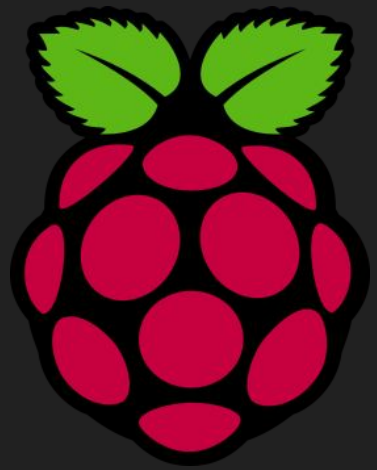
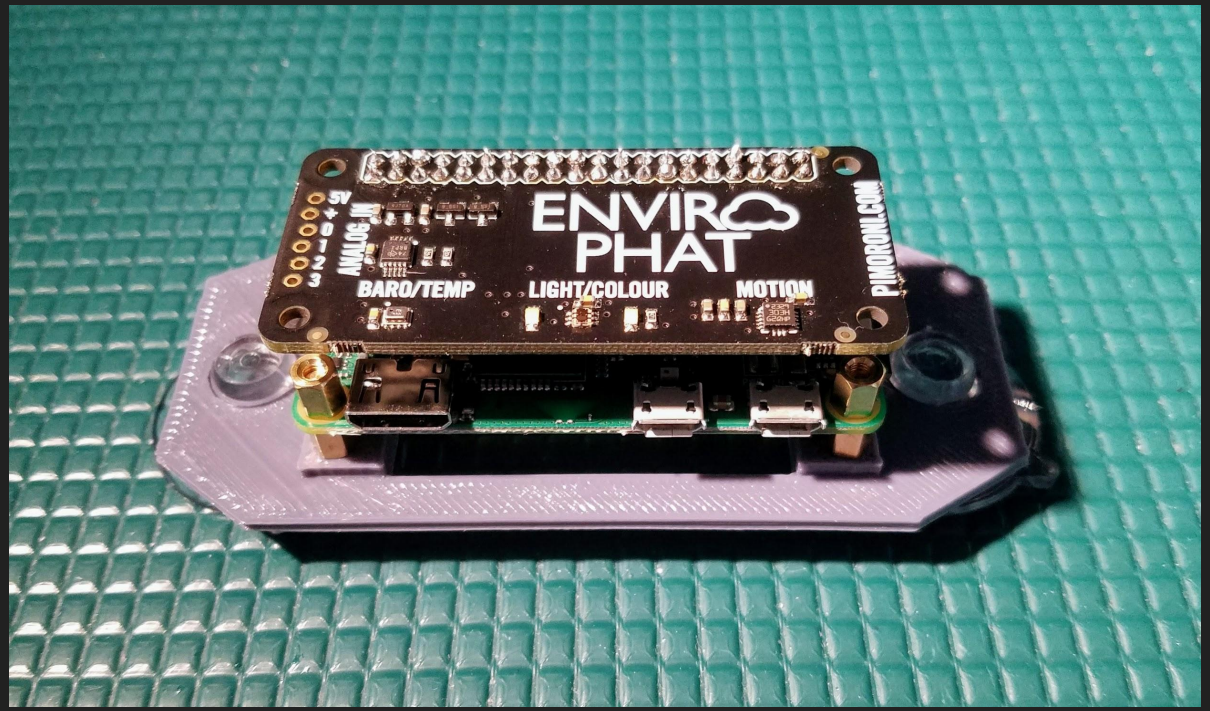
AC98

Dryer + IOT = "Dry"OT

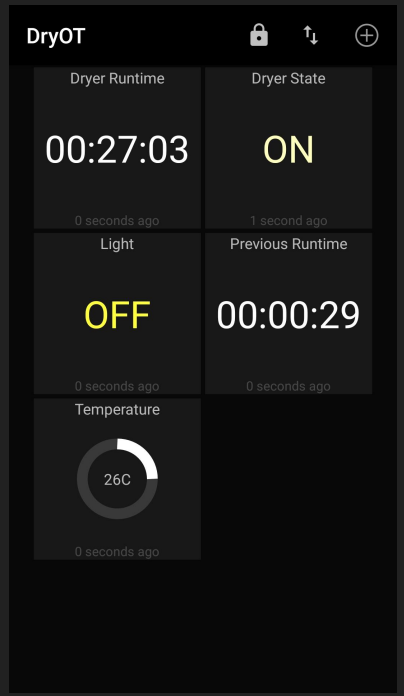
Part 3: Programming



Project DryOT: An IOT Laundry Room Monitor



Install the Raspberry Pi Zero W and Pimoroni EnviroPhat on our Clothes Dryer



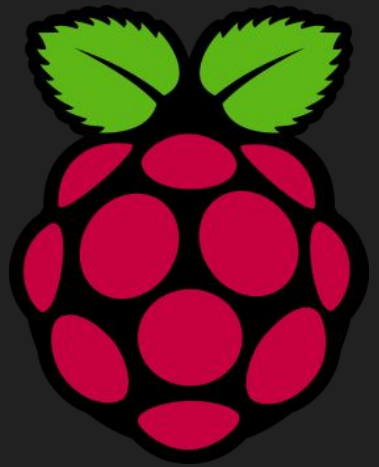
Project Goals

1. Monitor the motion sensor to tell if the dryer is running or not
2. Monitor the temperature in the Laundry Room
3. Tell if someone left the lights on in the Laundry room

