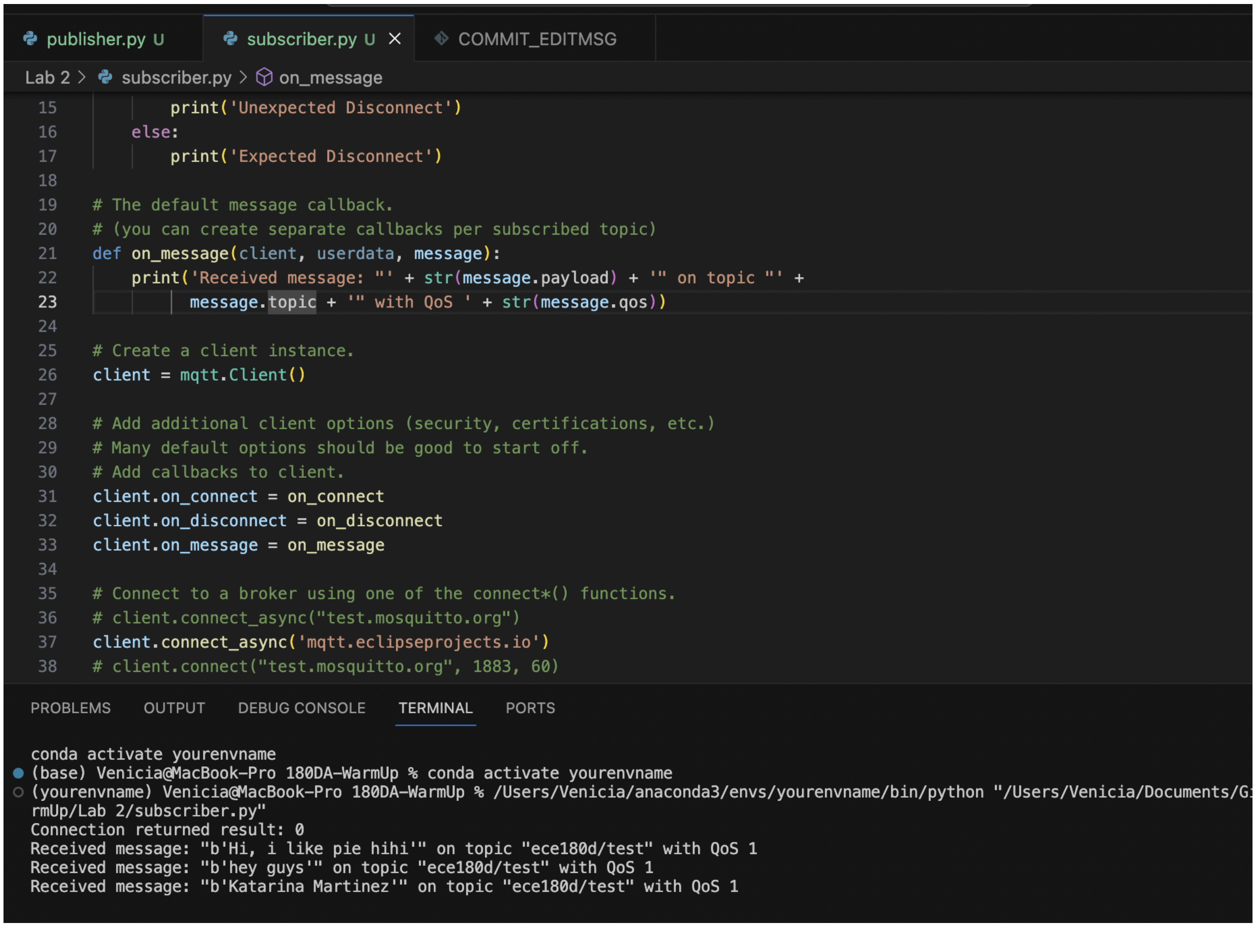
1) Through MQTT. we can have communication between multiple devices. This is done through a “publisher” and “subscriber” model. One thing that is difficult about MQTT is setting it up as well as how long it takes to send/receive messages. While using MQTT, a reasonable communications lag time would be 1 min - 5 min. This was probably due to the message size and also the wifi connection that the devices were connected to. I would prefer to use a different method of transmitting data, however, MQTT is a good way to be able to communicate with other users.



```python
        print('Unexpected Disconnect')
    else:
        print('Expected Disconnect')

# The default message callback.
# (you can create separate callbacks per subscribed topic)
def on_message(client, userdata, message):
    print('Received message: "' + str(message.payload) + '" on topic "' +
          message.topic + '" with QoS ' + str(message.qos))

# Create a client instance.
client = mqtt.Client()

# Add additional client options (security, certifications, etc.)
# Many default options should be good to start off.
# Add callbacks to client.
client.on_connect = on_connect
client.on_disconnect = on_disconnect
client.on_message = on_message

# Connect to a broker using one of the connect*() functions.
# client.connect_async("test.mosquitto.org")
client.connect_async('mqtt.eclipseprojects.io')
# client.connect("test.mosquitto.org", 1883, 60)
```

```
conda activate yourenvname
● (base) Venicia@MacBook-Pro 180DA-WarmUp % conda activate yourenvname
○ (yourenvname) Venicia@MacBook-Pro 180DA-WarmUp % /Users/Venicia/anaconda3/envs/yourenvname/bin/python "/Users/Venicia/Documents/G
rmUp/Lab 2/subscriber.py"
Connection returned result: 0
Received message: "b'Hi, i like pie hihi'" on topic "ece180d/test" with QoS 1
Received message: "b'hey guys'" on topic "ece180d/test" with QoS 1
Received message: "b'Katarina Martinez'" on topic "ece180d/test" with QoS 1
```

