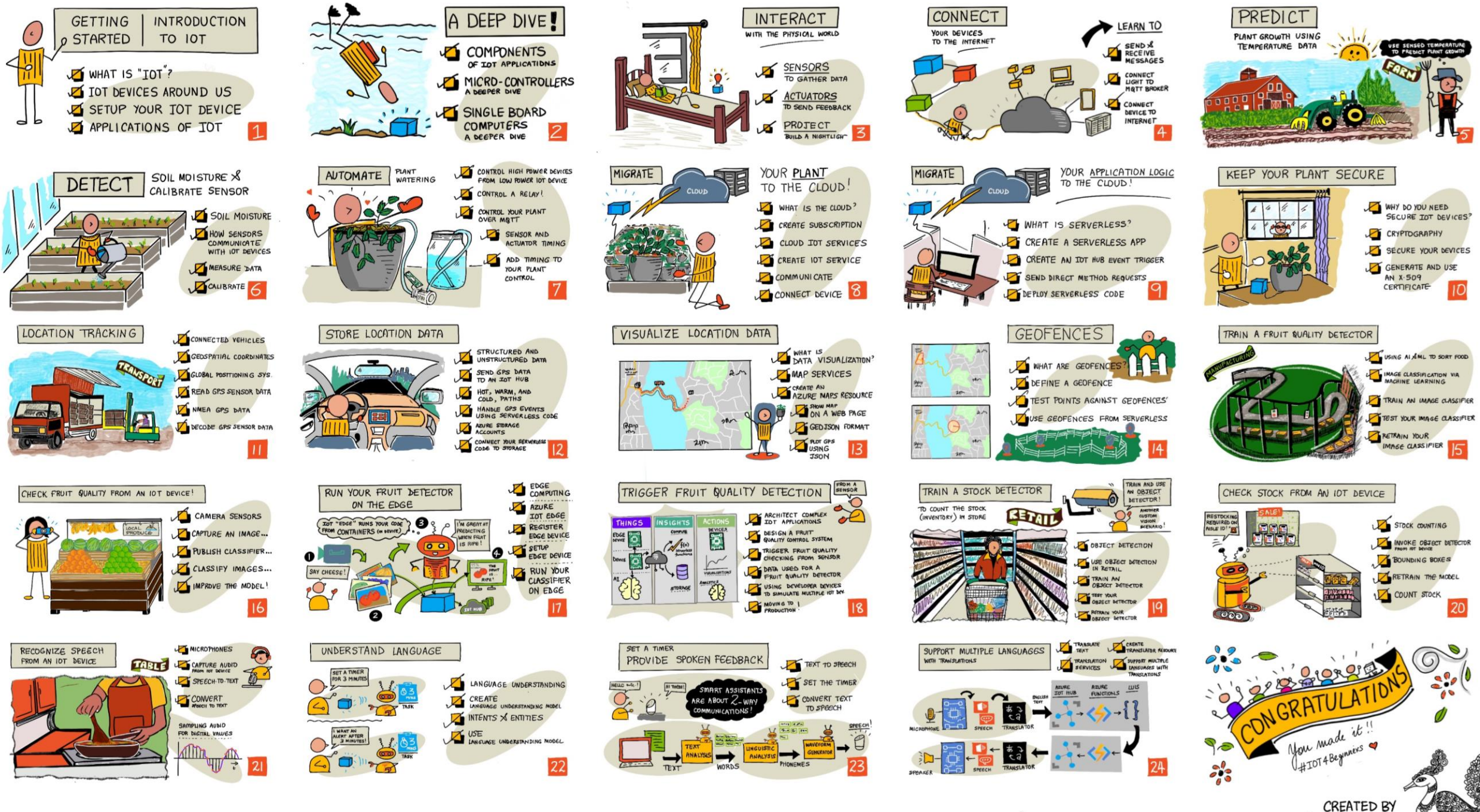
IoT for Beginners

AKA.MS/IOT-BEGINNERS


GETTING STARTED | INTRODUCTION TO IOT
