AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH
Faculty of Engineering

Lab Report

Experiment # 08
Experiment Title: Implementation of a weather forecast system using the ADC modules of an Arduino.

Date of Perform:	**13 MAY 2025**	**Date of Submission:**	
Course Title:	**Microprocessor and Embedded Systems Lab**		
Course Code:	**EEE4103**	**Section:**	**Q**
Semester:	**Spring 2024-25**	**Degree Program:**	**BSc in CSE**
Course Teacher:	**PROTIK PARVEZ SHEIKH**		

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FACULTY COMMENTS	**Marks Obtained**	
	Total Marks	

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Marking Rubrics (to be filled by Faculty):

Level Category	Excellent [5]	Proficient [4]	Good [3]	Acceptable [2]	Unacceptable [1]	No Response [0]
Title and Objectives	Able to clarify the understanding of the lab, no issues are missing and formatting is good.	Able to clarify the understanding of the lab experiment, no issues are missing but its formatting is not good.	Able to clarify the understanding of the lab experiment, but a few issues are wrong, and its formatting is bad.	Able to clarify the understanding of the lab experiment, but it lacks a few important issues of the experiment without maintaining the format.	Unable to clarify the understanding of the lab experiment.	No Response/ copied from others/ identical submissions with gross errors/image file printed
Codes and Methods	Able to explain the experimental codes and simulation methods using Proteus very well.	Able to explain the experimental codes and simulation methods using Proteus but is not formatted well.	Able to explain the experimental codes but simulation method using Proteus is not explained well.	Presents the experimental codes but didn't explain simulation methods using Proteus clearly.	Presents the experimental codes but didn't explain simulation methods using Proteus.	
Results	Key results and images are there. Figures/Tables have all identifications and refer to them properly in the texts.	Key results and images are there. Figures/Tables have all identifications, such as the axis labels, numbers, and captions with a few minor errors; the texts refer them.	Key results and images are there. Figures/Tables lack a few identifications, such as the axis labels, numbers, and captions; the texts refer them.	Misses several key results and images. Figures/Tables lack identification, such as the axis labels, numbers, and captions; the texts don't refer them.	Major results, such as experimental and simulation results' images are not included. Figures and tables are poorly constructed or not presented.	
Discussion and Conclusion	Proper interpretation of results and summarizes the results to draw a conclusion, discusses its applications in real-life situations to connect with the report's conclusion.	Proper interpretation of results and summarizes the results to draw a conclusion but didn't discuss its applications in real-life situations to connect with the conclusion of the report.	Interpretation of results is presented. However, there is a disconnect between the results and discussion.	Misses the interpretation of key results. There is little connection between the results and discussion.	Very poor interpretation of the results. No connection between results and discussions.	
Question and Answer	Able to produce all questions' answers correctly maintaining the lab report format.	Able to produce all questions' answers but didn't maintain the lab report format.	Able to produce all questions' answers but wrong answers to a few questions.	Able to produce all questions' answers but wrong/missing answers to multiple questions.	Unable to produce all questions' answers and completely wrong answers.	
Comments						**Total Marks (25)**

Title: Implementation of a weather forecast system using the ADC modules of an Arduino.

Objectives:

The objectives of this experiment are to-

1. Familiarize the students with the Micro-controller-based weather forecast system
2. Measure environmental parameters, such as temperature, pressure, and humidity.

