Workshop 6

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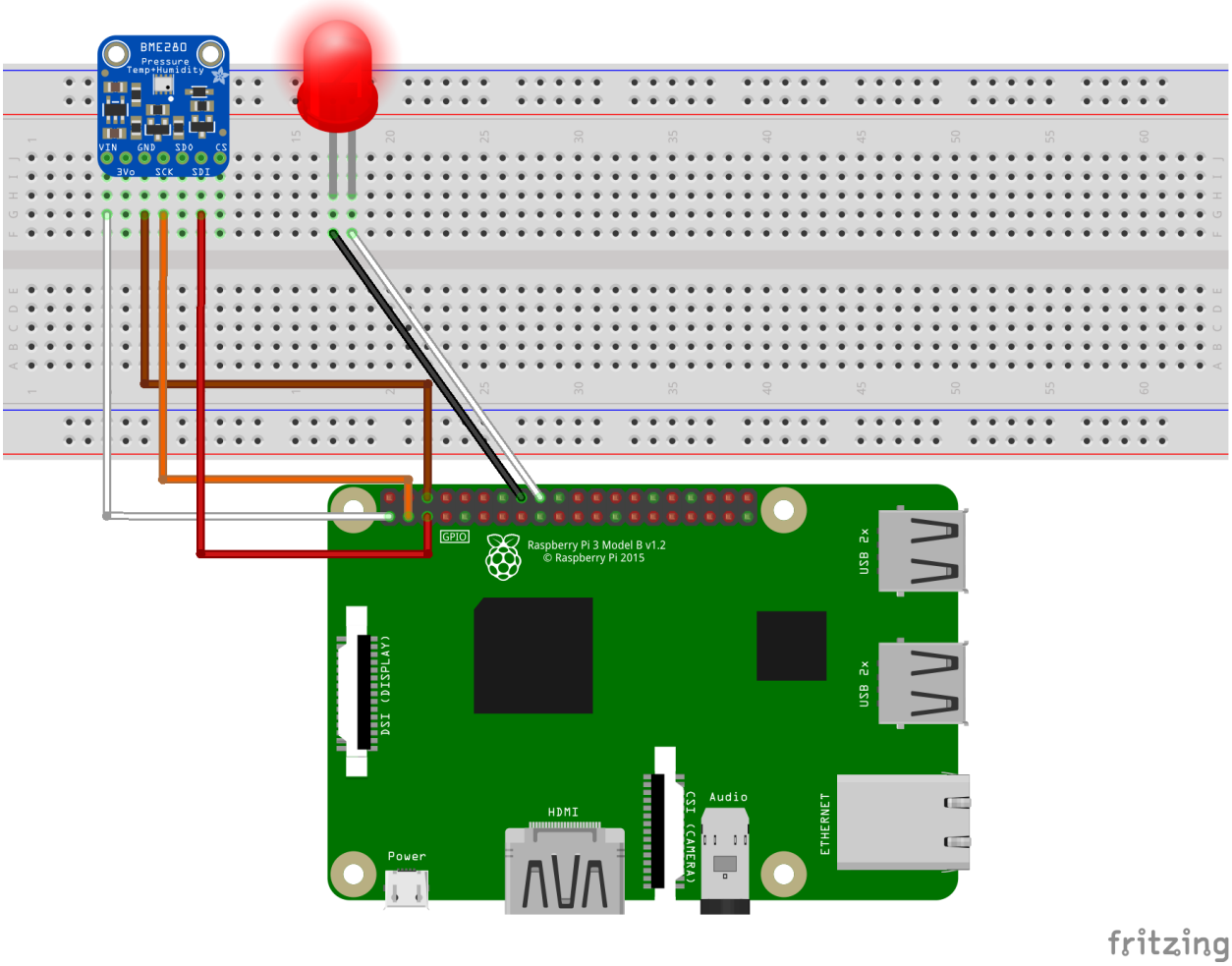
1. Identify the basic IoT model

When going to the provided URL to make some tests to the Rasperry pi simulator you will see the an image similar as shown below, that mainly contains:

a. A protoboard (the rectangular white board)
b. A BME280 sensor (the blue board)
c. A Raspberry Pi 3 (the green board at the bottom part)
d. LED diode (the red bulb)
e. Wires



The BME280 Sensor

The BME280 sensor was Bosch as an environmental sensor that can capture temperature, humidity and barometric pressure, is recommended for an indoor use, but can be used for controlled outdoor use.

This sensor is a good option when prototyping your projects because of its price and its accuracy, that is +- 1°C for temperature, +-1 hPa for barometric pressure and around of +-3% of humidity precision. Even the pressure should change depending on the altitude, the sensor accuracy makes it a good candidate for measuring altitudes as an altimeter if you have the right knowledge about it.

