Getting Started with IoT using Arduino

By

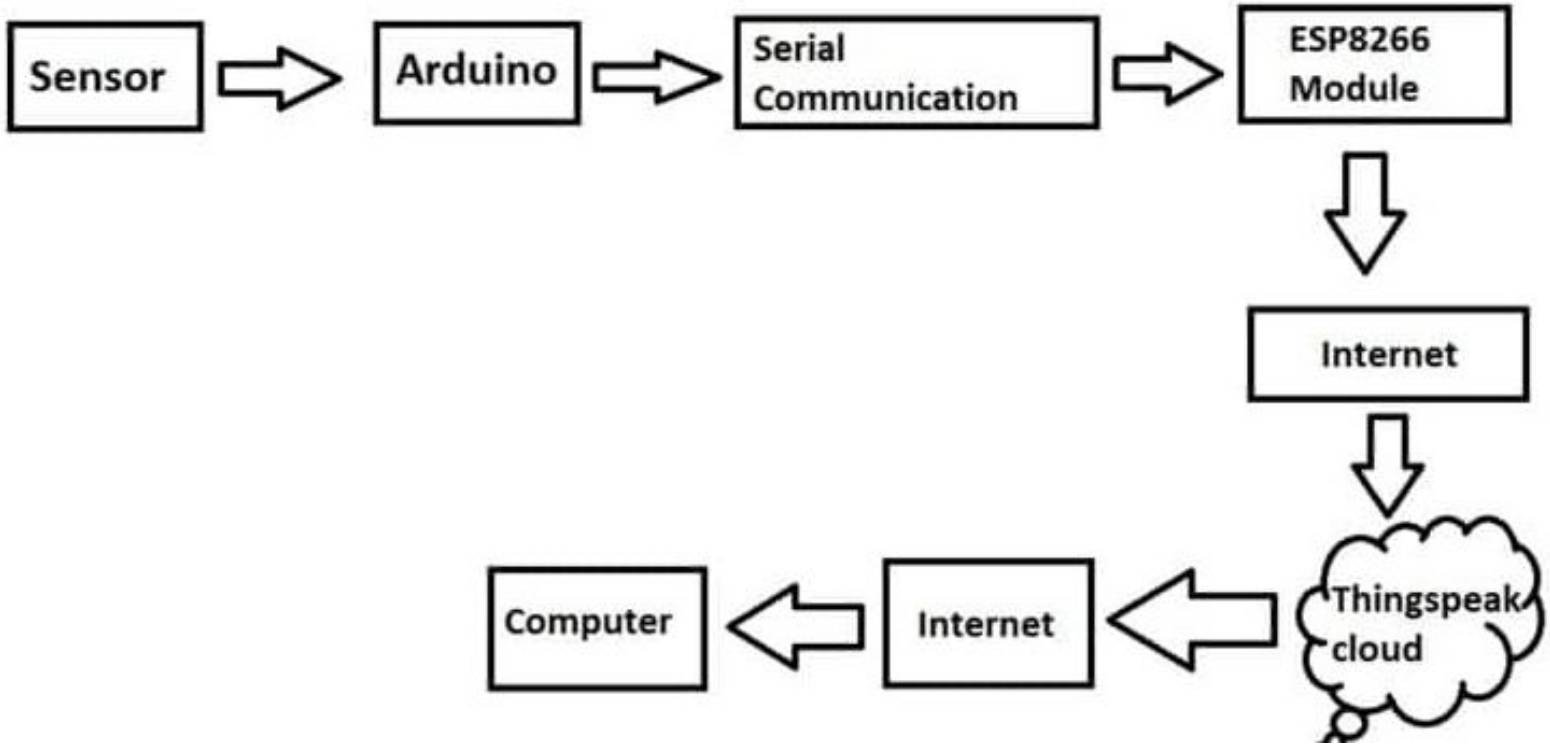
Joel Ssematimba & Priscilla Adong
Department of Computer Science,Makerere University,
Kampala, Uganda.

Lab session: IoT for air quality monitoring

Goal:

to build an air quality monitor using low-cost sensors. The monitor consists of sensors which detect **temperature** and **humidity** and the level of **PM2.5** in the air and sends this information to a cloud platform (Thingspeak) via a Wi-Fi module (ESP8266).

