AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH

Faculty of Engineering

Lab Report

Experiment Title:	Building a weather forecast system using pressure and heat index measurement.

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Course Title:	MICROPROCESSOR AND EMBEDDED SYSTEMS		
Section:	A		
Semester:	Spring 2022-23	Course Teacher:	MD. ALI NOOR

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No	Name	ID	Program	Signature
1	Medha Chowdhury	20-41930-1	BSc [CSE]	
2	Maimona Rahman Farjana	20-42954-1	BSc [CSE]	
3	Md.Sajidul Hoque Shohan	20-42022-1	BSc [CSE]	
4	Md. Rashedul Islam	20-43301-1	BSc [CSE]	
5	Md.Sumon	20-42556-1	BSc [CSE]	
6	Syeda Aynul Karim	19-41829-3	BSc [CSE]	
7	Syed Aftab Uddin	19-41522-3	EEE	

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	Total Marks	

Building a weather forecast system using pressure and heat index measurement.

1 INTRODUCTION

In This Experiment we can learn Building a weather forecast system using pressure and heat index measurement using Proteus 8.9 professional software. Our Main objective in this Experiment is to get familiarized with Micro-controller-based weather forecast system and heat index.

2 THEORY

Weather Prediction:

The MPL115A is an absolute device that can be used to anticipate and measure the barometric pressure to infer weather patterns. Weather prediction requires a inactive area for the sensor and 2-3 hours to analyze a full weather design. Regularly the weight changes due to weather are moderate, requiring a few hours to determine the inclining of the weight alter. Vertical development or a significant airflow can interfere with results due to only weather designs in barometric weight. The sensor should be kept in a relatively protected zone from any solid air flows and kept at that inactive area during analysis. Temperature effects can alter the comes about of a typical pressure sensor especially in case the measurement is done over a few hours in changing temperature. Due to the nature of the calibration and temperature compensation, MPL115A meets these requirements, compensating for temperature swings over a large 0 to 85°C working run. It'll not require auto-zeroing for shifts in off set or span over temperature.

How Pressure Increases and Decreases with Weather:

For weather pattern prediction, the MPL115A is a well-suited device with its pressure range and Barometric pressure changes can directly correlate to changes in the weather. H2O has a molecular mass of 18. So if there is a large amount of water vapor present in air, this air is patterns lead to high or low pressure. If bad weather originates in an area in the formation of water-vapor clouds, this is falling pressure on a The vapor will reduce the barometric pressure as the H2O reduces the mass above that point on High pressure will signal the clearing of the water vapor as the air dries. This is due to the fact that hurricanes are low pressure conditions
surrounded by The rush of air from higher to low pressure creates the fast moving winds .pressure in the center, the greater differential pressure between high and low areas.

Local Weather Station

When implementing a weather station, it is best to will check results with a local forecast. When researching local weather pressures, such as barometric pressure at the closest airport, remember that the weather is normalized for altitude. Normalization takes local barometric.

pressure and shifts it to reflect sea level altitude. Sea Level is 101.3 kPa, and by normalizing various points on a map, a meteorologist can see the weather pattern over a region. Without the normalization, the effect of altitude on the pressure reported by collection points will lead to useless data. A mountain data point will have pressure affected by altitude and as it leads to the valleys, the pressure point there will be higher, telling nothing about the weather without the normalization. Airports are typical reporting stations to check barometric pressure. Some display only normalized pressure during a web search. This is such that a pilot landing at any airport can deduce the weather conditions by knowing the barometric pressure. If the airport is located at the beach, or on a mountainous region, normalization of this value removes the barometric variation due to the altitude. It standardizes pressure so that weather patterns can be mapped.

Algorithms for weather Simple Approach:

How is weather predicted using the barometric sensor? There is a simple approach looking at increasing or decreasing pressure. Simply an increase over time is a trend that approaches "sunny" or "clear" days. Dropping pressure can signal a worsening "cloudy" or "rainy" day. This can be seen typically as a rising or falling bar on many simple solution weather stations. It can be interpreted as an increase/decrease gradient for the user to interpret, but the time interval is not used extensively to reach weather predictions. The user can look at the results for a 12 hour time frame to predict the weather trend. This table is typically used:

Analysis	Output
dP > +0.25 kPa	Sun Symbol
-0.25 kPa < dP < 0.25 kPa	Sun/Cloud Symbol
dP < -0.25 kPa	Rain Symbol

