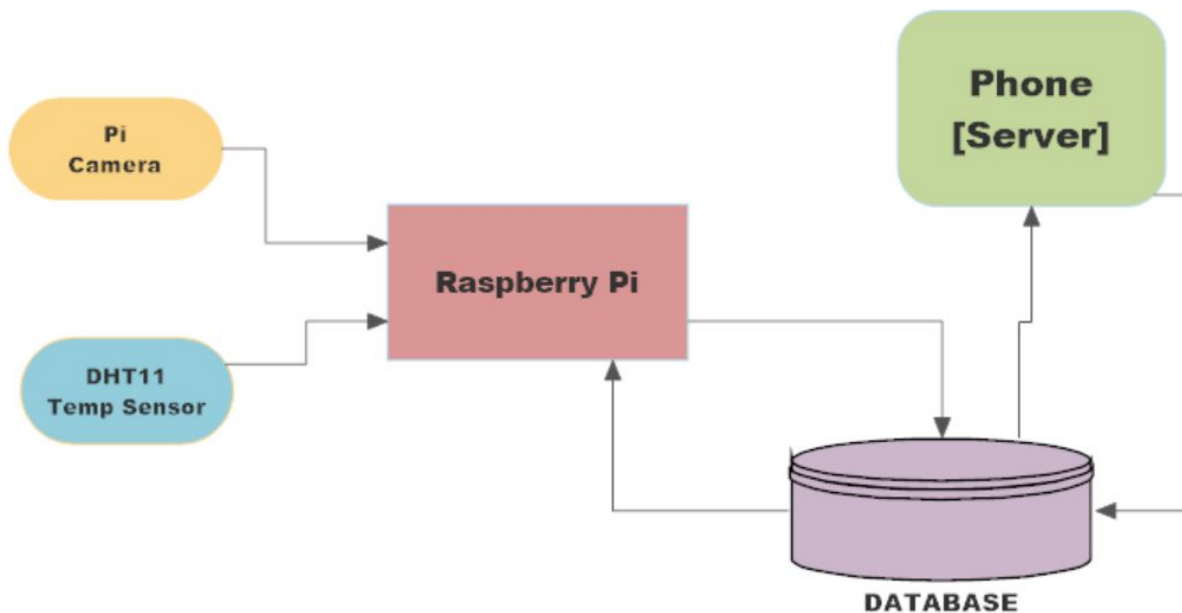
During the quarantine, I need to set up the pi camera to capture and send the live stream to the server. Unfortunately, since my apartment has really bad WiFi since all my roommates are also working on their classes at the same time. So I decided to buy the ethernet cable but the cable that was broken at my apt is not working and so finally I decided to work on the time lap to take pictures and send it to the server. Finally it works and then the server gets data from my pi with DHT11 and also takes a picture every one minute the pi camera takes a picture.

Satisfying Aspect of Project

I really enjoy seeing the end of the result while I can take pictures and videos of pi and at the same time, I am able to read the data from the DHT11 and those are the satisfying aspects of the projects. Finally I was able to send the picture to my pi camera as well. Also the most

satisfying part was our product is one of the products that can help people to social distance while using the product without physical contact.