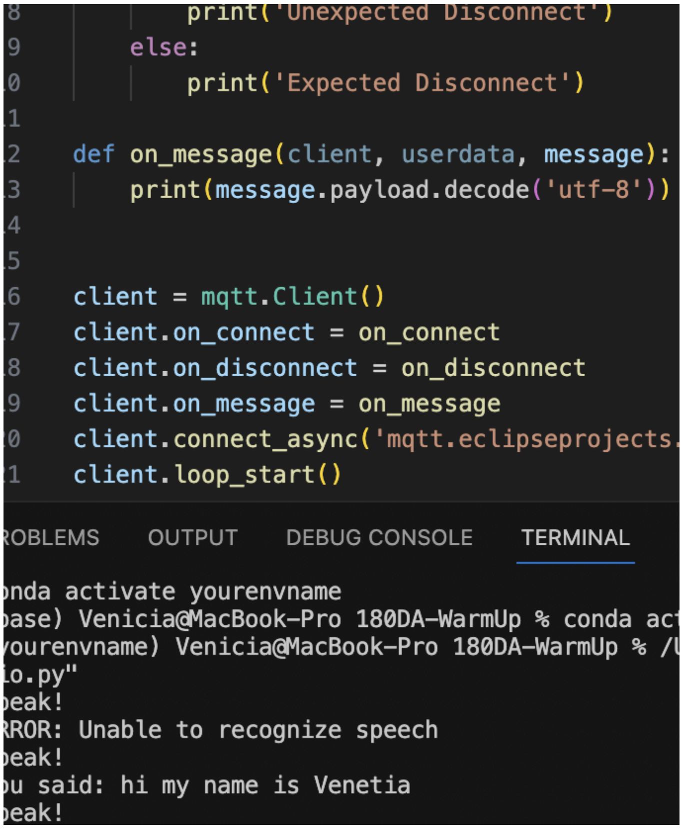
Image 1: Communicating with a group of 4.

2)

a) The performance seems to have not as much accuracy when determining sounds that have similar sounds. For example, the performance started to take a hit using just letters, and I had a harder time translating the letters I was saying.

b) Long phrases were performing great. However, extremely long phrases seem to cause more opportunities for errors. “Error correction” would be used effectively here when we are dealing with very long phrases.

c) With music or in the lab, the performance did a terrible job of picking up what was being said. Limiting the surrounding noise would help with picking up the actual words. One could do this by getting headphones.