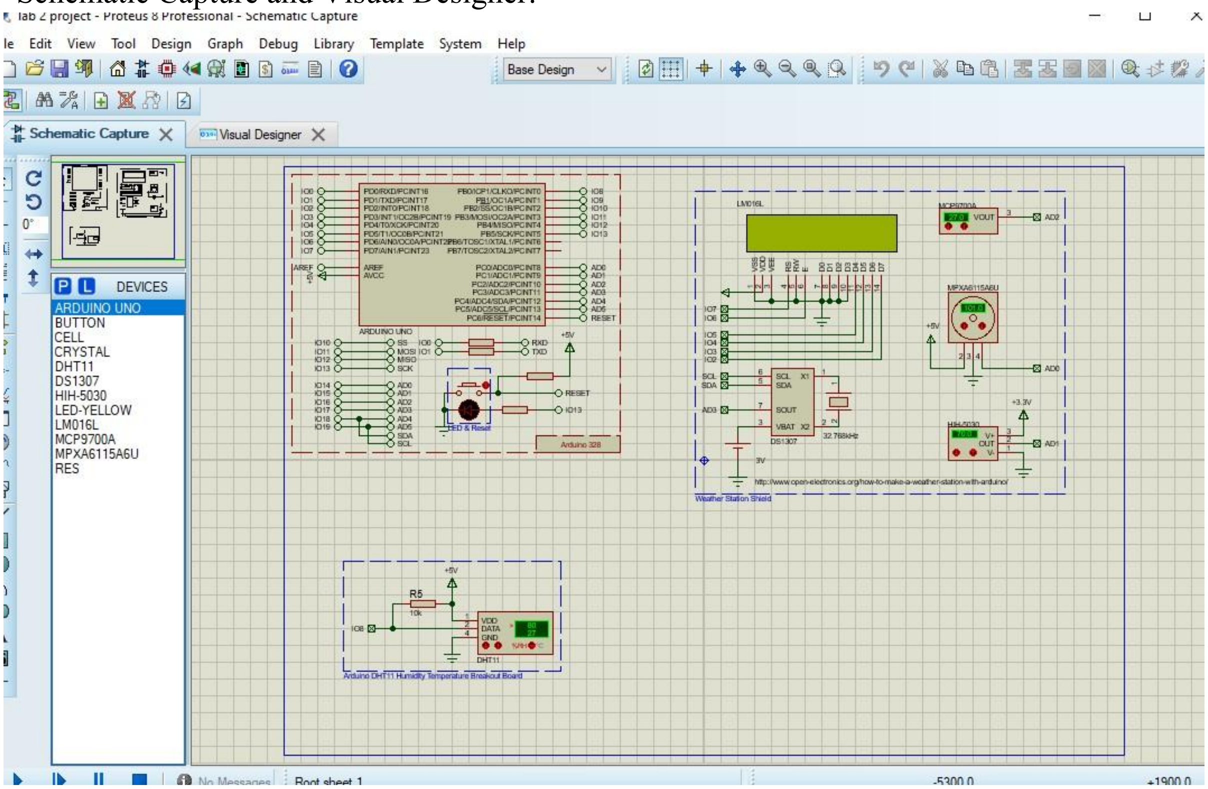
Advanced Version of Weather Station:

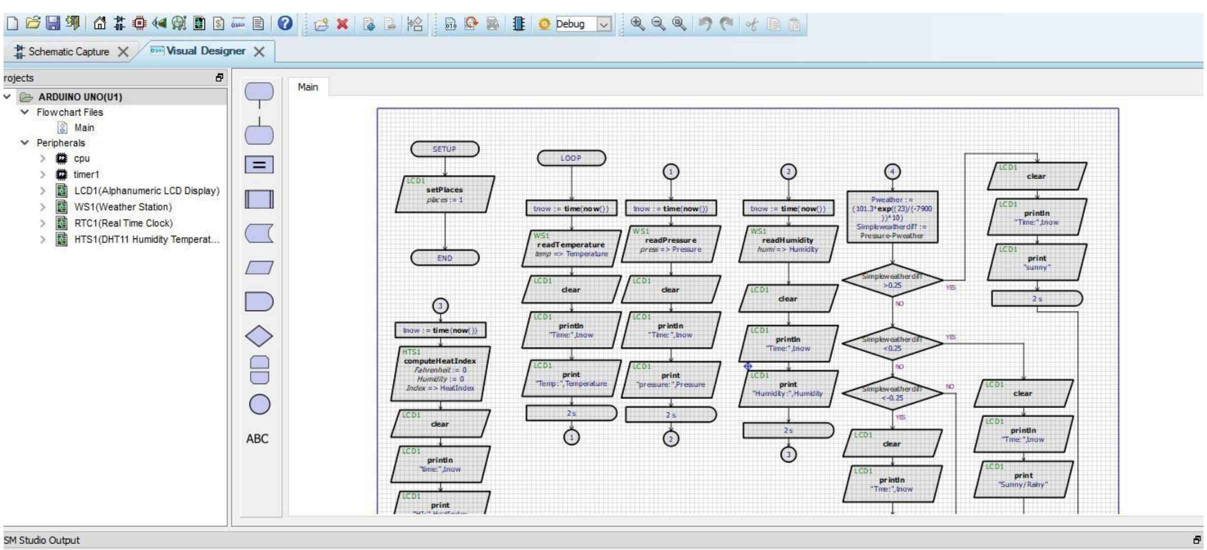
This can also use less time than waiting for a full 12 hours to see the pattern of pressure In Table 3, the ranges of pressure change over time leading to the definition of the It is a change in the pressure per one hour. to deduce how the pressure is migrating.In the provided flowchart, the pressure is sampled every minute for 3 hours/180 minutes hour point. Consecutive ½ hour marks have 5 minute averaged data-points stored. leads to 7 averaged results over the 180 minutes depicting the pressure every ½ hour. Once the data- points are collected, the patterns are deduced. which every ½ hour data point is compared to. and divided so that the change in pressure per 1 hour is compared every half an hour.