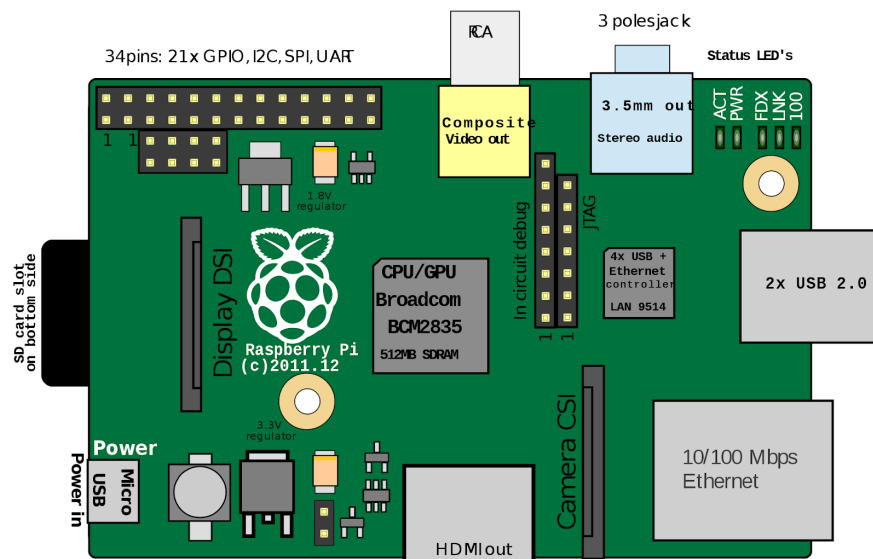
Block Diagram for Over All Project



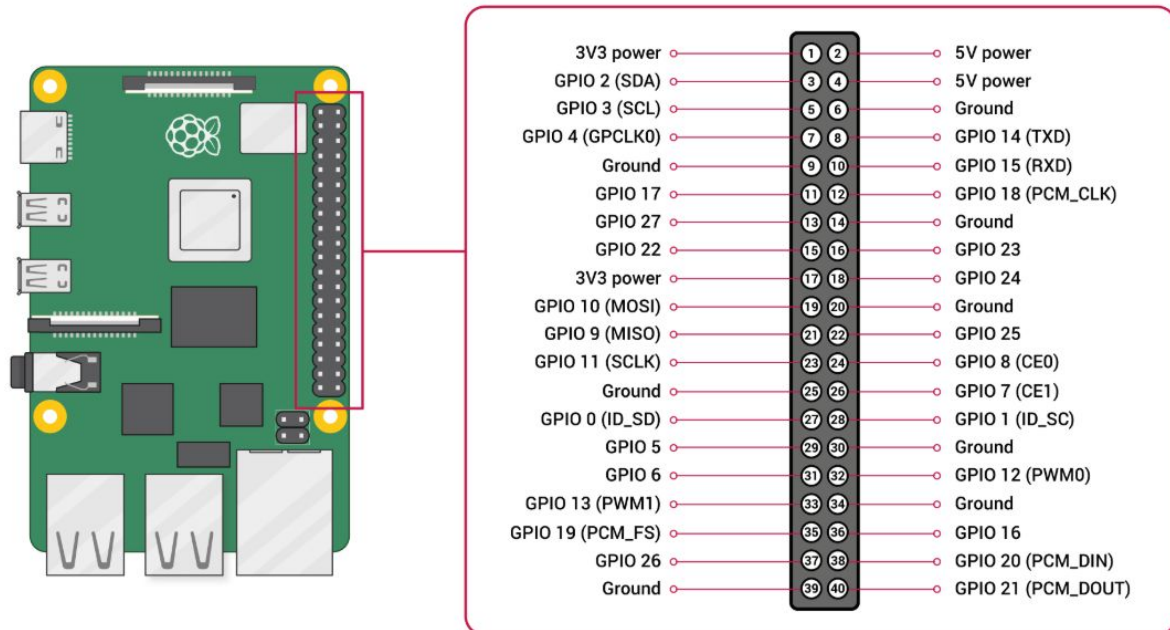
Raspberry Pi will get the datas from Pi cameras such as videos and pictures and also the data from DHT11 temperature sensors with current Date and Time with Humidity and Temperature inside the fridge. After that the database will communicate between Pi and the server which is the phone or app. The database will be taken care of by Abigail since her role is mainly focused on Software.

Raspberry Pi 3

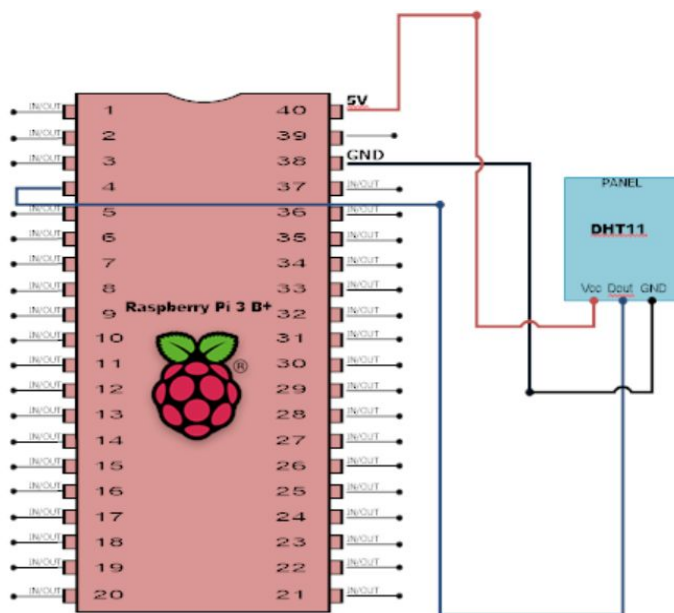
Raspberry Pi 3 will be performing as either Receiver or Transmitter . It will receive the data from Sensor & Camera, all the messages, filtering the messages, determining who is subscribed to each message and will check whether the data is right and then it will transmit to the app in order to perform whatever the data is sent from Raspberry Pi3. So Raspberry Pi 3 will be the broker of middlemen in this project and it is basically the heart of any protocol.



