Ambient Condition Monitoring Information System

System Design Document

By Christopher Sia

Design Options & Decisions

There are 3 areas that require considerations, namely the (1) choice of Microcontroller, (2) the implementation of the web services and (3) the choice of user interactions.

Microcontroller Options

	Arduino	Raspberry Pi	Jetson Nano
Pros	• Relatively low cost @ US$28 • Consumes little power which translate to longer operation on portable power source. • Small form factor with huge deployment flexibility • Very active community support	• Relatively low cost @ US$55 • Superior compute capability and suitable for projects that require running different processes concurrently • Small form factor with huge deployment flexibility • Has an OS with GUI option which make interaction much less challenging • Very active community support	• Superior compute capability and suitable for projects that require running different processes concurrently • Has the superior GPU processing capability which enables it to run AI workload • Small form factor with huge deployment flexibility • Has an OS with GUI option which make interaction much less challenging • Active CUDA community support
Cons	• Has low compute resources and not suitable for projects that require running different processes concurrently • No GUI option which make interaction with it more challenging • More difficult to implement application that connect to the internet as the Arduino has no	• Slightly more expensive compared to Arduino • Consumes more power than Arduino (but less than a Jetson Nano) • Less adaptable compared to Arduino when interfacing with external sensors. (It only has eight GPIOs while Arduino has 16).	• Most expensive option with the cost @ US$99 • Consume most power compared to Arduino and Raspberry Pi •

	Arduino	Raspberry Pi	Jetson Nano
	Ethernet port (unless a WIFI shield is obtained) - Little inbuilt external port options such as USB port, HDMI port, Ethernet port, Audio port		

The Raspberry Pi is chosen as the best platform of choice given it cost, compute capability and deployment versatility.

Implementation of web services

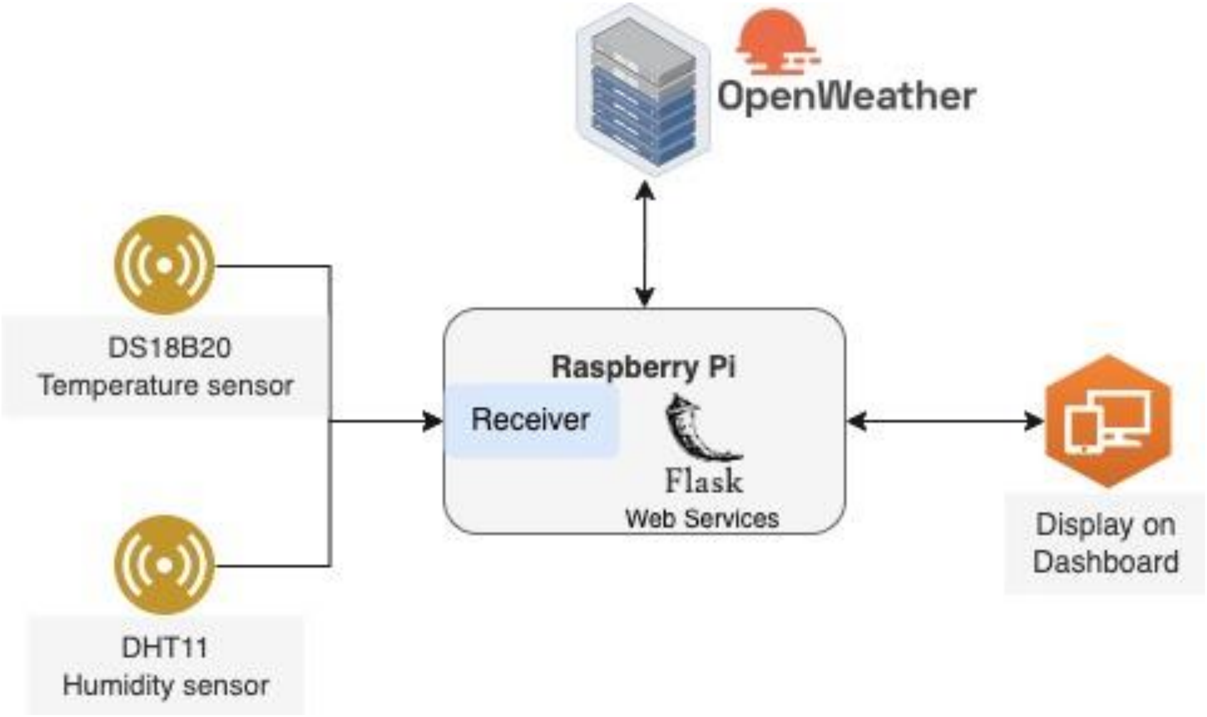
The implementation of a web service is also crucial in this whole set up. The main purpose of the web service is to provide the central business logic, data processing and visualization for this system. There are three options to implement the web services, namely (1) on the microcontroller, on cloud and on a local server:

	On Microcontroller	On Cloud	On Local Server
Pros	- Easiest to management with sensor connections and programming all done at one location	- Can leverage on the native services on Cloud to offer more capabilities - Provide a much more powerful compute capability than a Microcontroller	- Provide a more powerful compute capability than a Microcontroller
Cons	- Processing limited by the onboard hardware capability	- Need to incur more cost - Need to handle more configuration and network connections	- Need to provision another hardware and space to store the hardware - Need to handle more configuration and network connections

Given the options, the decision is taken to implement on the Microcontroller based on cost considerations and minimization of deployment overheads – less interfaces to configure and all necessary services to manage on a single platform.

System Block Diagram

The following is the high-level system block diagram of the Ambient Condition Monitoring System.


OpenWeather
DS18B20
Temperature sensor
DHT11
Humidity sensor
Raspberry Pi
Receiver
Flask
Web Services
Display on
Dashboard