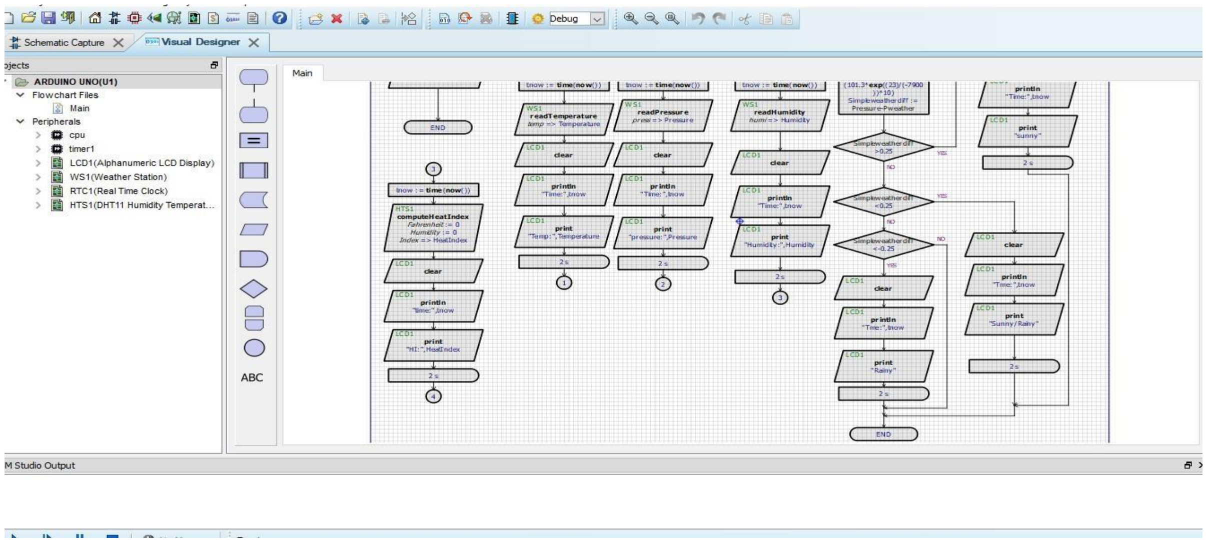
Analysis	Output
dP/dt > 0.25 kPa/h	Quickly rising High Pressure System, not stable
0.05 kPa/h < dP/dt < 0.25 kPa/h	Slowly rising High Pressure System, stable good weather

-0.05 kPa/h < dP/dt < 0.05 kPa/h	Stable weather condition
-0.25 kPa/h < dP/dt < -0.05 kPa/h	Slowly falling Low Pressure System, stable rainy weather
dP/dt < -0.25 kPa/h	Quickly falling Low Pressure, Thunderstorm, not

Schematic Capture and Visual Designer:







3 APPARATUS

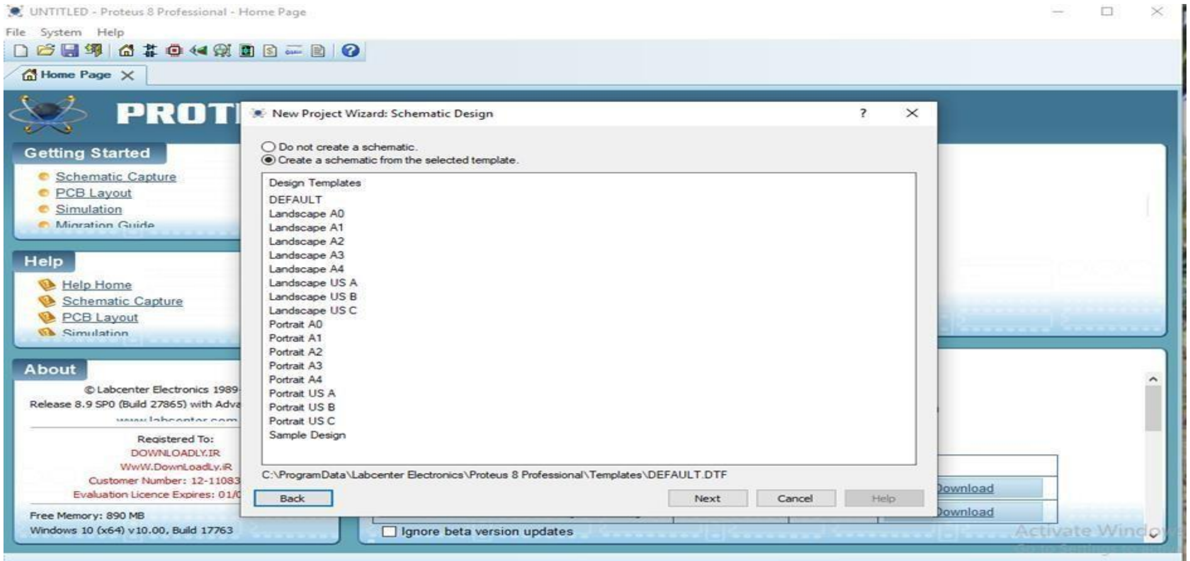
Proteus 8.9 professional software:

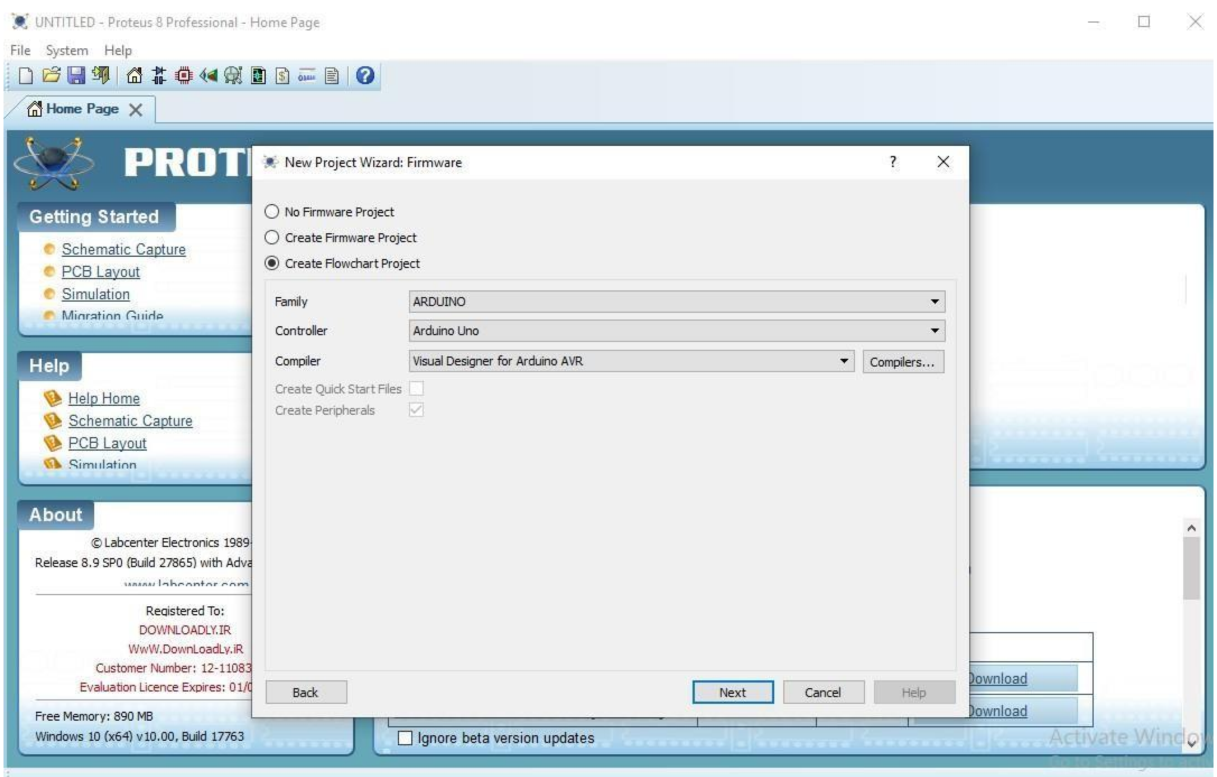
- Arduino Board
- DHT22
- MPXA6115A6U / MPL115A
- MCP9700A
- HIH-5030
- LM016L