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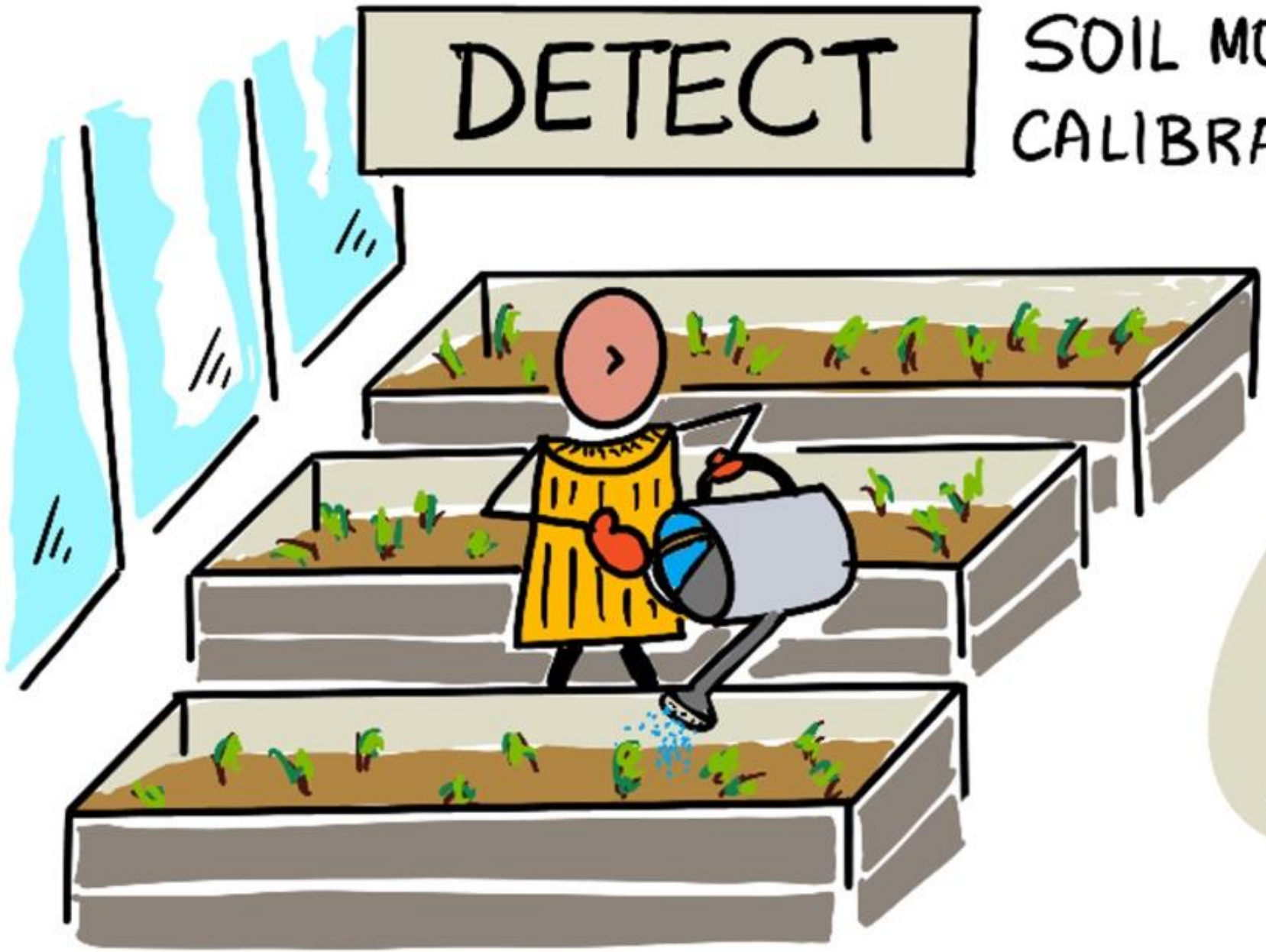
CONGRATULATIONS
You made it!!
#IOT4Beginners
CREATED BY @SKETCHTHEDOCS