Components List:

- Arduino Uno Board
- BMP180 / MPL115A
- inches96 inch OLED 128X64
- Breadboard and Jump Wires

Circuit Diagram:

The Arduino platform is made up of the following components,

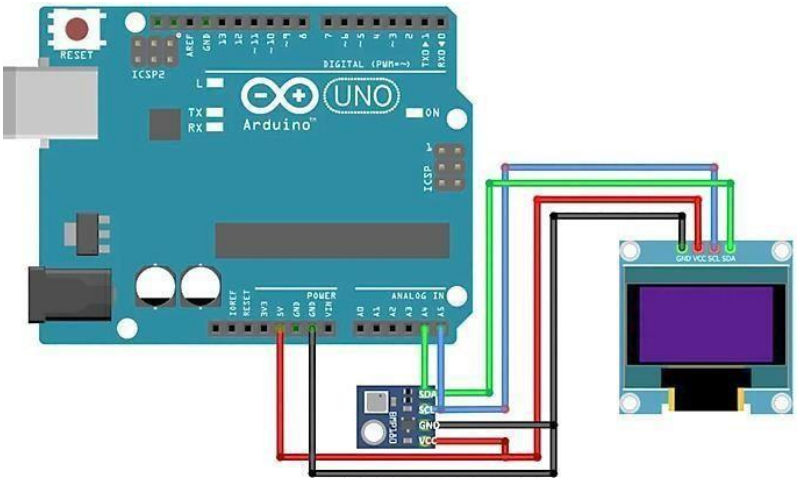

Fig. 1: Arduino board's pin connections with a weather sensor and an OLED

In the experiment, the BMP180 sensor detected the temperature of the room and presented the data of the room accordingly. As the sensor was lifted upward, the value of the altitude changed accordingly. By increasing the temperature, the value of the temperature changed accordingly as well. Due to the unchanged weather conditions, the value of the weather could not be changed.

Code/Program:

```
#include <SPI.h>
#include <Wire.h>
#include <Adafruit_GFX.h>
#include <Adafruit_SSD1306.h>
#include <Adafruit_BMP085.h>
#define SCREEN_WIDTH 128
#define SCREEN_HEIGHT 64

Adafruit_SSD1306 display(SCREEN_WIDTH, SCREEN_HEIGHT);
Adafruit_BMP085 bmp;
```

```
#define SEALEVELPRESSURE_PA (101500)
float simpleweatherdifference, currentpressure, predictedweather, currentaltitude;
void setup () {
  // put your setup code here, to run once:
  display.begin(SSD1306_SWITCHCAPVCC, 0x3C);
if (!bmp.begin()) {
  Serial.println("Could not find a valid BMP085 sensor, check wiring!");
  while (1) {}
  }
}
void loop() {
  // put your main code here, to run repeatedly:
  display.clearDisplay();
  display.setTextSize(1);
  display.setTextColor(SSD1306_WHITE);

  display.setCursor(0,5);
  display.print("BMP180");
  display.setCursor(0,19);
  display.print("T=");
  display.print(bmp.readTemperature(),1);
  display.println("*C");

  /*prints BME180 pressure in Hectopascal Pressure Unit*/
  display.setCursor(0,30);
  display.print("P=");
  display.print(bmp.readPressure()/100.0,1);
  display.println("hPa");

    /*prints BME180 altitude in meters*/
  display.setCursor(0,40);
  display.print("A=");
  display.print(bmp.readAltitude(SEALEVELPRESSURE_PA),1);
  display.println("m");
  delay(6000);
  display.display();

 currentpressure=bmp.readPressure()/100.0;
 currentaltitude=bmp.readAltitude(SEALEVELPRESSURE_PA);
 predictedweather=(101.3*exp(((float)(currentaltitude))/(-7990)));
 simpleweatherdifference=currentpressure-predictedweather;
 //display.clearDisplay();
 display.setCursor(0,50);
 if (simpleweatherdifference>0.25)
    display.print("SUNNY");
   if (simpleweatherdifference<=0.25)
```

```
   display.print("SUNNY/CLOUDY");

  if (simpleweatherdifference<-0.25)
   display.print("RAINY");
   display.display();
delay(2000);
}
```

Experimental Output Results:

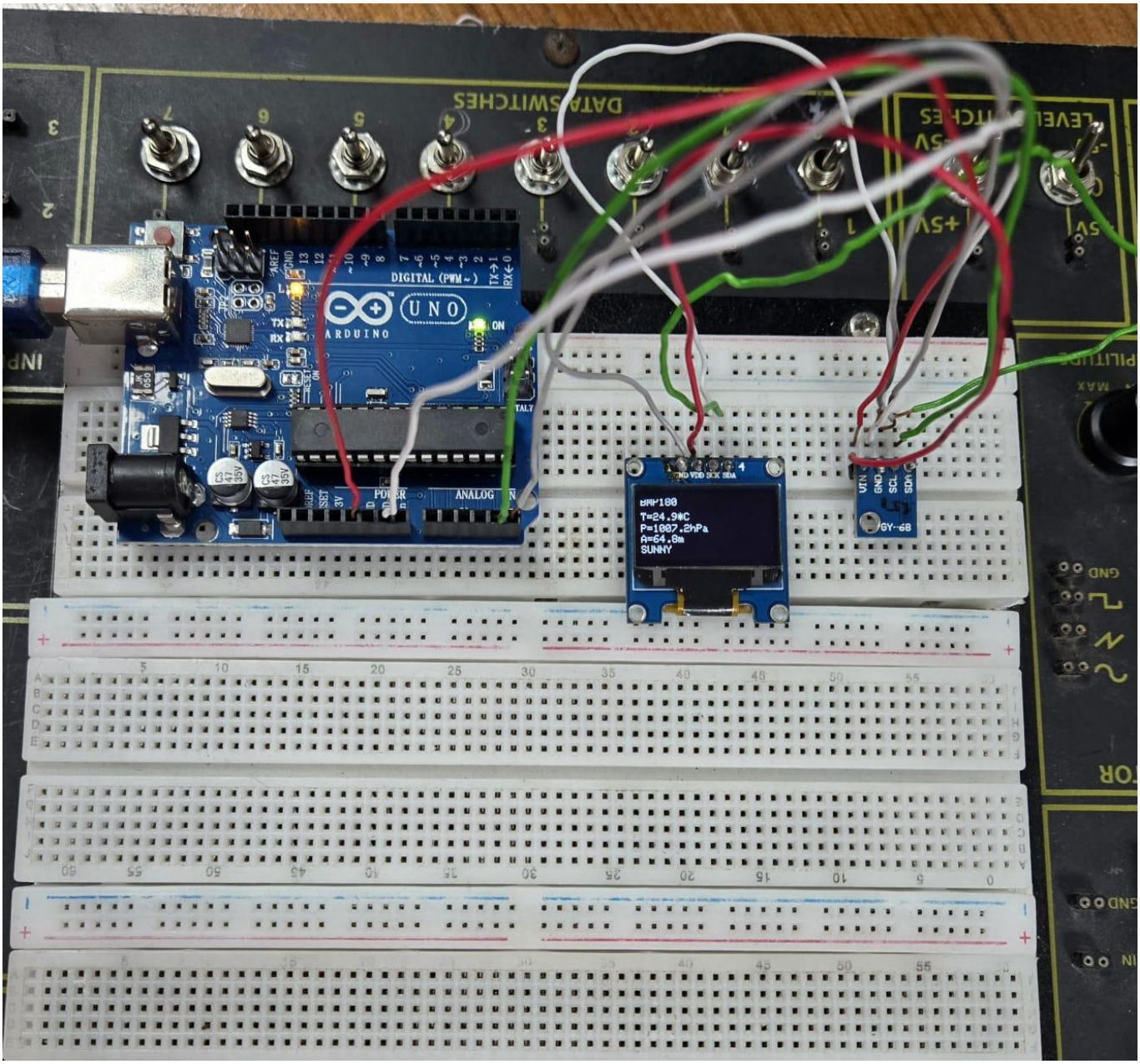

Figure-2: Experimental Output Results

Simulation:

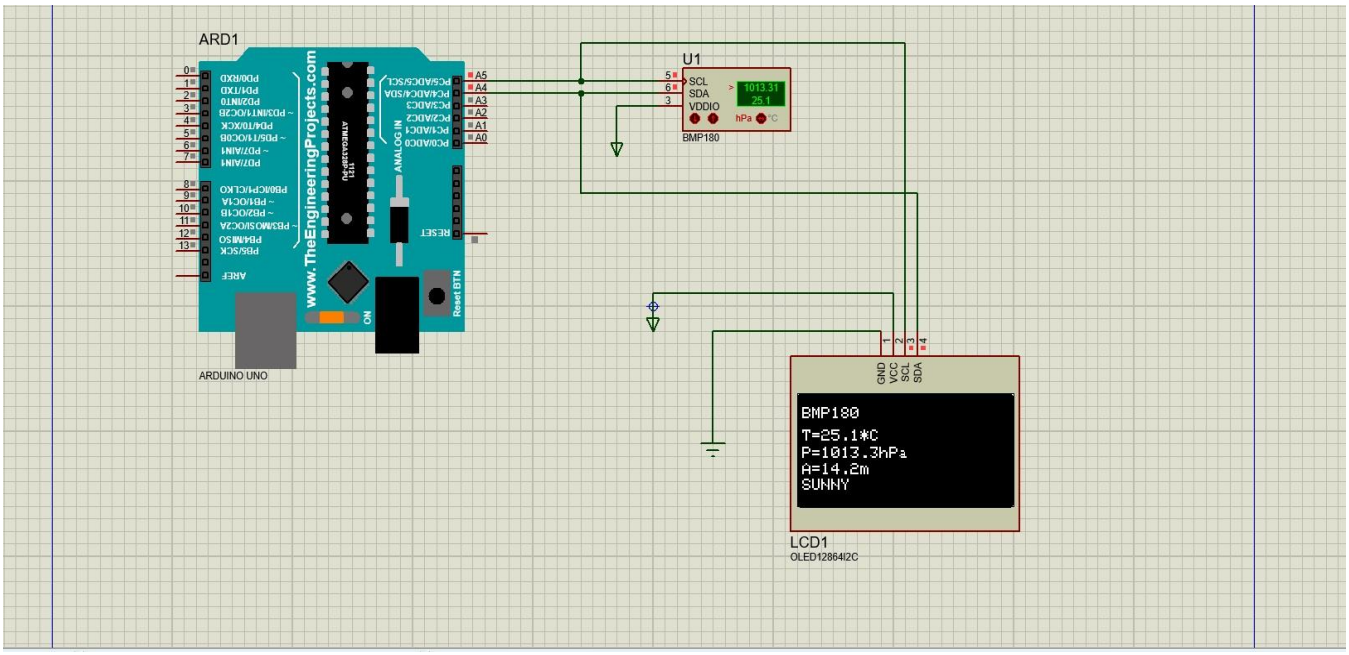

Fig.3: First Simulation where Temperature was 25.1°C, Pressure was 1013.3hPA, Altitude was 14.2m and SUNNY condition.

