Can you please pass the data? IoT communication in Micropython

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Hello!

- **Portland, OR**
- **Trans guy, trans masc slack**
- **Oregon Health & Science University**
- **He/Him**
- **Internet of Cats (PyDX 2016), IoT with Micropython and Friends (PyCon 2017)**

IoT Communication

Wow look at the t

Yikes! Can you turn it up to 78 please?

You betchya

Photo: Willamette Valley Vineyards http://www.wvv.com

Our Internet of Things

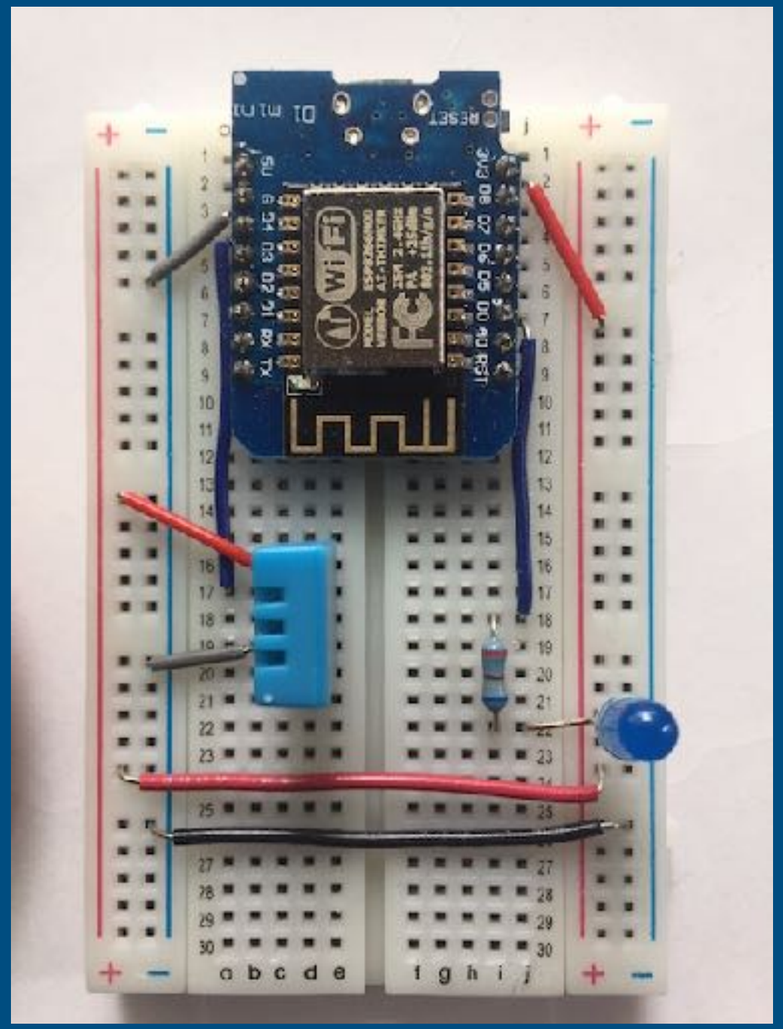
vineyard_network

vine1

vine2

Vine Sensor

ESP8266



DHT11

LED

Vineyard Network

ESP8266 **vineyard_network**

vine1

vine2

Setup WiFi

```
1   import network

2   ap_if = network.WLAN(network.AP_IF)

3   ap_if.config(essid='vineyard_network')

4   ap_if.active(True)
```

ESP8266

Connect vine sensors

```
1   import network

2   sta_if = network.WLAN(network.STA_IF)

3   sta_if.active(True)

4   sta_if.connect('vineyard_network',password)
```

vine1

Measuring humidity

```
1   import dht
2   import time
3   my_dht = dht.DHT11(machine.Pin(2))
4
5   def measure_humidity(poll_time_s):
6       while True:
7           my_dht.measure()
8           humidity = my_dht.humidity()
9           print("humidity: ", humidity)
10          time.sleep(poll_time_s)
```

Vineyard Network

ESP8266 **vineyard_network**

vine1

vine2

MQTT

Message Queuing Telemetry Transport!