Raspberry Pi 3 Pins



Schematic of Raspberry Pi with DHT11



Python Code to Run RaspberryPi with DHT11

```
import sys
import Adafruit_DHT
import time
import requests

while True:

    humidity, temperature = Adafruit_DHT.read_retry(11,4)

    print 'TEMP: {0:0.1f} C Humidity: {1:0.1f} %'.format(temperature, humidity)

    time.sleep(1)

    url = 'https://abigailkwan.00webhostapp.com/index.php'
    humid = '{:0.1f}'.format(humidity)
    temp = '{:0.1f}'.format(temperature)

    params = {'temperature': temp, 'humidity': humid}

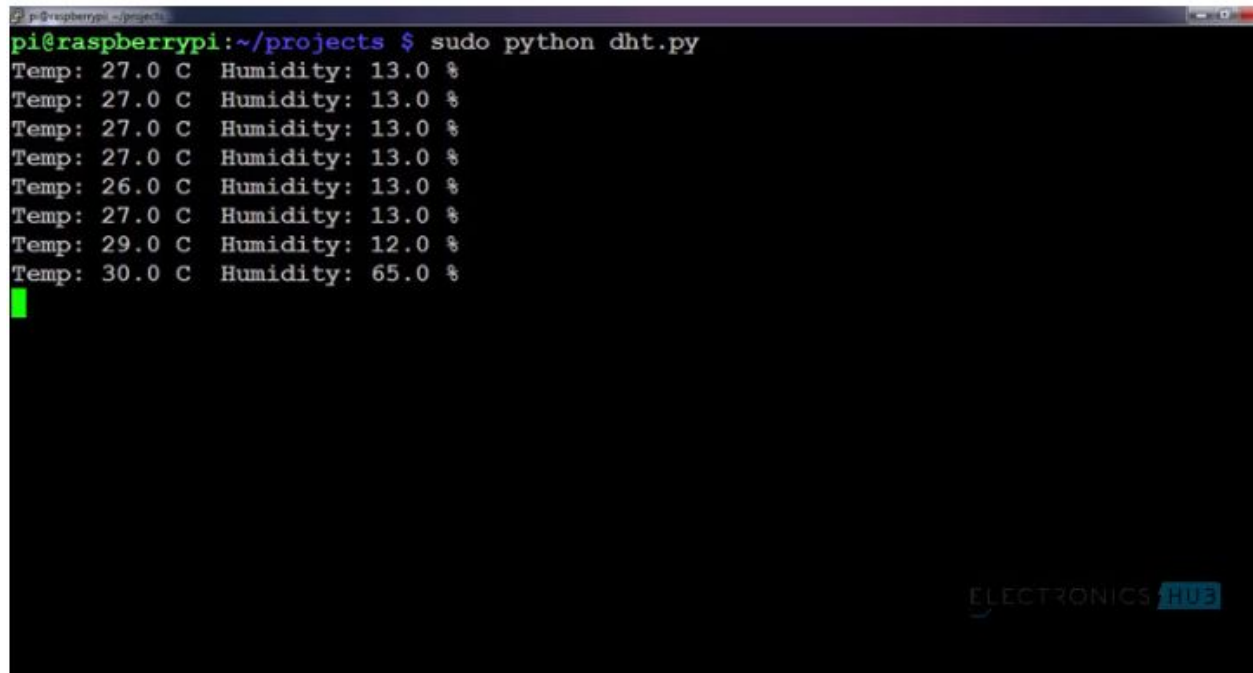
    x = requests.post(url,params)
    print(x.text)
```

I used the code to test

whether it is working or not. I found it from [this reference](#). Abigail worked on the url and params

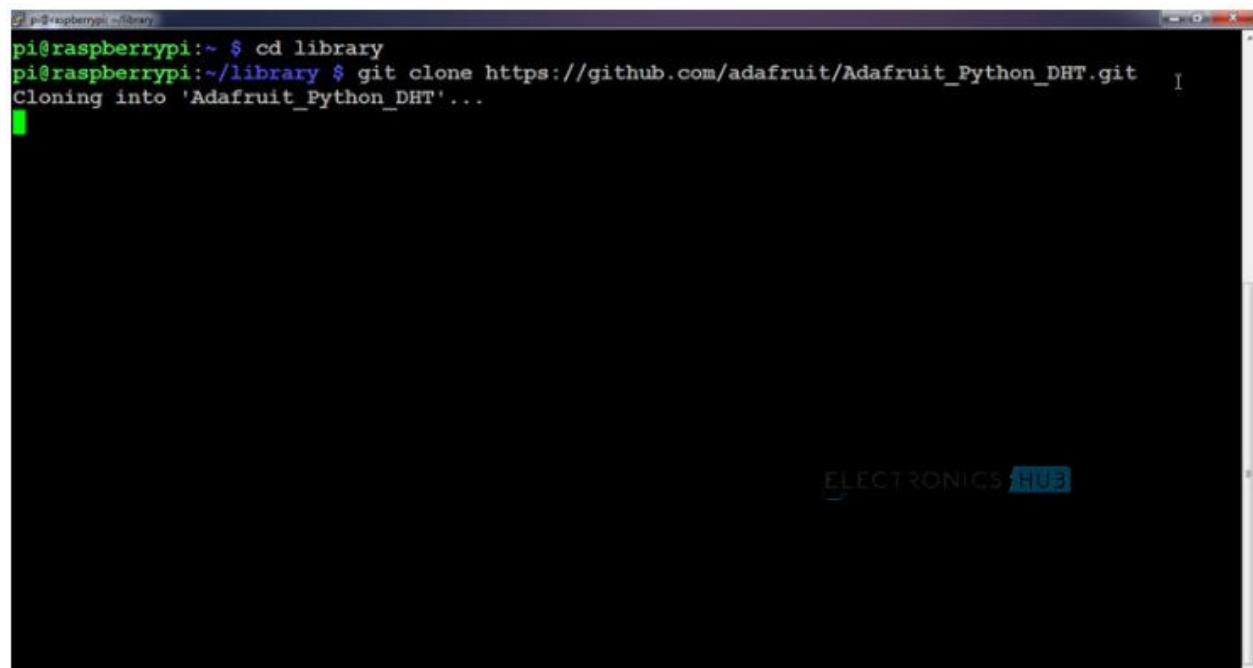
in order to make sure the date and current time is working.


```
pi@raspberrypi:~/projects $ sudo python dht.py
Temp: 27.0 C Humidity: 13.0 %
Temp: 27.0 C Humidity: 13.0 %
Temp: 27.0 C Humidity: 13.0 %
Temp: 27.0 C Humidity: 13.0 %
Temp: 26.0 C Humidity: 13.0 %
Temp: 27.0 C Humidity: 13.0 %
Temp: 29.0 C Humidity: 12.0 %
Temp: 30.0 C Humidity: 65.0 %
```