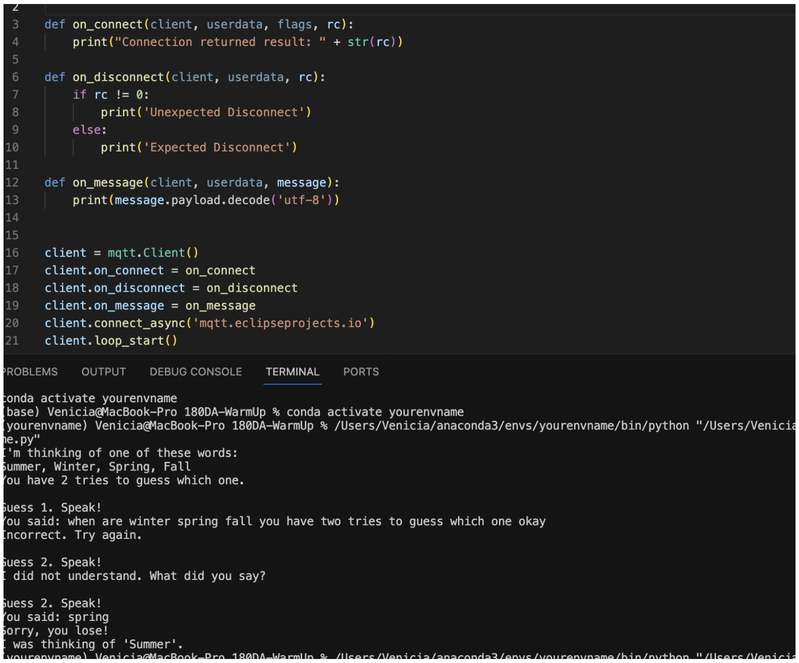


```
            print('Unexpected Disconnect')
        else:
            print('Expected Disconnect')

    def on_message(client, userdata, message):
        print(message.payload.decode('utf-8'))


    client = mqtt.Client()
    client.on_connect = on_connect
    client.on_disconnect = on_disconnect
    client.on_message = on_message
    client.connect_async('mqtt.eclipseprojects.
    client.loop_start()
```

```
onda activate yourenvname
base) Venicia@MacBook-Pro 180DA-WarmUp % conda act
yourenvname) Venicia@MacBook-Pro 180DA-WarmUp % /U
io.py"
peak!
RROR: Unable to recognize speech
peak!
ou said: hi my name is Venetia
peak!
```



```
def on_connect(client, userdata, flags, rc):
    print("Connection returned result: " + str(rc))

def on_disconnect(client, userdata, rc):
    if rc != 0:
        print('Unexpected Disconnect')
    else:
        print('Expected Disconnect')

def on_message(client, userdata, message):
    print(message.payload.decode('utf-8'))


client = mqtt.Client()
client.on_connect = on_connect
client.on_disconnect = on_disconnect
client.on_message = on_message
client.connect_async('mqtt.eclipseprojects.io')
client.loop_start()
```

```
conda activate yourenvname
(base) Venicia@MacBook-Pro 180DA-WarmUp % conda activate yourenvname
(yourenvname) Venicia@MacBook-Pro 180DA-WarmUp % /Users/Venicia/anaconda3/envs/yourenvname/bin/python "/Users/Venicia
ne.py"
I'm thinking of one of these words:
Summer, Winter, Spring, Fall
You have 2 tries to guess which one.

Guess 1. Speak!
You said: when are winter spring fall you have two tries to guess which one okay
Incorrect. Try again.

Guess 2. Speak!
I did not understand. What did you say?

Guess 2. Speak!
You said: spring
Sorry, you lose!
I was thinking of 'Summer'.
(yourenvname) Venicia@MacBook-Pro 180DA-WarmUp % /Users/Venicia/anaconda3/envs/yourenvname/bin/python "/Users/Venicia
```

3) Questions
    a) In a project form, one would be able to have the user say specific words to trigger a game to start or end or release bonuses or challenges.
    b) I would want my program to be complex enough to handle different commands but also overly complicated and pick up on unnecessary noise around. This would also include having users easily use the project through natural speech patterns.
    c) I would say we would need a high level of speech accuracy to not only pick up on what the user is saying correctly but also take what the user is saying quickly to continue the game. Missed recognition does hurt the game as it takes more time and stops the user from continuing the next process.
    d) The type of hardware needed would be strong microphones and a quiet surrounding area for the audio to be picked up clearly and concisely.