- **Light weight, pub/sub model w/ broker**

sub

msg

pub

MQTT - Topics

- vineyard/
  - vineyard/humidity
    - vineyard/humidity/vine1
- vineyard/temp/#
- vineyard/+/vine1

MQTT Pub in Micropython

```
1   from umqtt.simple import MQTTClient
2   p = MQTTClient( client_id, broker_ip )
3   p.connect()
4   p.publish( vineyard/temp/vine1, 15 )
```

MQTT Sub in Micropython

```
1    s = MQTTClient( client_id, broker_ip )

2    s.connect()

3    def cb(topic, message):

4            print(topic + ": " + message)
```

MQTT Sub in Micropython

```
1    s.set_callback(cb)
2    s.subscribe(”vineyard/temp/#”)
3    while 1:
4        s.wait_msg()
```

```
from umqtt.simple import MQTTClient
import dht
import time
my_dht = dht.DHT11(machine.Pin(2))

def measure_mqtt(poll_time_s, broker_ip, client_id, topic):
    p = MQTTClient(client_id, broker_ip)
    p.connect()

    while True:
        my_dht.measure()
        humidity = my_dht.humidity()
        humid_topic =  topic + '/humidity/' + client_id
        p.publish(humid_topic, str(humidity))
        time.sleep(poll_time_s)
```

Demo!

```
from mqtt_measure import *
measure_mqtt(4, "192.168.4.2", "vine1", "vineyard")
```

```
from mqtt_measure import *
measure_mqtt(4, "192.168.4.2", "vine2", "vineyard")
```

Summary

- **Create WLAN access point**
- **Connect sensors to WLAN**
- **Measure humidity and temperature**
- **MQTT for message relay**

Thanks!

- **References in backup**
- **gizm0_0@tenforward.social**
- **github.com/gizm00/pycascades_2018**
- **sev@thedatascout.com**

Backup

Demo setup

- connect laptop to vineyard_network
- ipconfig | grep inet
- pico /usr/local/Cellar/mosquitto/1.4.11_2/etc/mosquitto/mosquitto.conf
- brew services restart mosquitto
- mosquitto_sub -h 192.168.4.2 -t vineyard/#
- nav webrepl to 192.168.4.3 and 4.4 to get to vine sensors
- from mqtt_measure import *
- measure_mqtt(4, "192.168.4.2", "vine1", "vineyard")
- from mqtt_measure import *
- measure_mqtt(4, "192.168.4.2", "vine2", "vineyard")

MQTT Spy Setup

- Goto Connections -> Manage Connections
- Update Server URI if needed
- Click “Close and reopen existing connections”
- Under subscriptions & received messages click New tab
- Add vineyard/temp/#
- Add vineyard/humidity/#
- To show graphs:
  - Right click received messages and go to Charts
  - Show all browsed topics

References

- https://en.wikipedia.org/wiki/MQTT
- https://mosquitto.org
- https://micropython.org
- https://www.hivemq.com/blog/how-to-get-started-with-mqtt

Agenda

- **IoT IRL**
- **ESP8266**
- **Micropython**
- **MQTT**
- **Sending MQTT messages**
- **Demo!**