System Architecture

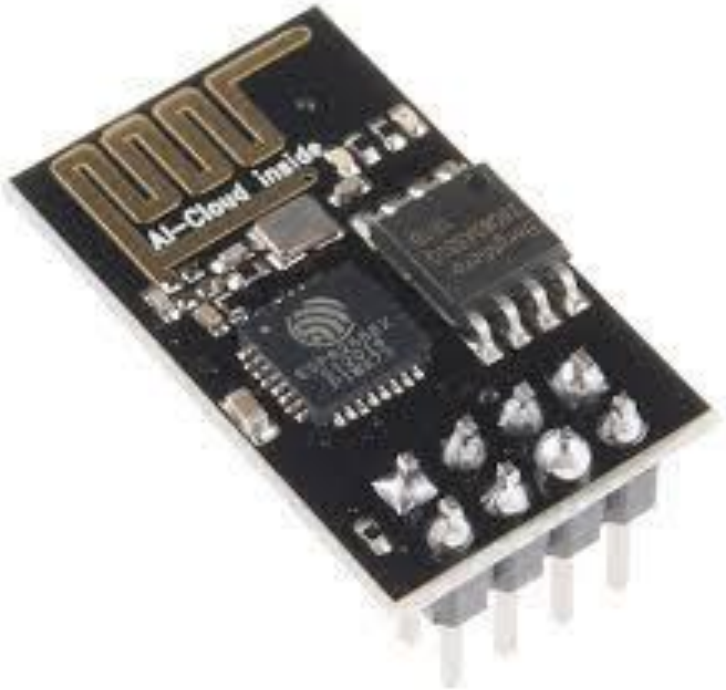


Hardware Components

Arduino UNO

Hardware Components

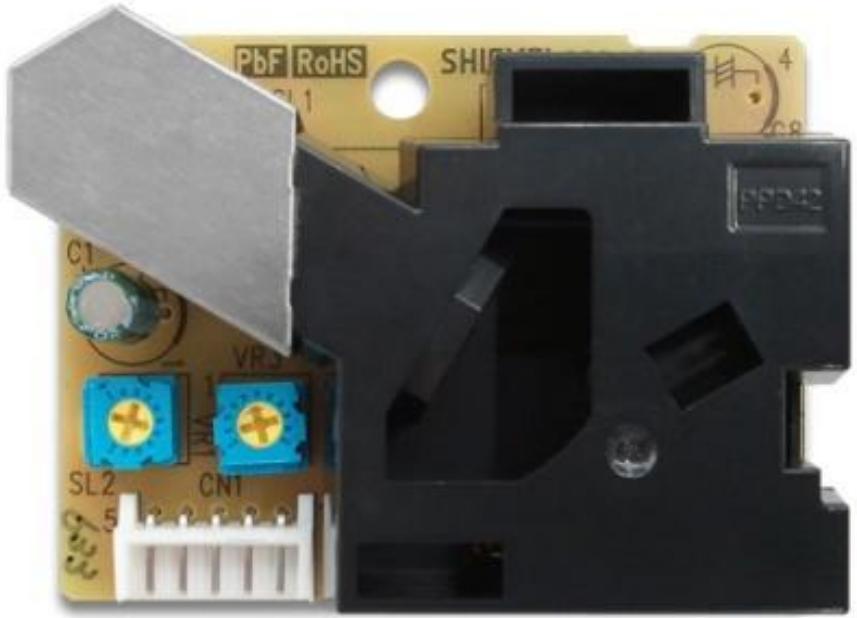
Wi-Fi module (ESP8866)



Hardware Components

Shenyei PPD42NJ

PM sensor



Hardware Components

Dht11

Temperature and Humidity Sensor

Hardware Components

Jumper wires

IoT Cloud Platform

An IoT cloud platform receives data from sensors where it is stored for analysis.

We use ThingSpeak as our IoT cloud platform. Other platforms include Google IoT core, AWS IoT core, Azure IoT Hub, etc.

Connecting the components

Esp8266 | Arduino

— — — — — — — — -

RX | 9

TX | 8

GND | GND (same)

VCC | 5v (same)

CH_PD | 5v (same)

GPIO 0 | None (same)

GPIO 2 | None (same)

DHT 11 | Arduino

Data | A0

GND | GND (same)

VCC | 5V

PM Sensor | Arduino

Programming Session

What you will need:-

1. A ThingSpeak Account: Our cloud platform
2. Arduino IDE:Used to write and upload programs to Arduino compatible boards.
3. DHT 11 library: To read from DHT 11 sensors

Sending data to the cloud platform

1. Command **“AT”**

This is a test command to ensure proper communication between the DTE and DCE.

DTE(Data Terminal Equipment)

2. Command **“AT+RST”**

This is used to reset the DCE device.

RES “**Generic information**”

3. Command “**AT+CIPSHUT**”

This is used to shut any current connections

RES “**SHUT OK**”

Sending data to the cloud platform

4. Command “**AT+CWMODE=1**”

WIFI mode（station/softAP/station+softAP）
1 means Station mode
2 means AP mode
3 means AP + Station mode
RES “**OK**”

Sending data to the cloud platform

5. Command “AT+CWJAP”

Parameter description:

ssid: string, AP’s SSID

pwd: string, MAX: 64 bytes

Example:

AT+CWJAP="wifi-1","12345678"

RES “**Connected**”

Sending data to the cloud platform

6. Command “**AT+CIFSR**”

   Parameter description：

   IP_address:

   IP address of ESP8266 softAP

   IP address of ESP8266 station

   RES “**IP address**”

7. AT+CIPSTART="TCP","184.106.153.149",80
8. AT+CIPSEND=44
9. GET /update?key= S81QKAFKPGRR7LK8 &field1=96

Homework

The task and challenge we leave to you is to have the above programmatically working and sending values without input.