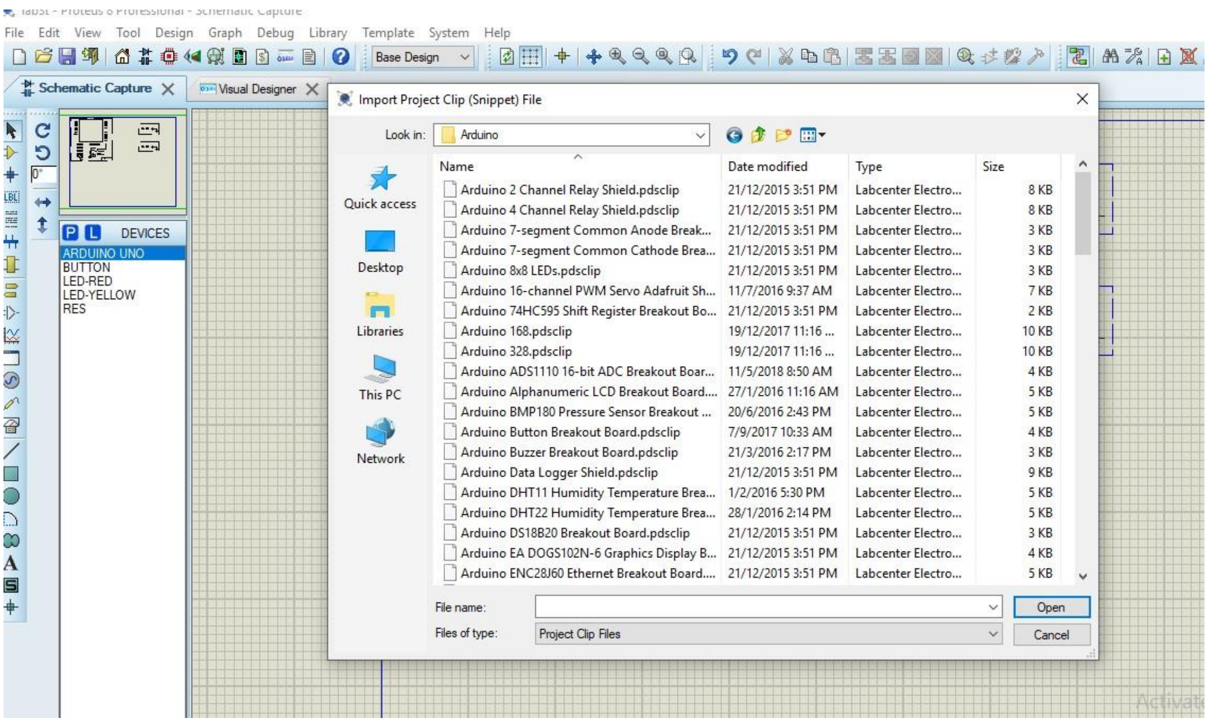
4 PROCEDURE

For this experiment first we open Proteus 8.9 professional software. Then we select “New project” option. After that we give a name for this project and select a pat were to save this project. Then the software shows two option foe schematic design. We select “Create a schematic from the selected template” option. Then we choose “Do not create a PCB layout” option and click the “Next” option. After that we select “Create a flowchart project” option, again we click “Next” and then “Finish”. Then we saw two windows were open. One is” Schematic Capture” and another one is “Visual Designer”. In” Schematic Capture” we took “Import project clip”,” Arduino” one after another. From “Arduino” library we took Weather station shield, Humidity Temperature Breakout board.

Then we went to the “Visual Designer” window. And Create 7 Variable I/o operation. And Create loop system and setup system and create decision block, operation block, and assignment block. And continue the loop system.