Installing DHT11 Temperature on Pi

```
pi@raspberrypi:~ $ cd library
pi@raspberrypi:~/library $ git clone https://github.com/adafruit/Adafruit_Python_DHT.git
Cloning into 'Adafruit_Python_DHT'...
```





I use the above code to install the DHT11 on Pi.

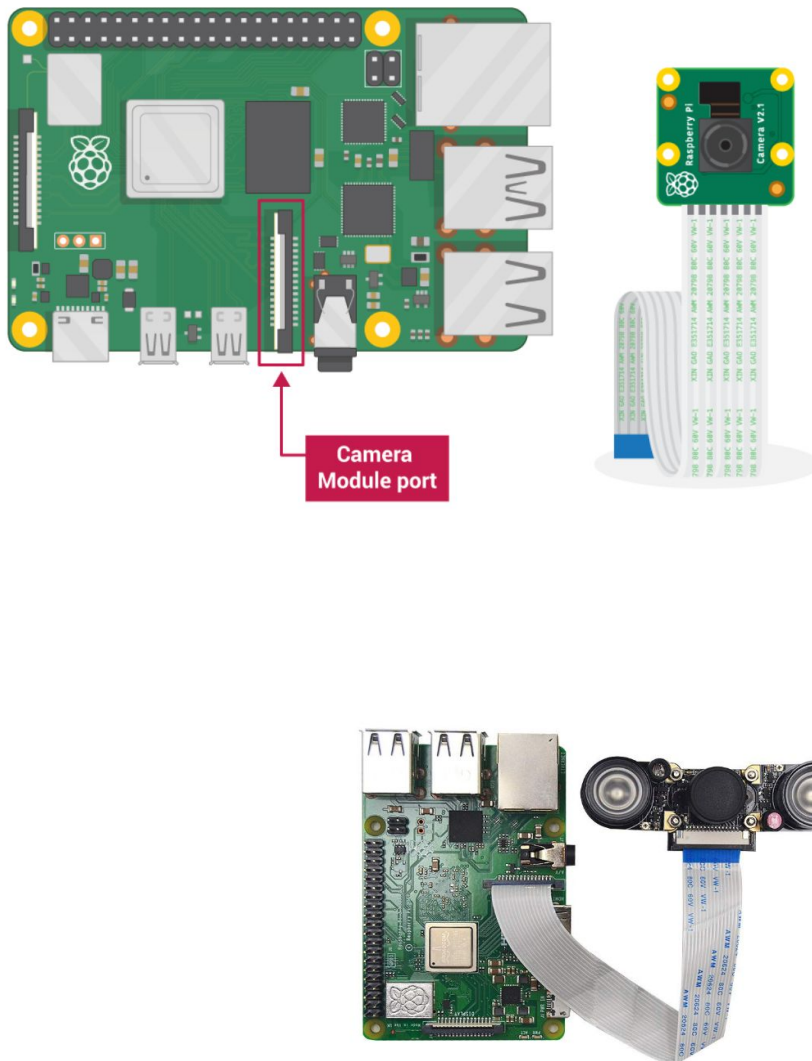
Module to Run the Pi

Frist of all, we need to open the pi terminal, then followings are the modules

- Module to open file
 - **nano <Filename.py>**
- Module to edit the file
 - **sudo nano <Filename.py>**
- Module to run the code
 - Python file
 - **sudo python <Filename.py>**

Installing Pi Camera

Step1: Set Up Pi Camera



Above picture is how I set up the Pi camera. After the set up, I need to install openCV on my pi.

