Group-4

Week-1

Day-6- LAB Assessement

Submission by-Devid Kumar Deka, Disha Shakyawal, Chandan Kumar, Badal Singh, Chhavi Nath,B N Mallikarjuna, Balusu Devashish

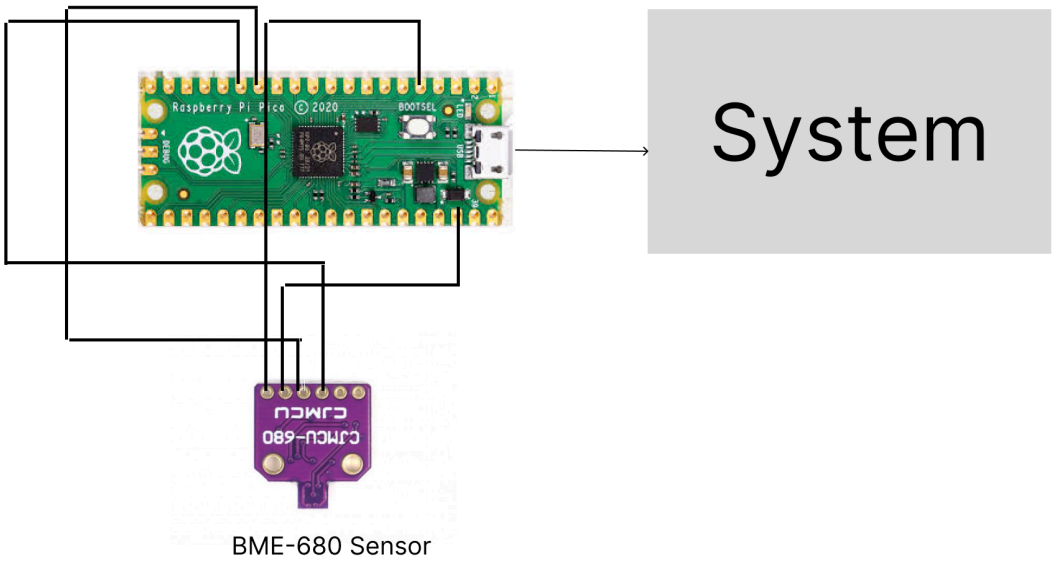
Title of the experiment:

Forecasting with Bytes: The Web Server Weather Station

Objective: Develop a Web Server Weather Station using Raspberry Pi Pico W and BMP680 sensor components to provide an accessible, accurate, and real-time pressure monitoring solution. The project addresses the need for affordable atmospheric pressure monitoring systems that can be deployed in various settings, including educational institutions, small businesses, and tunnels etc.

Components Used:1x Raspberry Pi Pico W,1x BME-680, 4x F-F Jumper Wires.

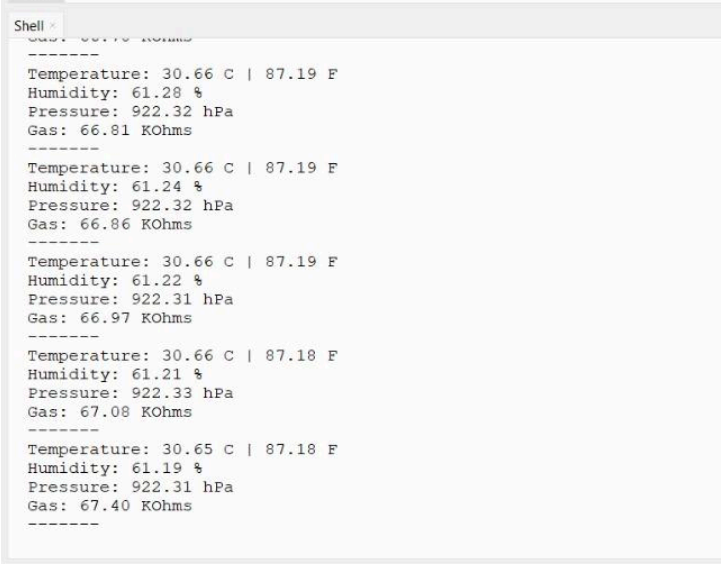
Block Diagram:



Code and Debugs:

```
    from machine import Pin, SoftI2C
from time import sleep
from bme680 import BME680_I2C

def initialize_bme680():
    i2c = SoftI2C(scl=Pin(21), sda=Pin(20))
    bme = BME680_I2C(i2c=i2c)
    return bme

def read_bme680_sensor(bme):
    try:
        temperature_C = bme.temperature
        temperature_F = (temperature_C * 9/5) + 32
        humidity = bme.humidity
        pressure = bme.pressure
        gas_KOhms = bme.gas / 1000

        return temperature_C, temperature_F, humidity, pressure, gas_KOhms
    except OSError as e:
        print('Failed to read BME680 sensor.')
        return None

def main():
    bme = initialize_bme680()

    while True:
        sensor_data = read_bme680_sensor(bme)

        if sensor_data is not None:
            temperature_C, temperature_F, humidity, pressure, gas_KOhms = sensor_data

            print(f'Temperature: {temperature_C:.2f} C | {temperature_F:.2f} F')
            print(f'Humidity: {humidity:.2f} %')
            print(f'Pressure: {pressure:.2f} hPa')
            print(f'Gas: {gas_KOhms:.2f} KOhms')
            print('-------')

        sleep(1)

if _name_ == "_main_":
    main()
```

Result and Observations:



Applications: The Web Server Weather Station using Raspberry Pi Pico W and BMP680 sensor has several practical applications across different settings due to its affordability, accessibility, and real-time monitoring capabilities. Here are some identified applications along with detailed explanations:

1. **Tunnels and Underground Areas:**The weather station checks the air pressure inside tunnels and underground places.
   It's important for safety. If the air pressure changes a lot, it could affect how well the tunnels are ventilated. It helps keep people safe by letting workers know if there might be a problem with the air.
2. **Schools and Colleges:**The weather station shows students how air pressure changes in real-time.
   Teachers can use it to teach students about weather patterns. For example, they can explain how high or low pressure affects the weather outside their classroom. It helps students understand what causes different types of weather, like sunny days or rainy weather.
3. **Small Businesses:** It helps businesses keep an eye on the weather so they can plan ahead. Farmers can use it to decide when to water their crops. If the air pressure drops, it might mean rain is coming, so they can prepare. Event planners can check if the weather will be good for outdoor events, like weddings or fairs, and change plans if needed.

Future Aspects:

The future aspects of using the BMP680 sensor include enhanced accuracy and precision for environmental monitoring, expanded gas sensing capabilities, and reduced power consumption for longer battery life. Smaller form factors will enable integration into compact devices like wearables, smartphones, and IoT gadgets. Improved connectivity options will facilitate broader integration into various applications. Advanced calibration and self-diagnostic features will simplify setup and maintenance, while on-sensor AI capabilities will support predictive maintenance and anomaly detection. The sensor will also offer improved robustness and durability for harsh environments, adherence to new environmental and data security regulations, and broader applications in smart cities, healthcare, and industrial automation.