File Edit View Tool Design Graph Debug Library Template System Help
Base Design
Schematic Capture
Visual Designer
DEVICES
ARDUINO UNO
BUTTON
LED-RED
LED-YELLOW
RES
Import Project Clip (Snippet) File
Look in: Arduino
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Desktop
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Arduino 4 Channel Relay Shield.pdsclip 21/12/2015 3:51 PM Labcenter Electro... 8 KB
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Arduino Alphanumeric LCD Breakout Board.... 27/1/2016 11:16 AM Labcenter Electro... 5 KB
Arduino BMP180 Pressure Sensor Breakout ... 20/6/2016 2:43 PM Labcenter Electro... 5 KB
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Arduino Buzzer Breakout Board.pdsclip 21/3/2016 2:17 PM Labcenter Electro... 3 KB
Arduino Data Logger Shield.pdsclip 21/12/2015 3:51 PM Labcenter Electro... 9 KB
Arduino DHT11 Humidity Temperature Brea... 1/2/2016 5:30 PM Labcenter Electro... 5 KB
Arduino DHT22 Humidity Temperature Brea... 28/1/2016 2:14 PM Labcenter Electro... 5 KB
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Files of type: Project Clip Files
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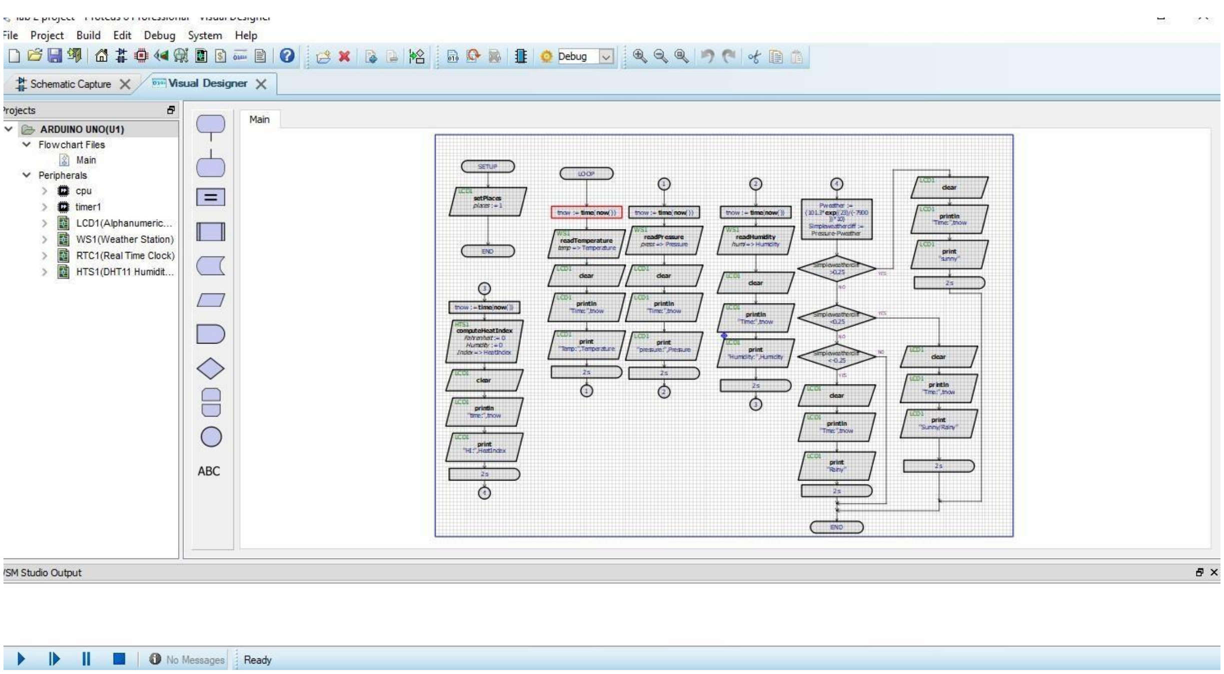
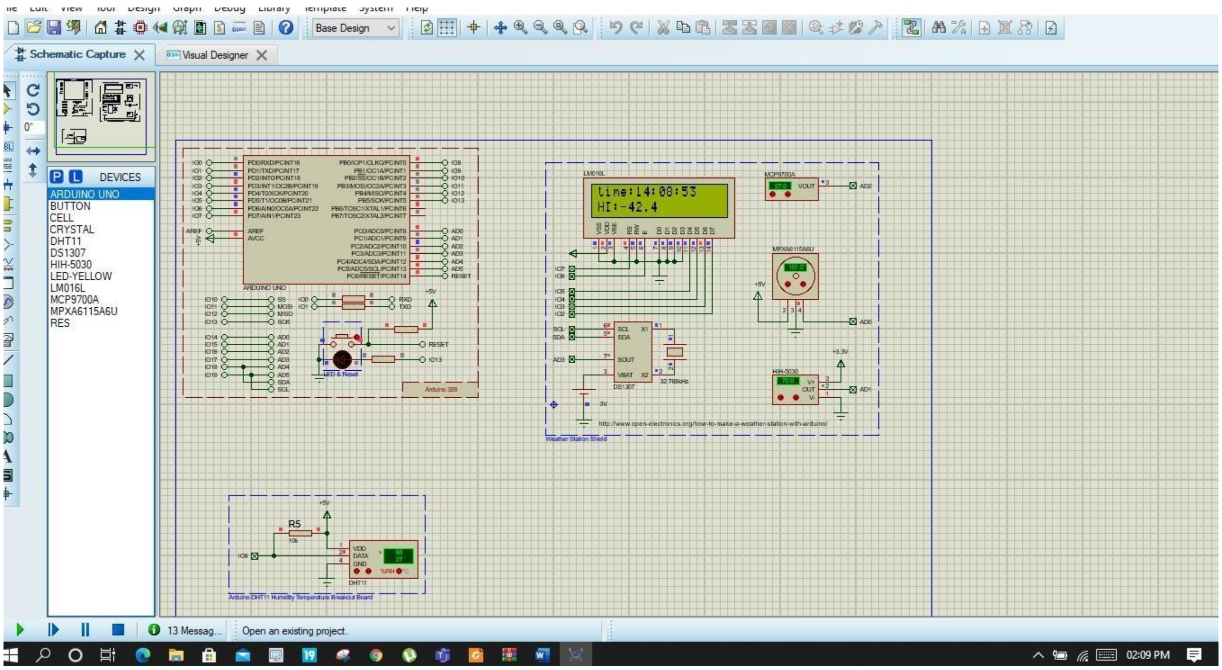

File Project Build Edit Debug System Help
Debug
Schematic Capture
Visual Designer
Projects
ARDUINO UNO(U1)
Flowchart Files
Main
Peripherals
cpu
timer1
LCD1(Alphanumeric...
WS1(Weather Station)
RTC1(Real Time Clock)
HTS1(DHT11 Humidit...
ABC
Main
SETUP
LOOP
END
VSM Studio Output
No Messages
Ready