Module for Raspberry Pi Camera to Take Picture

Taking Pictures for pi camera is as below and the picture as shown below is the first picture I took inside the fridge

◆ **`raspistill -o Desktop/image.jpg`**



Taking Videos for pi camera is as below and I also attached the video file which shows that pic can take video

◆ **`raspivid -o Desktop/video1.h264`**

[Video for Whole Usage of Pi camera while attached to Fridge](#)

Code to Take pictures with Title with Timing and Sending the Data to Server

```
camera.py •
C: > Users > Yamin Yee > Downloads > camera.py > ...
1  import sys
2  import picamera
3  from time import sleep
4  import requests as req
5
6  cam = picamera.PiCamera()
7
8  while True:
9      #Set up the camera
10
11  #Start the Camera
12      cam.start_preview()
13
14  #Display Text On Image
15      cam.annotate_text="Hello!!! Welcome From Blue Jay's Service"
16
17  #Flip camera Horizontally TRUE/FALSE
18      #cam.hflip = True
19  #cam.vflip = True
20
21
22      cam.capture('/home/pi/Desktop/camera/abby.jpg')
23
24      sleep(5)
25  #for i in range(5):
26      #Directory where you wish to capture the pictures
27      # cam.capture('/home/pi/Desktop/camera/pic%s.jpg'%i)
28
29
30      #Done after it is capturing the picture
31  #cam.stop_preview()
32
33      url = 'https://abigailkwan.000webhostapp.com/upload_img.php'
34
35  with open('abby.jpg','rb') as f:
36      files = {'file' : f}
37
38      r = req.post(url, files = files)
39      print(r.text)
40
41      cam.stop_preview()
42
43      #sleep(30)
```

Coding Details

I set up the pi camera and after that I need to use the request module in order to send the data to the url of Abigail's server. In order to take pictures under a certain location, I put the directory of the location of the pictures which will be saved. Then use the while loop in order to keep taking pictures every 1 minute and then it will send to the server.

Virtual Result

Here is the sample image and [Video](#) of inside the fridge with Pi Camera. Everytime, the camera is binked for 1 minute, that means pi is taking a picture and also successfully sending the picture to the server. The picture will overwrite the previous picture since the pi is taking the new picture and sending them to the server.



Code to Take Video with Title and Timing

```
import picamera
from time import sleep

#Set Up Camera
cam = picamera.PiCamera()

#Start Camera
cam.start_preview()

#Text to Display when taking the video
cam.annotate_text = 'Hello!!Welcome From Blue Jay Servie'

#Start Recording the Video
for i in range(40):
    cam.start_recording('/home/pi/Desktop/camera/video%s.h264'% i) #Directory to record the video with the location of poython code
    sleep(60)

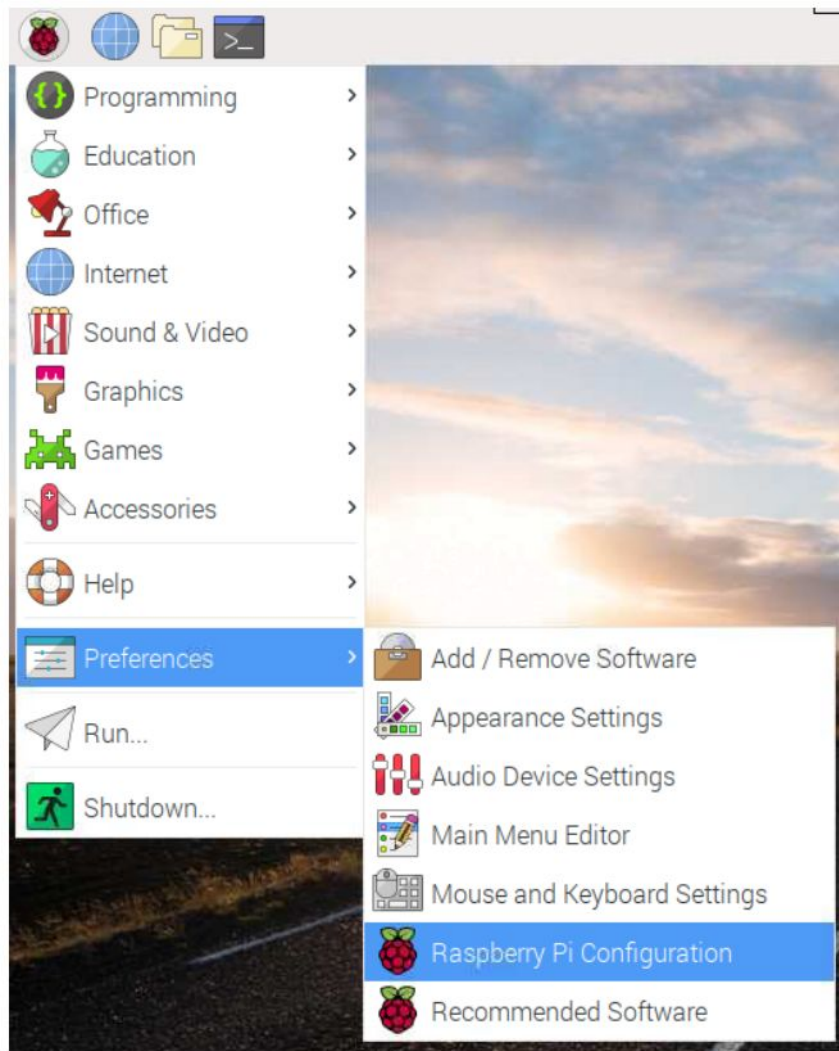
#Stop Recording the Video
cam.stop_recording()

#When it stops, review the record
cam.stop_preview()
```