AKA.MS/IOT-BEGINNERS-KITS

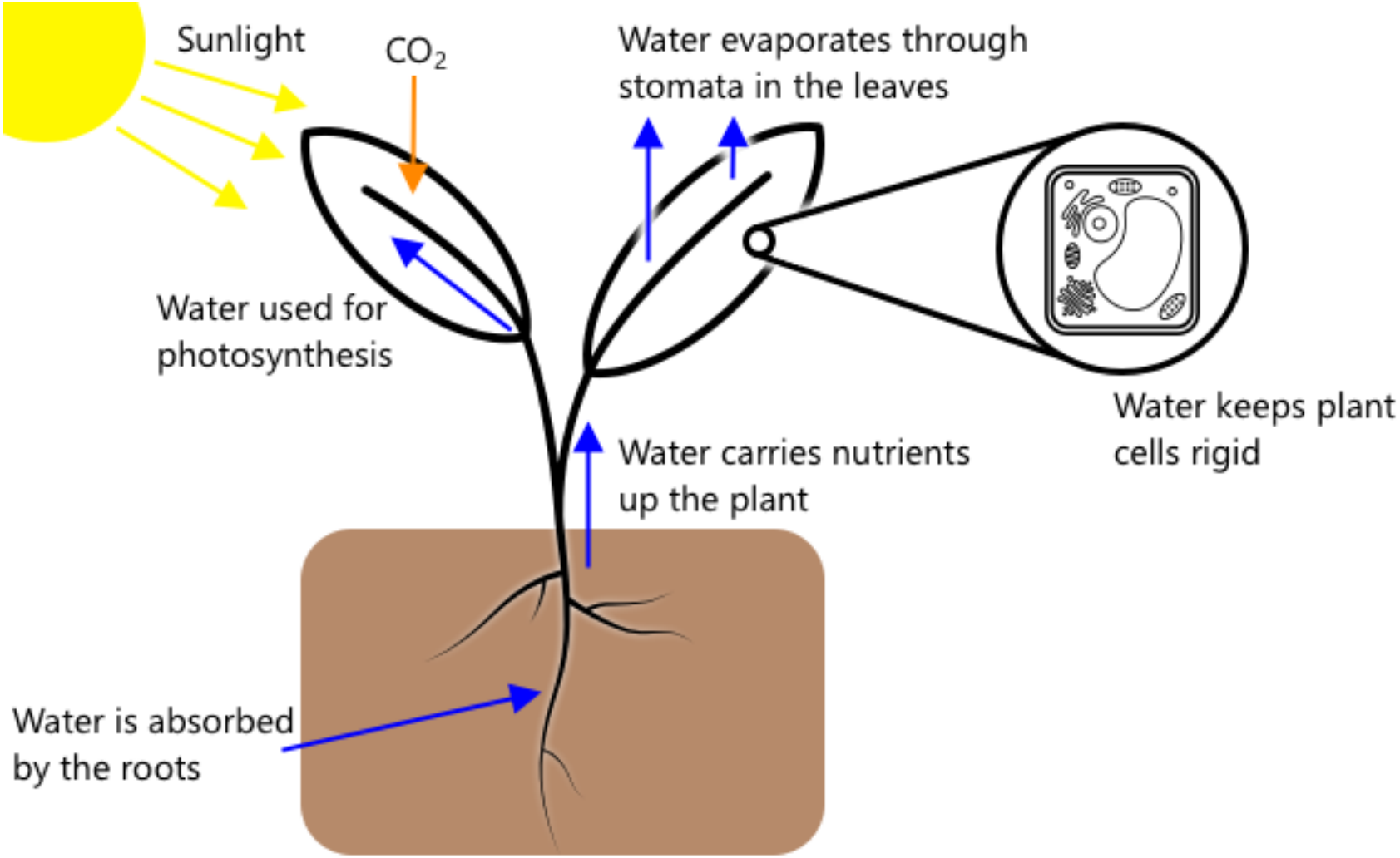
DETECT

SOIL MOISTURE & CALIBRATE SENSOR



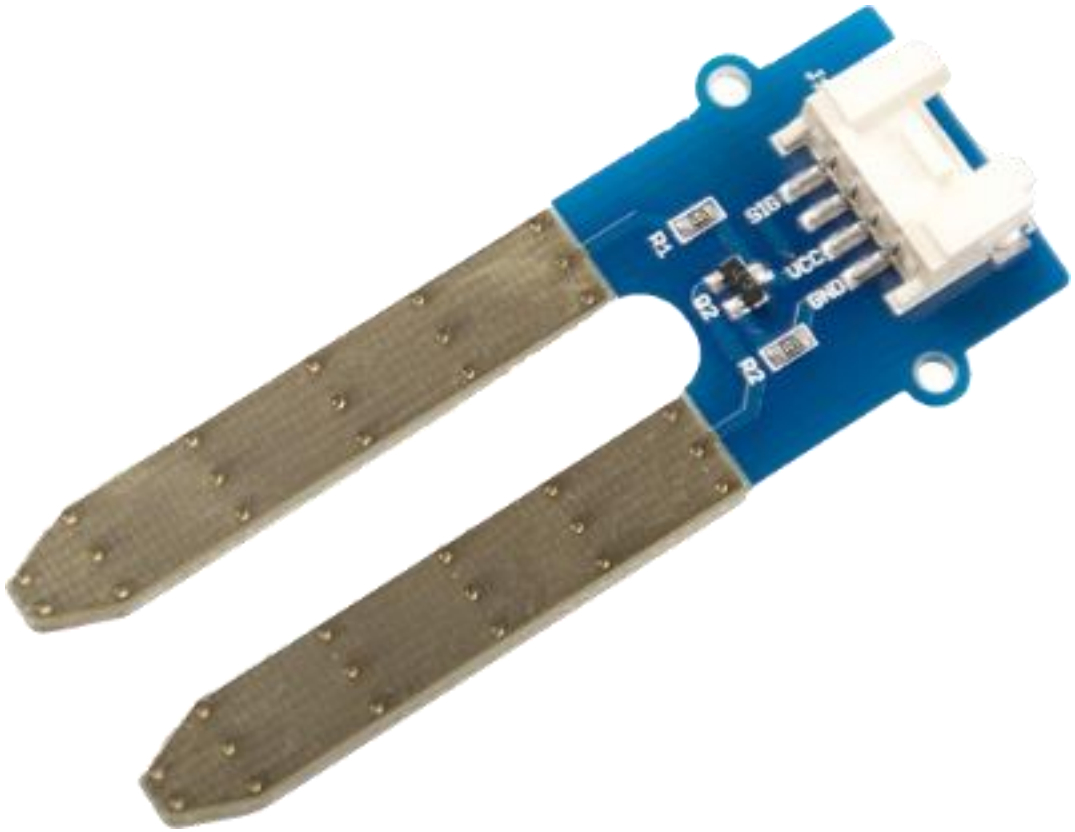
- SOIL MOISTURE
- HOW SENSORS COMMUNICATE WITH IOT DEVICES
- MEASURE DATA
- CALIBRATE

SOIL MOISTURE



HOW TO MEASURE SOIL MOISTURE

- Resistive sensor



HOW TO MEASURE SOIL MOISTURE

HOW TO MEASURE SOIL MOISTURE

- Capacitive sensor

DEMO: MEASURE SOIL MOISTURE

Connect the sensor

Program the device

HOW DO SENSORS COMMUNICATE WITH IOT DEVICES?