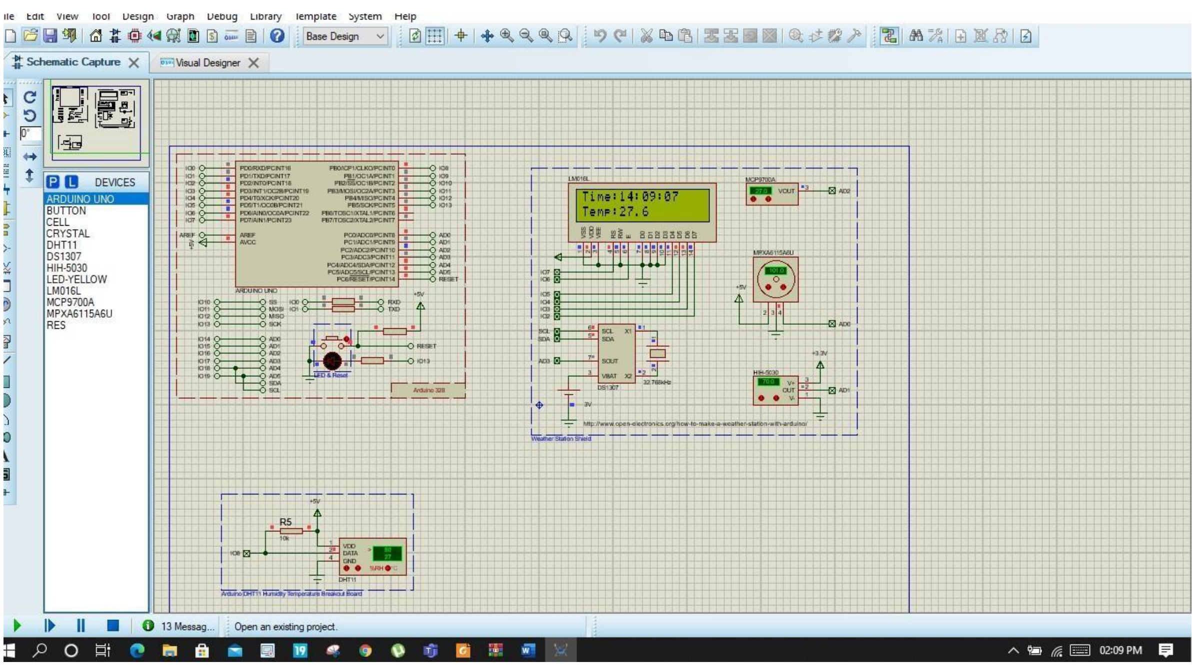
Explanation of Code:

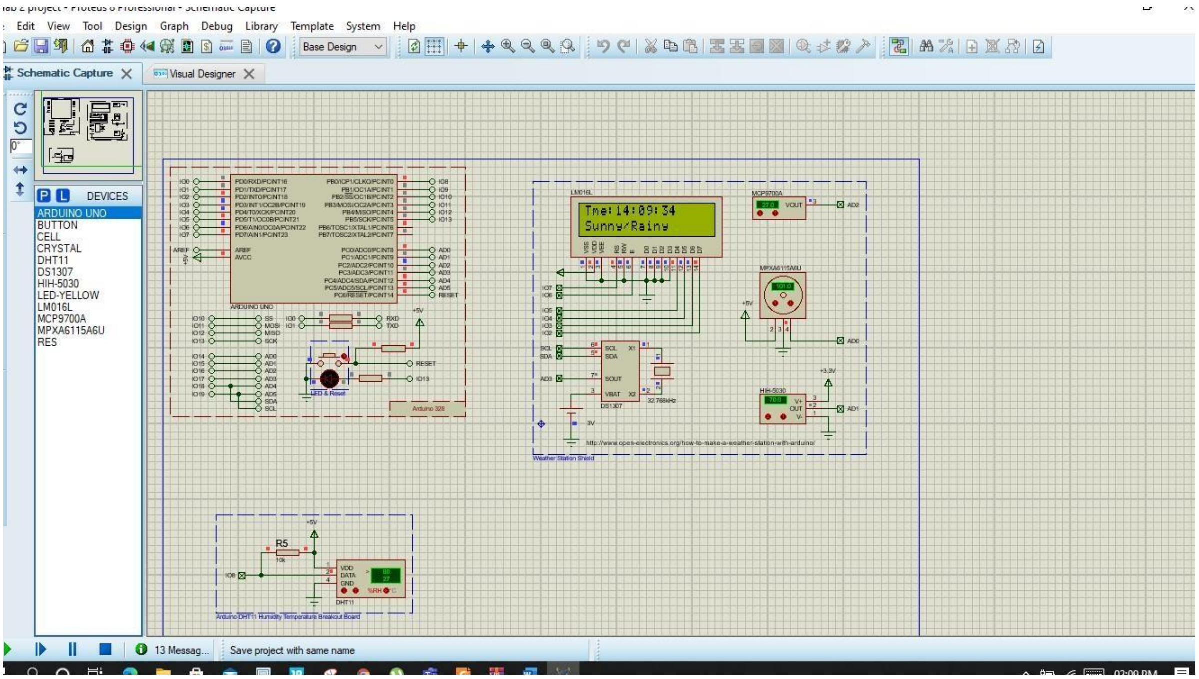
```
#include <SPI.h>
 #include <Wire.h>
 #include <Adafruit_GFX.h>
 #include <Adafruit_SSD1306.h>
 #include <Adafruit_BMP085.h>
 #define SCREEN_WIDTH 128
 #define SCREEN_HEIGHT 64
 Adafruit_SSD1306 display(SCREEN_WIDTH, SCREEN_HEIGHT); Adafruit_BMP085 bmp;
 #define SEALEVELPRESSURE_HPA (101500)
 float simpleweatherdifference, currentpressure, predictedweather, currentaltitude; void

setup()
 {
 display.begin(SSD1306_SWITCHCAPVCC, 0x3C); if (!bmp.begin()) {

Serial.println("Could not find a valid BMP085 sensor, check wiring!"); while (1) {}

} }

void loop() {

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"); display.setCursor(0,30);
display.print("P="); display.print(bmp.readPressure()/100.0F,1);
```