Future Goal

1. Add a Raspberry Pi Camera and detect the estimated time remaining on the Dryer cycle

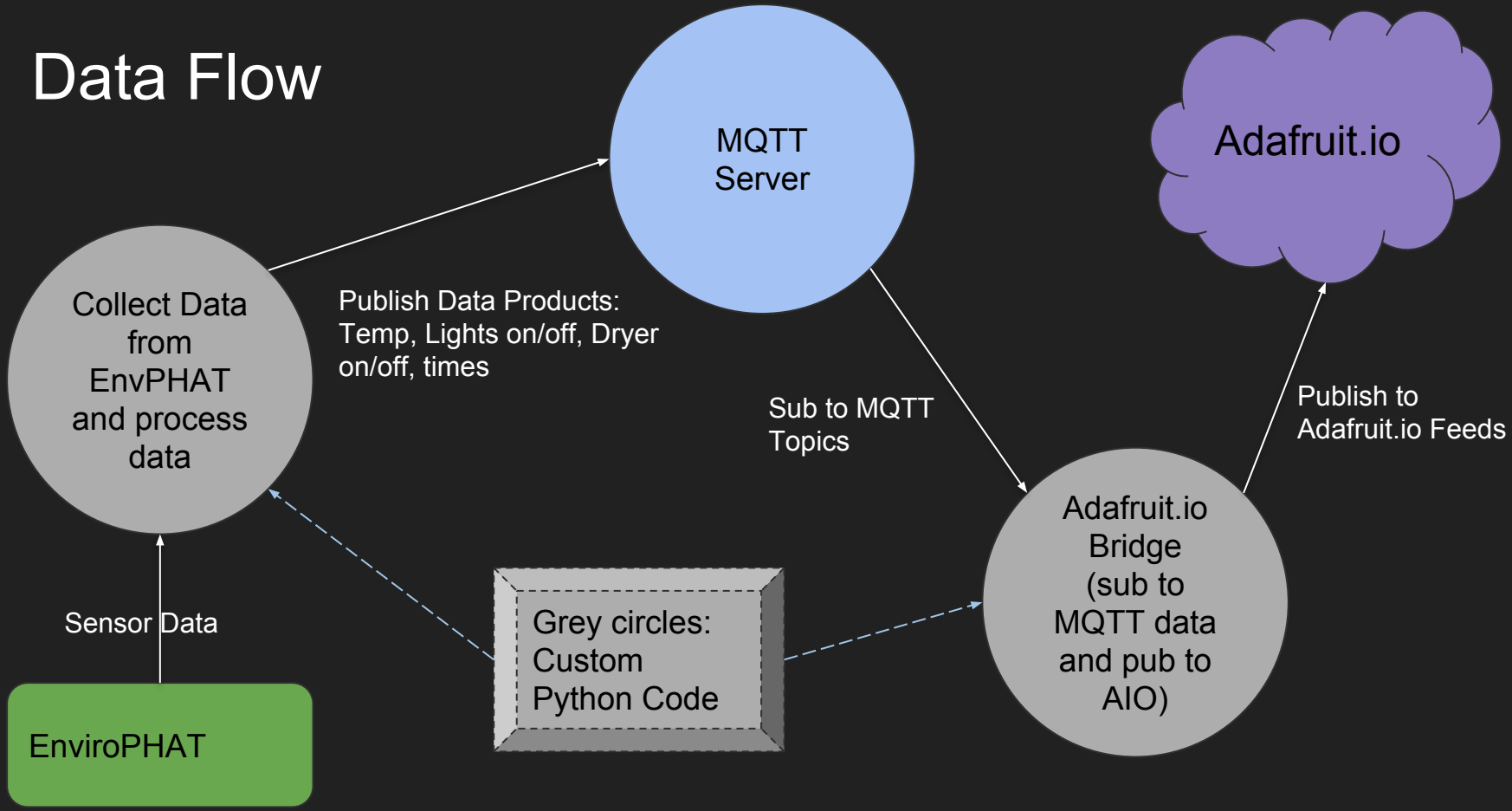
Part 3:
Software
Programming



Programming Overview

- Program Organization / Data Flow
- Program Design
  - Python Programs
    - dryot_sensor_loop.py
      - Parameters (dryot.ini)
      - MQTT Topics
    - dryot_pub_to_adafruit_io.py
      - Parameters (adafruitio.ini)
      - Adafruit.io MQTT Feeds
- Installing the Programs on the Pi

Data Flow


MQTT Server
Adafruit.io
Collect Data from EnvPHAT and process data
Publish Data Products: Temp, Lights on/off, Dryer on/off, times
Sub to MQTT Topics
Publish to Adafruit.io Feeds
Adafruit.io Bridge (sub to MQTT data and pub to AIO)
Grey circles: Custom Python Code
Sensor Data
EnviroPHAT

