INTEGRATING EXPERIMENTAL SENSORS INTO WAGGLE EDGE-COMPUTING PLATFORM

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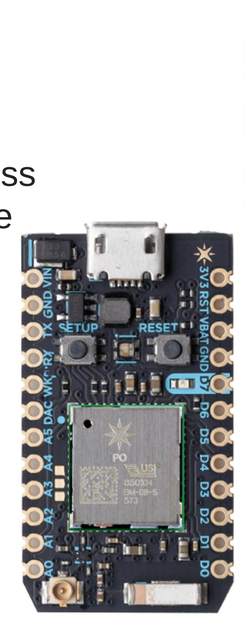
ABSTRACT

- Waggle Infrastructure:
  - Utilizes a network of sensors to provide environmental information
  - Currently relays light, meteorological, chemical, and particulate data
- Project goals:
  - Integrate commercial off-the-shelf (COTS) water level, soil moisture, and airborne particulate matter sensors
  - Deploy and test the sensors
  - Determine applicability to the Waggle Platform

PLATFORMS

- Goal: interface sensors using Particle's Photon and Electron Internet of Things (IoT) modules, and Waggle sensor infrastructure
- Method of transmission: Photon → wireless network, Electron → cellular data, Waggle → wired, wireless, or cellular data
- Embedded communication protocols
  - I²C
  - UART
  - GPIO
  - A/D
- Photon and Electron firmware is programmed on the Particle IDE
- Data is either sent to a computer's serial port or sent to Particle's cloud



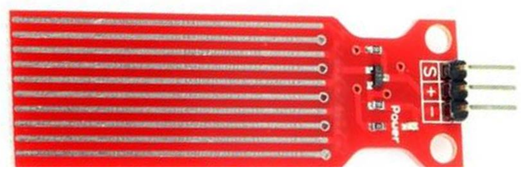
Photon

Electron

EVALUATED SENSORS

Water Level Sensors

- RobotDyn Sens-WaterLev and MH Water Sensor
- Type: analog
- Output of ADC starts at 0 and increases to 500 as water level rises
  - Completely dry: < 10
  - Submerged halfway: ~450
  - Completely submerged: ~500
- Water salinity can also affect the readings and may have to be considered
- Sensors are useful for flood detection in basements and understanding changes in water tables after it rains



Water Sensor

Sens-WaterLev

Particle Sensors

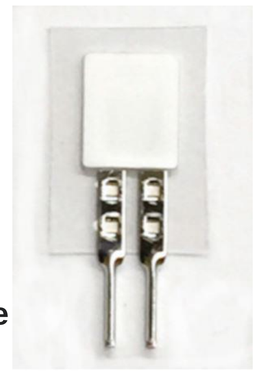
- Plantower PMS 7003 and PMS 3003
- Type: UART
- Operating Voltage: 4.95 – 5.05 V
- 7003 outputs 32 bytes, 3003 outputs 24 bytes
- Range of results: 0 – 500 μg/m³
- Detects fine particulate matter (width of particles < 2.5 microns)
- Can help prevent respiratory and heart conditions that stem from increased exposure to 2.5 particulate matter

PMS 7003

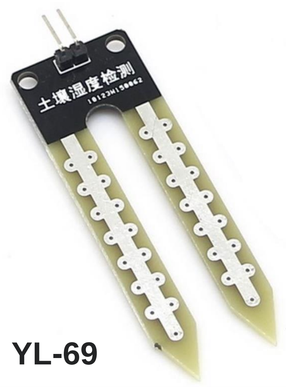
PMS 3003

Soil Moisture Sensors

- BSI InFlect Moisture Sensor
  - Type: analog
  - Outputs both measured relative humidity and resistance
  - Resistance increases as humidity increases
- YL-69 Soil Moisture Sensor
  - Type: analog/digital
  - Outputs an analog value that decreases as moisture increases
  - Outputs high digital signal if moisture crosses a predetermined threshold

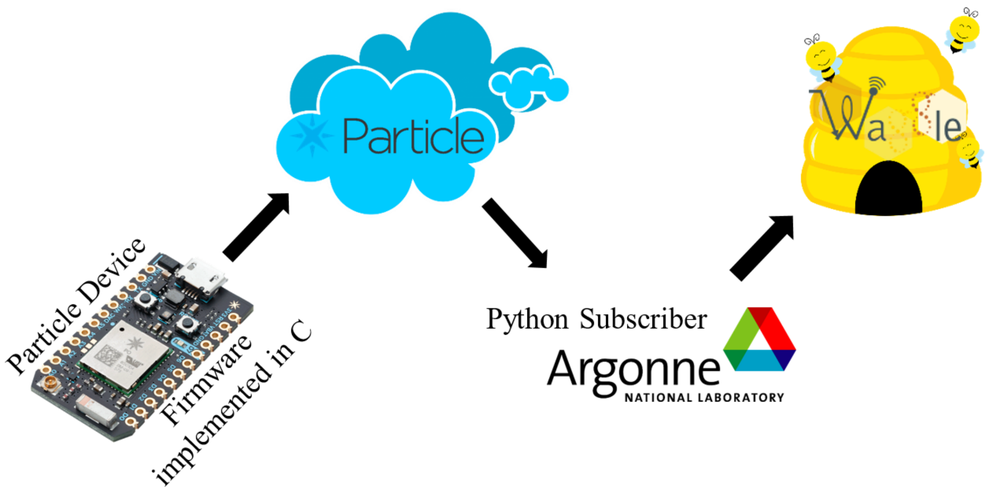


InFlect Moisture Sensor



YL-69

IMPLEMENTATION



WORK TO BE PERFORMED

- Integrate and test the YHDC SCT013-030 current sensor
  - To be placed around sump pump power cords as an alternative flood detector
- Integrate and test a tipping bucket rain gauge
- Integrate the soil moisture, particle, water level, current, and rain sensors into the Waggle edge-computing platform.

SCT013-030 Current Sensor

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