Sample Video with Title of “Hello, welcome from Blue Jay Servie”

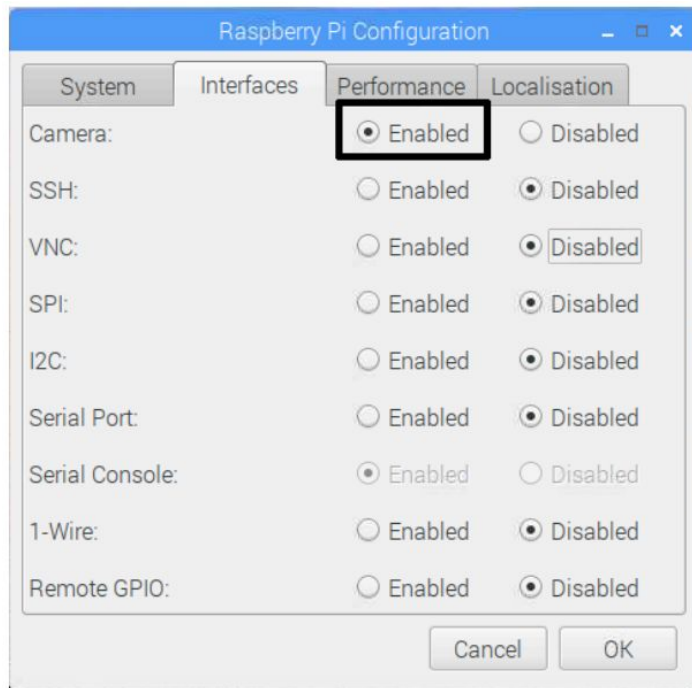
Video of Pi with Title

Step 2 : Raspberry Pi Configuration



on

Select the Interfaces tab and ensure that the camera is enabled:



Step 3: How to control the Camera Module via the command line

There are two command line tools raspistill and raspivid

- raspistill is the command for taking picture
- raspivid is the command for taking video

Use terminal window to take picture

The command line is as the following and then enter press to take picture

```
raspistill -o Desktop/image.jpg
```

We can resize the picture by using the following command line

```
raspistill -o Desktop/image-small.jpg -w 640 -h 480
```

Step4: Controlling Pi camera with Python Code

I use the following code to control the pi camera

```
from picamera import PiCamera
from time import sleep

camera = PiCamera()

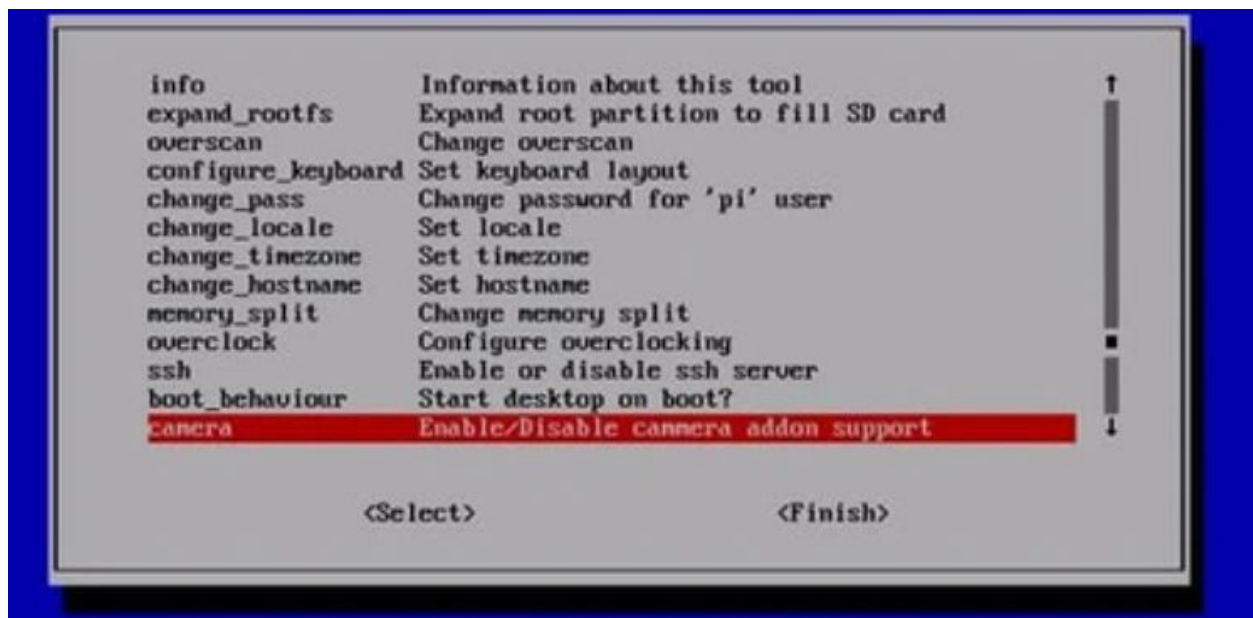
camera.start_preview()
sleep(5)
camera.stop_preview()
```

I can rotate the image by using 90, 180, or 270 degrees. To reset the image, set rotation to 0 degrees.