GPIO

I^2C

UART

SPI

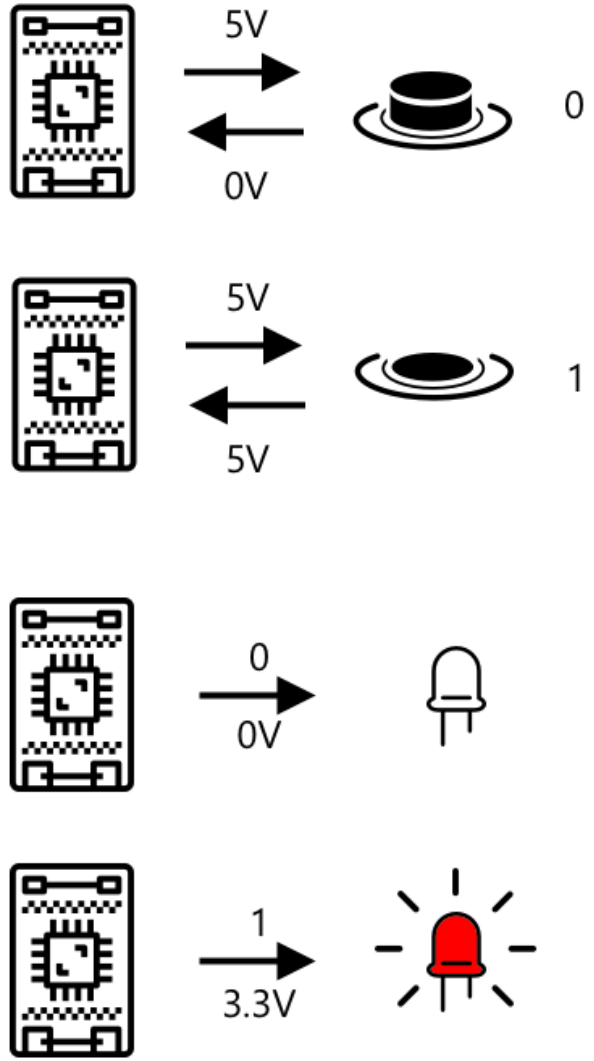
Wireless

GPIO

- GPIO – General Purpose Input Output
- Other communication protocols can use them to connect
- Standard hardware pins, with connectivity to ADC/DAC
  - 3.3V/5V
  - Ground
  - Programmable analog/digital
- One device per set of pins unless using another protocol

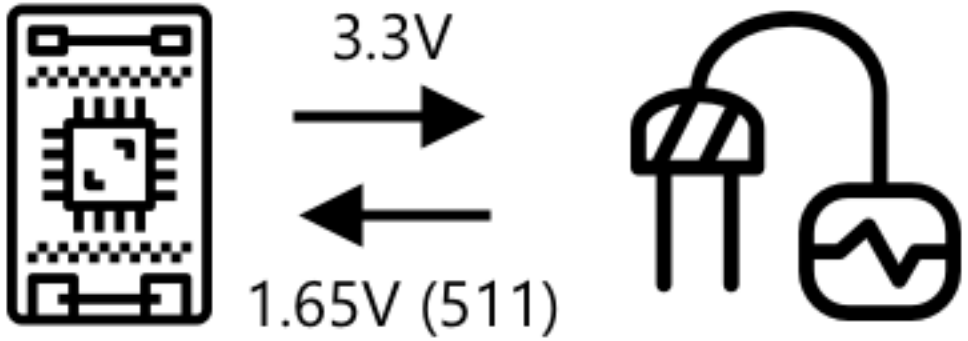
GPIO - DIGITAL

- Digital pins can be set to 1 (on), or 0 (off)
- Input pins – voltage is set on the digital pin, and read from the ground
- Output pins – voltage is set on the digital pin based off the required output



GPIO - ANALOG

- Analog pins can send or receive a voltage from 0 to 3.3V/5V
- Input pins use an ADC to convert to a 10-bit number
- Output pins use an DAC to convert from a 10-bit number