According with Adafruit the BME280 sensor is the Bosch's upgrade of BMP085 and BMP180 sensors. This BMP280 sensor gives you a better performance, accuracy and durability than its predecessors and you can connect it to many platforms to 3.3V or 5V using its own voltage regulator. The sensor can be used in both:

I2C: The Inter-Integrated Circuit protocol is a simple two wire serial protocol that is used to communicate two chips or devices in an embedded system and has two lines:

SCL, used for clock

SDA, used for data

SPI: Serial Peripheral Interface is a four wire serial communication protocol that is based on master-slave architecture. The four lines of SPI are SS, SCL, MISO and MOSI:

SS: Slave Select

SCL: Serial Clock used for data communication.

MISO: Master In Slave Out is the master's input data line.

MOSI is the Master Out Slave In is the output data line from the master.

In the table below, developed by Bosch you can see more technical details about the sensor.

Parameter	Technical data
Operation range	Pressure: 300...1100 hPa Temperature: -40...85°C
Supply voltage VDDIO Supply voltage VDD	1.2 ... 3.6 V 1.71 ... 3.6 V
Interface	I^2C and SPI
Average current consumption (typ.) (1Hz data refresh rate)	1.8 µA @ 1 Hz (H, T) 2.8 µA @ 1 Hz (P, T) 3.6 µA @ 1 Hz (H, P, T) T = temperature
Average current consumption in sleep mode	0.1 µA
Humidity sensor Response time (τ63%) Accuracy tolerance Hysteresis	 1 s ±3% relative humidity ≤2% relative humidity
Pressure sensor RMS Noise Sensitivity Error Temperature coefficient offset	 0.2Pa (equiv. to 1.7cm) ±0.25% (equiv. to 1m at 400m height change) ±1.5Pa/K (equiv. to ±12.6cm at 1 °C temperature change)
RoHS compliant, halogen-free, MSL1	
Package dimensions	8-Pin LGA with metal 2.5 x 2.5 x 0.93 mm^3

The Embedded System

The Raspberry Pi 3 is a board created and supported by the Raspberry foundation and is part of all the Raspberry Pi family that removes the high entry cost to computing for people across all demographics: while children can benefit from a computing education that previously wasn't open to them, many adults have also historically been priced out of using computers for enterprise, entertainment and creativity. Raspberry Pi eliminates those barriers. Paraphrased from Raspberry.

The Software: The most common operative system for Raspberry is the Raspberry Pi OS which is a linux-based distribution that takes advantage of the kernel execution efficiency. You can also use almost any Linux-based Operative System in Raspberry, but you may experiment different performances, you have to take into account the reasons you purchased the Raspberry, because for IoT you can use a light Linux distribution (even Microsoft Windows IoT Core) or use a robust OS if you want to use as a low cost personal computer.

The Hardware: This is probably one of the best features that Raspberry could have, because of the versatility and the low cost of the components. As mentioned above, you will need an Operative System for using the board, an you can store it in a SD card with must match some transfer rates requirements but nowadays almost all SD cards can be used to store a Raspberry OS.

In the first image above, the Raspberry board is a 2015 Raspberry Pi model 3 B that is Single-board computer with wireless LAN and Bluetooth connectivity.

This Raspberry board hardware includes:

Quad Core 1.2GHz Broadcom BCM2837 64bit CPU: probably one of the most significant changes from version 2 to version 3, because even they share the same processor architecture (ARM), the ARM v8 gives more than 45% of velocity improvement compared to the ARM v7 that the Raspberry 2 uses. Find out more info about the processor by clicking here.

1GB RAM

BCM43438 wireless LAN and Bluetooth Low Energy (BLE) on board: The Cypress CYW43438 is a highly integrated single-chip solution and offers the lowest RBOM in the industry for smartphones,tablets, and a wide range of other portable devices. The chip includes a 2.4 GHz WLAN IEEE 802.11 b/g/n MAC/baseband/radio,Bluetooth 4.1 support, and an FM receiver. In addition, it integrates a power amplifier (PA) that meets the output power requirementsof most handheld systems, a low-noise amplifier (LNA) for best-in-class receiver sensitivity, and an internal transmit/receive (iTR) RFswitch, further reducing the overall solution cost and printed circuit board area. Taken from Cypress

100 Base Ethernet: Also known as "Fast Ethernet" is one of the current ethernet standard of 100 Mbits/second for twisted pair cable.

40-pin extended GPIO: are the pins in the top part of the board in the image, those are the pins where you can connect input and output wires.

4 USB 2 ports

4 Pole stereo output and composite video port: also known as a audio jack that can also transmit low quality video signals.

Full size HDMI: the High Definition Media Interface port for connecting the Raspberry to a monitor, screen or audio system.

CSI camera port for connecting a Raspberry Pi camera

DSI display port for connecting a Raspberry Pi touchscreen display: this a popular feature among educational institutions that use Raspberry for teaching. The touch interface allows children (and other users) to interact with the interface.

Micro SD port for loading your operating system and storing data

Upgraded switched Micro USB power source up to 2.5A: the micro USB connector that many cell phones and smart devices use, you can connect it to a wall outlet or even to a PowerBank.