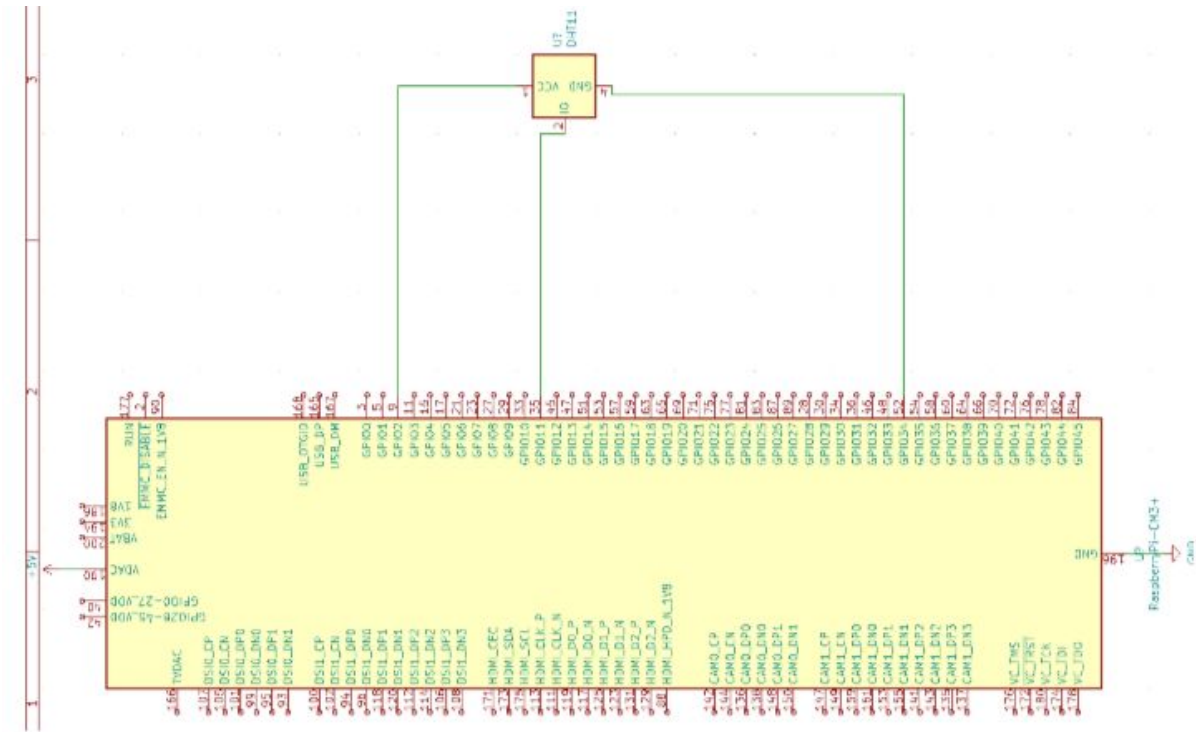
Also I can make the pi camera preview by using alpha level.

```
camera.start_preview(alpha=200)
```

Everything we create, we need to reboot in order to make sure the pi is running properly.



Technical Details(Tools, Methods, Schematics/Datasheets)



This is the schematic for the DHT11's connection to the Pi

Technical Difficulties:

I encountered a lot of technical difficulties before I got to the result of completion. The main difficulties will be due to COVID-19, the wifi is really bad and I wasn't able to use the IP address therefore I decided to change it to use the time lapping pictures and then send it to the server. During the time, when I was trying to figure out for streaming, I installed motion to pi and it blocked the camera from taking pictures and so at the end, my team member, Jermery tried to solve the problem. After I deleted the motion form pi, it worked at the end.