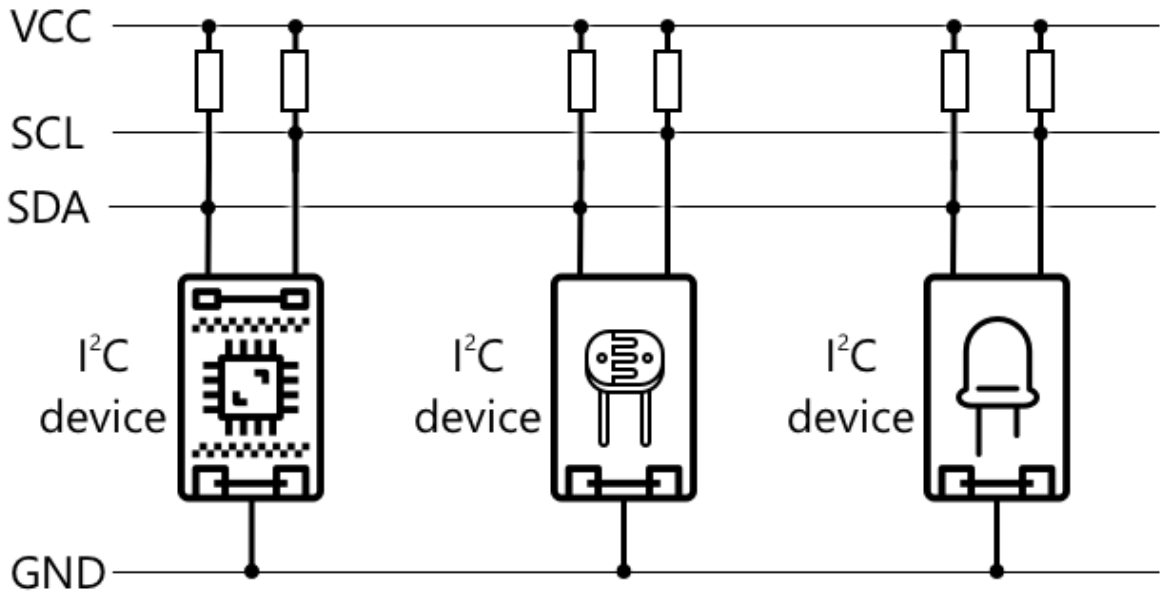


I^2C – INTER INTEGRATED CIRCUIT

- Multi-controller, multi-peripheral protocol
- Any device on the bus can be a peripheral or controller
- Data is sent as addressed packets

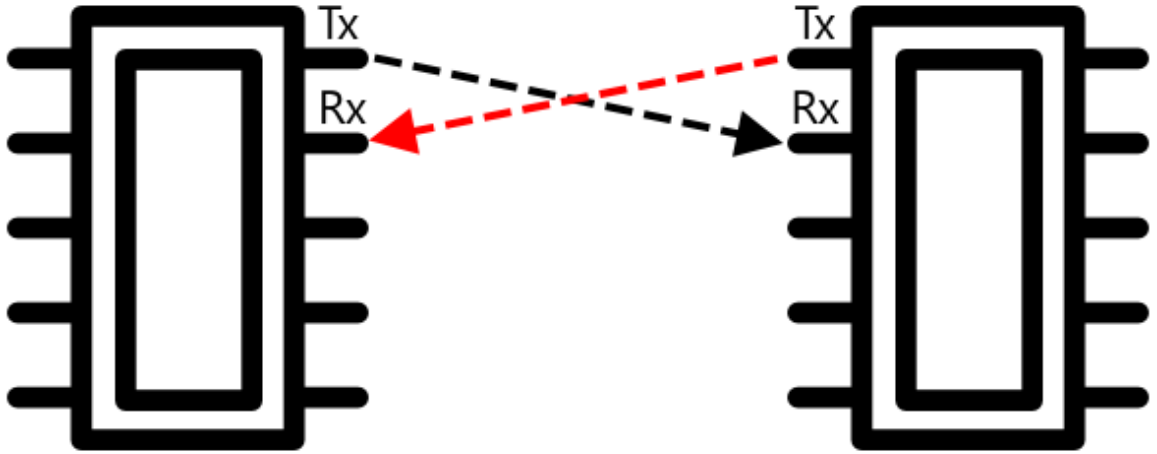
I²C – INTER INTEGRATED CIRCUIT

- I²C uses 4 wires:
  - 2 power wires
  - 2 message wires (data and clock)



UART – UNIVERSAL ASYNCHRONOUS RECEIVER-TRANSMITTER

- Direct connection between 2 devices
- 2 wires – transmit (tx) and receive (rx).
  - Transmit on device 1 connects to receive on device 2
  - Transmit on device 2 connects to receive on device 1