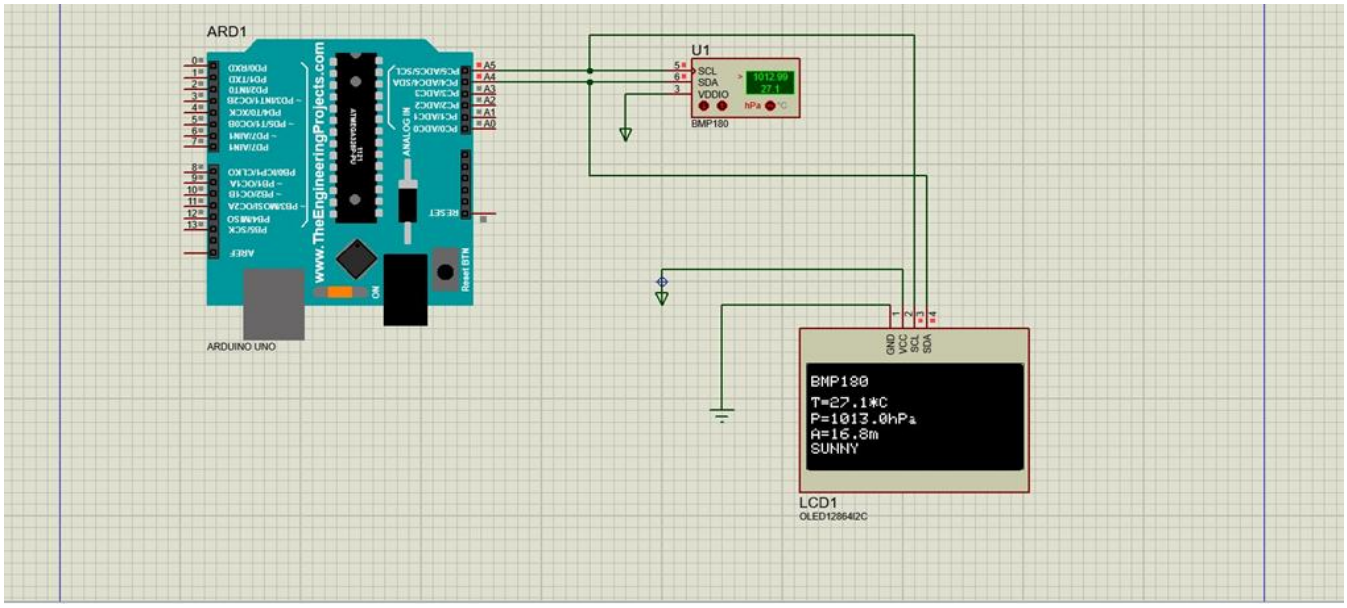

Fig.4: Second Simulation where Temperature was 27.1°C, Pressure was 1013.0hPA, Altitude was 16.8m and SUNNY condition.

Discussion:

In this experiment,

- A weather forecasting system using Arduino and the BMP180 sensor to measure barometric pressure and temperature was successfully implemented.
- Real-time weather prediction by monitoring atmospheric pressure changes and identifying trends over time was achieved.
- A simple algorithm to calculate local barometric pressure based on altitude, providing quicker weather predictions without needing extended trend analysis was developed.
- The pressure equation to normalize weather conditions at the current altitude, ensuring accurate comparisons to expected values for sunny, cloudy, or rainy weather was utilized.
- A simple interface for users to easily interpret weather predictions through displaying key information like the temperature, pressure, altitude etc. was created on an OLED screen.

Conclusion:

The experiment was successful in utilizing the Arduino Uno and BMP180 barometric sensor to accurately predict weather conditions by monitoring changes in atmospheric pressure and applying altitude-based calculations. A simple algorithm was developed to calculate local barometric pressure based on altitude, enabling quicker weather predictions without relying on extended trend analysis. The pressure values were normalized to current altitude, ensuring accurate comparisons to standard weather conditions such as sunny, cloudy, or rainy. An intuitive OLED interface was created to display key environmental data including temperature, pressure, and altitude. Overall, the system functioned effectively in both physical and simulated environments, achieving the experiment's objectives.

References:

- BMP180 Datasheet, [Online] [Cited: July 29, 2023] Available: https://cdnshop.adafruit.com/datasheets/BST-BMP180- DS000-09.pdf
- Arduino CC Website, [Online] [Cited: July 29, 2023] Available: https://docs.arduino.cc/hardware/uno-rev3
- Interface BMP180 Barometric Pressure & Temperature Sensor with Arduino, Last Minute Engineers, [Cited: July 29, 2023] Available: https://lastminuteengineers.com/bmp180-arduino-tutorial/
- AIUB Microprocessor and Embedded Systems Lab Manual 8