Program Design: **dryot_sensor_loop.py (1)**

- Purpose:
  - Collect data from EnviroPHAT Sensors
  - Process the data to determine
    - Is the Dryer on?
    - How long has it been on?
    - Is the light on?
  - Publish the data to MQTT server
- Notes
  - There might be a better way of counting dryer runtime
  - This program could have been modularized by breaking apart the sensor data collection with the data processing
    - Module 1: Collect raw sensor data and publish to MQTT
    - Module 2: process raw data and publish results back to MQTT

Program Design: **dryot_sensor_loop.py (2)**

- Data collected from EnviroPHAT sensors
  - Motion (Z axis)
  - Temperature
  - Lux (light level)
- Parameters (read from **dryot.ini** file)
  - on_threshold
    - Seconds of detected dryer motion before dryer is “on”
  - off_threshold
    - Seconds of dryer lack of motion before dryer is “off”
  - threshold
    - Sensitivity of accelerometer used to detect dryer motion
  - light_threshold
    - Light level where laundry room light is considered “on”
  - publish_rate
    - How often MQTT topics are published - every “publish_rate” seconds

Program Design: **dryot_sensor_loop.py (3)**

MQTT Topics published

MQTT Topic	Payload format/values
dryot/dryer_state	“ON” or “OFF”
dryot/light_state	“ON” or “OFF”
dryot/light_level	Integer lux level : 000
dryot/dryer_runtime	“HH:MM:SS” -> “00:12:33”
dryot/previous_dryer_runtime	“HH:MM:SS” -> “00:42:10”
dryot/temperature	00.000 in Celsius

Program Design **dryot_pub_to_adafruit_io.py (1)**

- Purpose
  - Subscribe to MQTT topics from the “dryot_sensor_loop.py” program
  - Re-publish the data to MQTT Feeds on Adafruit.io
    - Allow for a slower publish rate. Don’t want to overwhelm Adafruit.io with data, especially on a free account
- Notes:
  - You need to setup an Adafruit.io account to use this
  - You will also need to create the Adafruit.io feeds and a dashboard
  - Eventually it would be nice to have a generic file driven approach to subscribing to local MQTT data, then republishing it to Adafruit.io

Program Design: **dryot_pub_to_adafruit_io.py (2)**

Adafruit.io MQTT Feeds (note the “dryot” group and slightly different syntax required)

Adafruit.io MQTT Feed	Payload format/values
dryot.dryer-state	0 = OFF, 1 = ON
dryot.light-state	0 = OFF, 1 = ON
dryot.light-level	Integer lux level : 000
dryot.dryer-runtime	“HH:MM:SS” -> “00:12:33”
dryot.previous-dryer-runtime	“HH:MM:SS” -> “00:42:10”
dryot.temperature	00.000 in Celcius

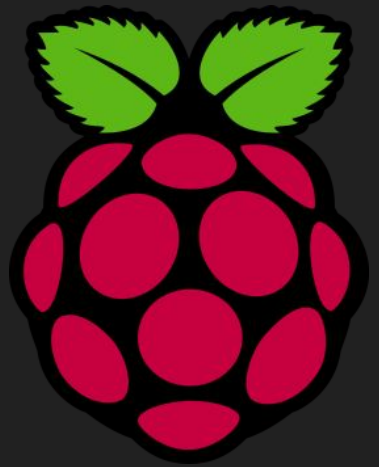
Program Design **dryot_pub_to_adafruit_io.py (3)**

- Parameters (read from adafruitio.ini)
  - adafruit_io_key
  - adafruit_io_username
    - Set these to your Adafruit.io account name and key
    - If you put this online (github.com, etc) make sure you don't leave these set to your account details! This should be your secret!
  - mqtt_broker_address
    - Set this to the address of the MQTT broker
    - It's usually OK to leave this 127.0.0.1
  - publish_max
    - Every 1 of "publish_max" messages are published to Adafruit.io
    - For example: If you have publish_max set to 10, then every 10th message will be sent on to Adafruit.io.
    - There are different counters for each topic
    - Don't want to publish data too fast to Adafruit.io

Installing the Programs on the DryOT Pi

- Login/ssh to the Pi
  - A note about the network address
    - Mac, or systems with zeroconf
    - Static IP address
- Clone the git repository
  - git clone https://github.com/alanc98/dryot.git
- Customize the programs
  - dryot_sensor_loop.py
  - dryot_pub_to_adafruit_io.py
- Start the programs automatically
  - Edit /etc/rc.local
- Reboot

Project Testing



Project Testing

- Subscribe to MQTT topics with command line clients
- Setup Android (MQTT Dash) Client
- Setup Adafruit IO feeds and dashboard
- Run the Dryer
- Turn the light on and off
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- To do / Future work
  - Calibrate the temperature sensor
    - I think it reads high, possibly due to the proximity to the Raspberry Pi processor