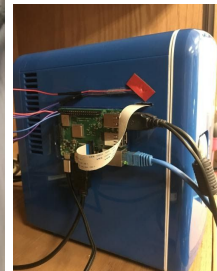
Dimension of the fridge



Dimensions of the fridge that we will be modifying

Physical Wires Connection with Fridge and Pi

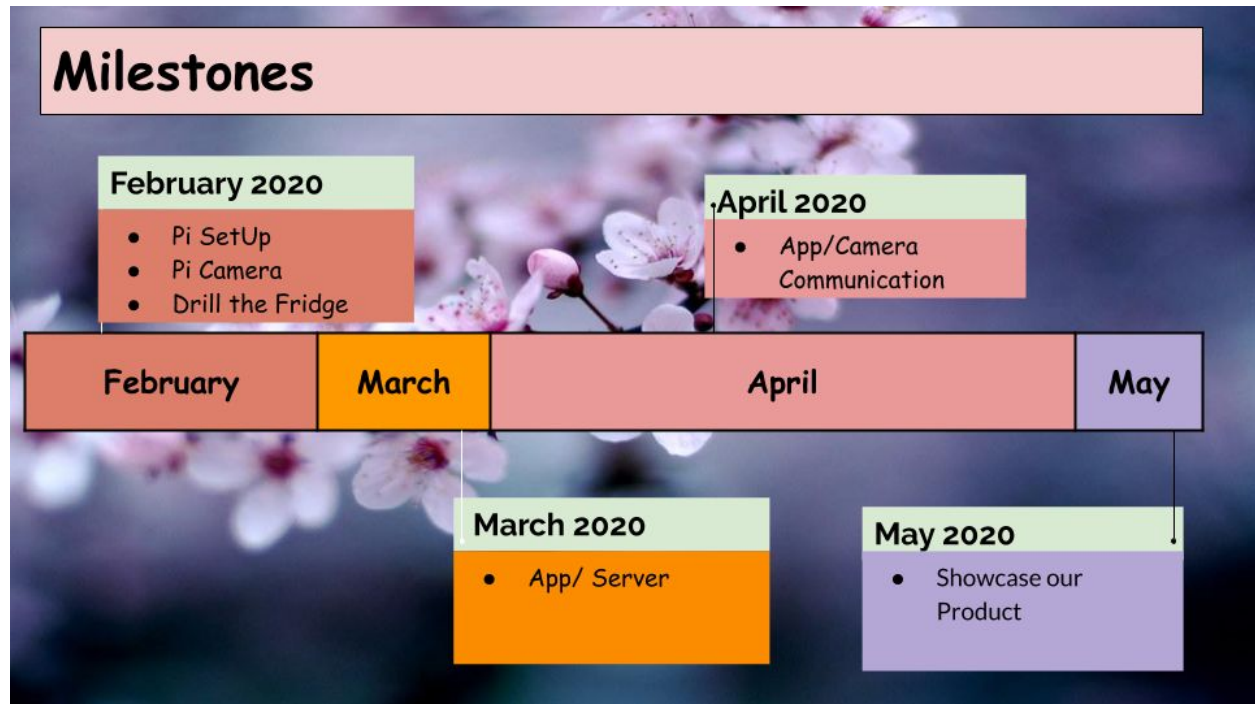
I drilled the fridge and also I attached the pi on the left side of the fridge with the wire going through the drilled area. Please see the attached photos below



Timeline(Completed)

	January	February	March	April	May
Progress	Successfully tested DHT11 temperature reading capabilities, began work on server and app	Successfully tested DHT11 and Raspberry Pi Camera with Pi, Began work on Fridge hardware/modification, PHP database set up, general UI tested	(Planned) Successfully incorporate sensor into fridge via wiring/fridge modification, test the App with internet, and successfully connect to server from Pi	(Planned) Test the App's capabilities of displaying temperature and food inputs, Further modify the fridge.	(Planned) Successfully test App, alerts, and camera feed (image snapshots or video feed).
Obstacle	Fridge creation/modification plan was still in flux, thus leading to some lost time.	Part decisions were being finalized on the sensor end, and Raspberry Pi-Server connection issues.	One team member (Jeremy) may be unavailable for Friday mornings given class, Raspberry Pi connectivity still poses threat to server-device communication	Raspberry Pi connectivity still poses threat to server-device communication	Raspberry Pi connectivity still poses threat to server-device communication


Milestone (Completed)



My Projected Final Grade:

Since this is the last report I did and also the final closing for the senior design, first of all, I am really proud of myself and also with my team. Yes, it wasn't easy since teamwork always has something up and down, but at the end, we were able to communicate really well, talk it out and sit down and talk to have conversation in order to continue and had a good result.

I worked on the pi, wiring the pi camera and also DHT11 all by myself and also researching for coding and also for sending the data to the server. I encouraged my team as much as I can to work on the powerpoint and also in a creative way. I not only focused on working the



project but also focused on interpersonal communication with my team such as whenever there were conflict, I talked it out loud in order to avoid delaying the project.

So in conclusion, I strongly believe that I do deserve **A** for the grade since I really put my effort on this project not because I obligated to do it but because I love doing it which was different from doing it done because I had to but because doing it was done because I wanted to.

Conclusion

I want to say a special thank you to the professor and my team to make me feel like I am able to work on a project or done project without any description. It really makes me feel like I am a real engineer without needing any help but being able to figure out the things by myself or along with my team. This Senior class prepares me not only as a future engineer but also teaches me how to work in a team and adjust it along with their different personalities. So thank you Professor and thank you Abby and Jeremy for being Blue Jay.

References

<https://www.electronicshub.org/raspberry-pi-dht11-humidity-temperature-sensor-interface/>

<https://picamera.readthedocs.io/en/release-1.10/recipes1.html>

<https://www.raspberrypi.org/forums/viewtopic.php?t=126358>

<https://medium.com/@petehouston/capture-images-from-raspberry-pi-camera-module-using-picamera-505e9788d609>

<https://projects.raspberrypi.org/en/projects/getting-started-with-picamera/1>