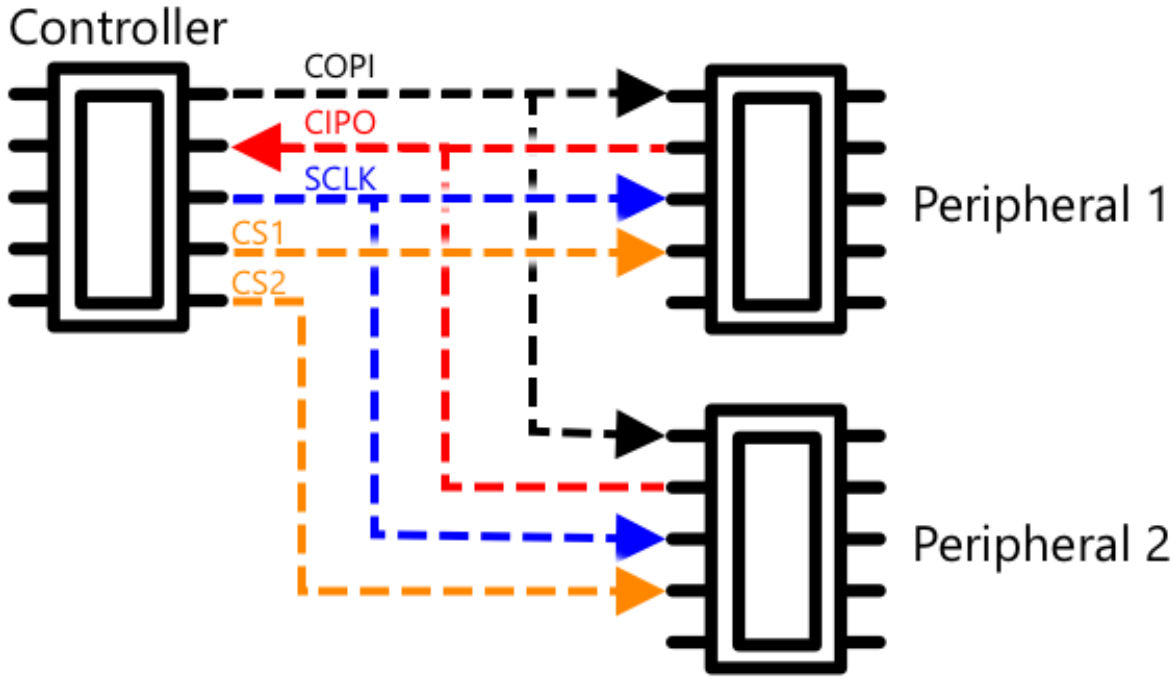


SPI –SERIAL PERIPHERAL INTERFACE

- Single controller, multiple peripheral
- Full duplex – can send and receive data at the same time
- No defined speed limits – fast for things like flash storage access

SPI –SERIAL PERIPHERAL INTERFACE

- Controller has 3 wires plus one per peripheral
- Peripheral has 4 wires



WIRELESS

- IoT devices can also communicate over wireless
- BLE, WiFI, LoRa, Zigbee…

WHAT DO SENSOR VALUES MEAN?

Sensor calibration

SENSOR CALIBRATION

- Sensors work by detecting electrical signals such as resistance, voltage or capacitance
- Imagine if a temperature sensor sent you 22.5KΩ instead of degrees Celsius 
- Sensors need to be calibrated to convert from electrical units to the correct unit

SENSOR CALIBRATION – SOIL MOISTURE

- How do we convert values of 0-1,023 to soil moisture?
  - We may not care – if we know the value for ideal soil moisture, then just use that
  - If we care – there are standard measurements
- There is no fixed calibration – value varies by soil type
- Official soil moisture measurements:
  - Gravimetric – weight of water per weight of soil
  - Volumetric – volume of water per volume of soil

SENSOR CALIBRATION – SOIL MOISTURE

- Soil for a known reading is sent to a lab, moisture is measured
  - Weigh/check volume
  - Dry in an oven
  - Weight/check volume again