Agricultural Technology

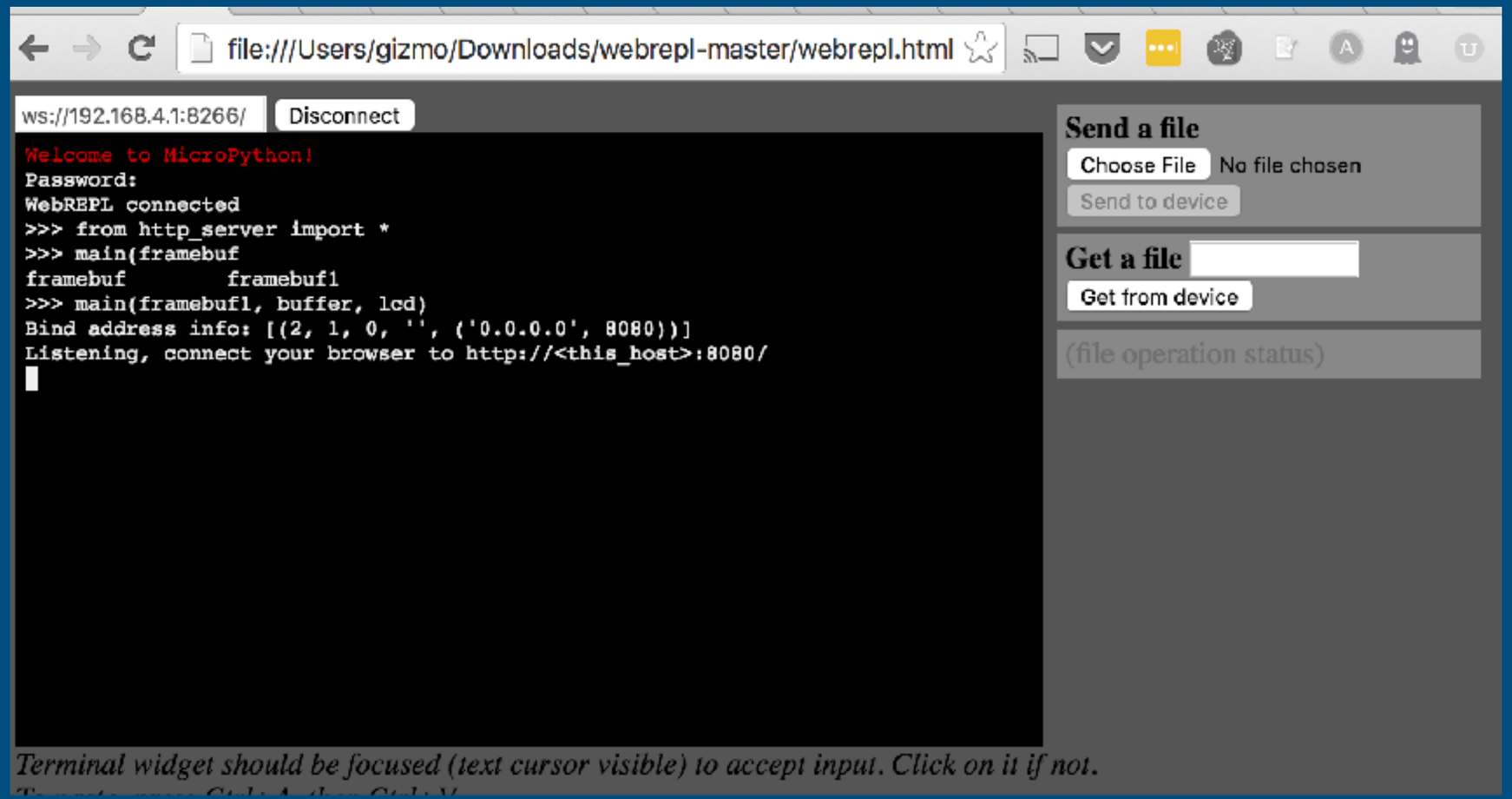
TechCrunch

Agtech startup Prospera, which uses AI and computer vision to guide farmers, harvests $15M

Ceres Imaging raises $5 million to pinpoint crop stress for farmers

Vinsight gives grape and almond growers a high-tech crystal ball

WebREPL


file:///Users/gizmo/Downloads/webrepl-master/webrepl.html
ws://192.168.4.1:8266/
Disconnect
Welcome to MicroPython!
Password:
WebREPL connected
>>> from http_server import *
>>> main(framebuf
framebuf framebuf1
>>> main(framebuf1, buffer, lcd)
Bind address info: [(2, 1, 0, '', ('0.0.0.0', 8080))]
Listening, connect your browser to http://<this_host>:8080/
Send a file
Choose File
No file chosen
Send to device
Get a file
Get from device
(file operation status)
Terminal widget should be focused (text cursor visible) to accept input. Click on it if not.

Micropython

A. Like regular Python, but small and hard to read X

B. A version of Python optimized for use on microcontrollers
Funded via Kickstarter

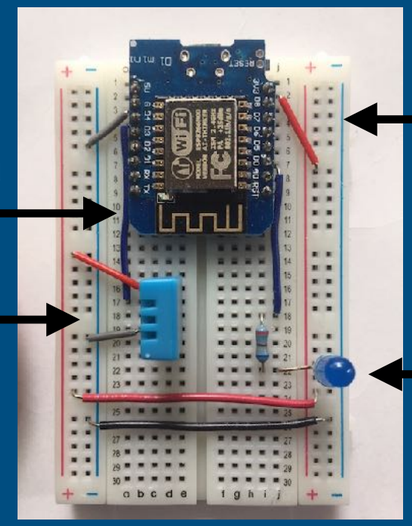
C. All of the above

D. Some of the above

E. Some of the above!

micropython.org

ESP 8266 Microcontroller



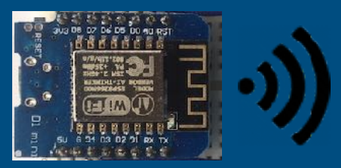
Antenna

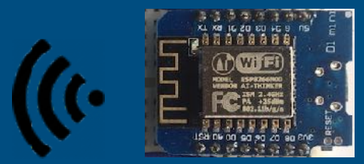
DHT11
Digital Humidity
Temperature sensor

ESP8266
(WeMos D1)

LED

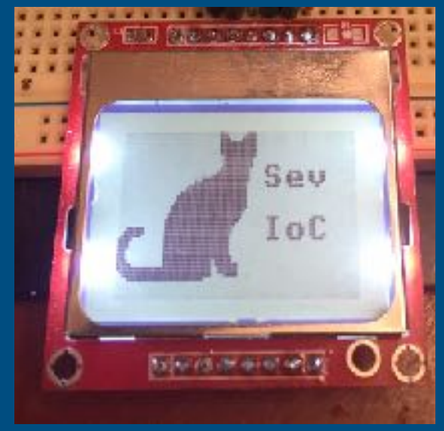
Access Point





Station

Station



Vineyard Sensors

- **ESP 8266 Microcontroller**
  - **WiFi enabled**
    - **3.3V**
- **Digital Humdity and Temperature Sensor DHT 11**
- **5 USD**