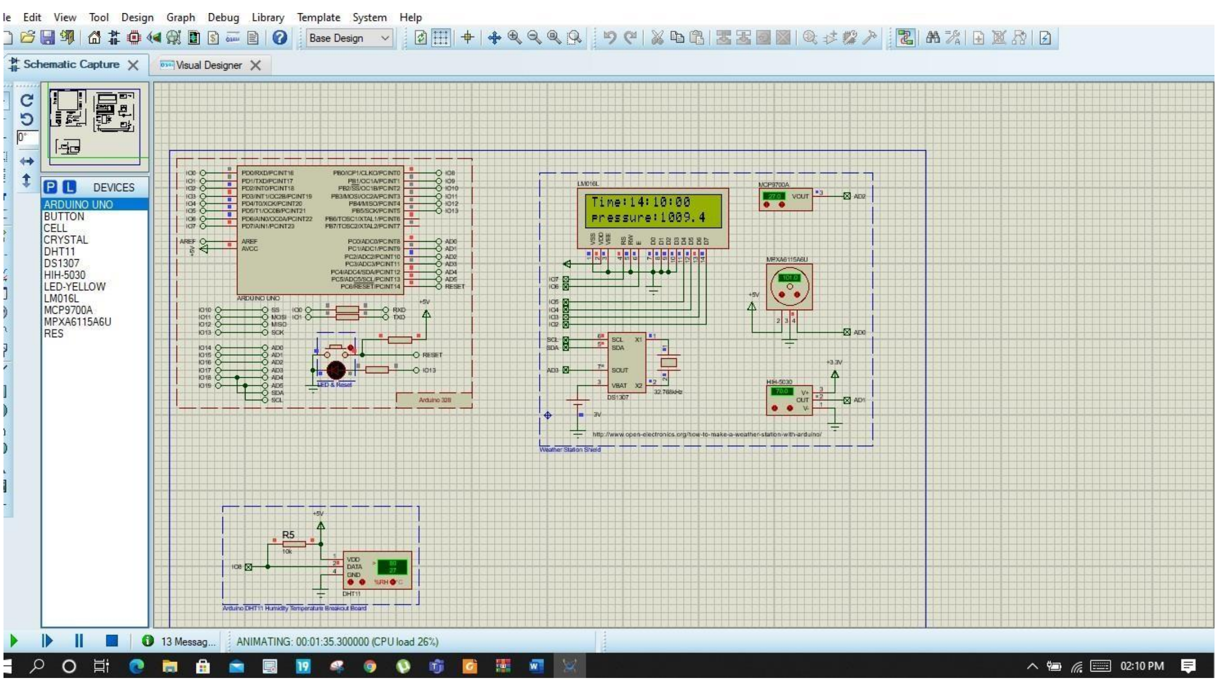
```
display.println("hPa");

display.setCursor(0,40); display.print("A=");

display.print(bmp.readAltitude(SEALEVELPRESSURE_HPA),1); display.println("m");

delay(6000); display.display();

currentpressure=bmp.readPressure()/100.0;
predictedweather=(101.3*exp(((float)(currentaltitude))/(7900)));
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);

}
```

5 RESULT









6 Discussion

In this experiment we have done Building a weather forecast system using pressure and heat index measurement. In this experiment we used proteus 8.9 software. In this software we took Weather station shield, Humidity Temperature Breakout board and Arduino Uno microcontroller. We measured Temperature, Humidity, HI, Pressure and condition of weather