Technical Report

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A **weather station** is system that monitors local weather and displays and/or records parameter such as air temperature, air pressure, wind speed, rainfall and humidity. In our weather station, we will simplify it to only monitor the basic weather parameters – temperature, humidity and air pressure as monitoring other parameters requires more advanced sensors which will increase the total cost of the project, so this is something that we may look into at a later stage.

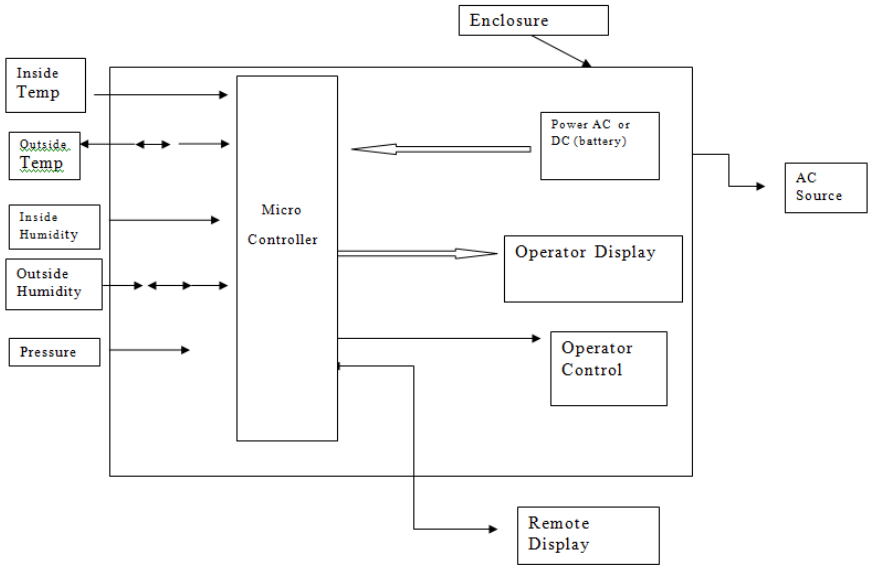
Market Requirements Document (MRD)

Weather Station includes:

1. Indoor Temperature
2. Outdoor Temperature
3. Barometric Pressure
4. Indoor Humidity
5. Outdoor Humidity
6. Viewable in daylight or dark
7. Optional Remote Control/Display

Design

Our **weather station** will use the DHT11 (or DHT22) Digital Temperature and Humidity Sensor along with the BMP280 air Pressure Sensor. The sensor data will be read and processed using a Arduino UNO microcontroller board that contains an AVR Atmega328 microcontroller chip. Once the microcontroller has gathered the weather data, it will then display it on a 16×2 LCD display. The advantage of using an LCD display is that it will remove the need for a computer to view the data making the project portable. The unique about our design is that our station will display its reading for Temperature , Humidity and Pressure in both systems (SI, American System).



Block Diagram

Build of Material

1. Microcontroller board
2. Arduino Uno
3. LCD display
4. Potentiometer
5. Jumper wires
6. DHT 11

Marketing and Sales

Since our Weather Station displays both the SI unit and the American system and it is only displayed in the english language. We'll be selling this product in the United States and Canada to reduce tariffs imposed on our product. We'll sell our product at $74.99, which is about 50% more than our original price which is $48.81, and make 25K units. Our product will mostly be selled in the United States, but our design was made for international markets too. In Fact, the future expansion was taken into account. We'll sell 15,000 units in the United States and 10,000 Units in Canada to make more profit.

If we were to sell our product in canada, tariffs will be imposed on our product which will reduce the revenue that we'll obtain:

Contribution margin = revenue − variable costs
$74.99 - $3.75 = $ 71.24

$71.24 is how much our product will cost in Canada due to taxes. If we sell 10,000 units in Canada We'll make a possible profit of:

$71.24 x 10,000 = $712,400

Revenue	Tariffs in canada	Variable Cost
$74.99	5%	$3.75

If we sell 15,000 units in the United States we can make possible profit of:

$74.99 x 15,000 = $1,124,850

If we sell 10,000 units in Canada we'll make a possible profit of:

$71.24 x 10,000 = $712,400

The Total possible profit would be:

$1,124,850 + $712,400 = $\underline{1,837,250}$

Price (hardware)

1) Arduino Uno $18.90
2) 16x2 character LCD display $3.00
3) Potentiometer $6.79
4) Jumper wires — male to female (MF) and female to female (FF) $7.02 25ct.
5) DHT11 (temperature and humidity sensor) $3.15

Software

The Program:

```
#include <dht.h>
#include <Adafruit_BMP085.h>
#include <LiquidCrystal.h>

Adafruit_BMP085 bmp;
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
dht DHT;
#define DHT11_PIN 7
#define DHT11_PIN2 8
void setup()
{
lcd.begin(16, 2);
}
void loop()
{
int chk = DHT.read11(DHT11_PIN);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Inside Temp: ");

//continues on next column
```

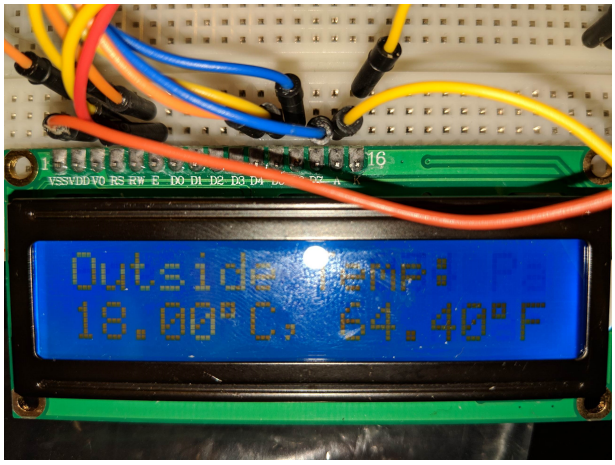
```
lcd.setCursor(0,1);
lcd.print(DHT.temperature);
lcd.print((char)223);
lcd.print("C, ");
lcd.print((DHT.temperature)*(9.0/5.0)+32.
0);
lcd.print((char)223);
lcd.print("F");
delay(2000);
chk = DHT.read11(DHT11_PIN);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("In Hdty: ");
lcd.print(DHT.humidity);
lcd.print("%");
lcd.setCursor(0,1);
int chk2 = DHT.read11(DHT11_PIN2);
lcd.print("Out Hdty: ");
lcd.print(DHT.humidity);
lcd.print("%");
delay(2000);

//continues on next column
```

```
cd.clear();
lcd.setCursor(0,0);
lcd.print("Pressure: ");
lcd.print(bmp.readPressure());
lcd.print(" Pa");
lcd.setCursor(4,1);
lcd.print("or ");
lcd.print((bmp.readPressure())/100.0);
lcd.print(" mbar");
delay(2000);

chk2 = DHT.read11(DHT11_PIN2);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Outside Temp: ");
lcd.setCursor(0,1);
lcd.print(DHT.temperature);
lcd.print((char)223);
lcd.print("C, ");
lcd.print((DHT.temperature)*(9.0/5.0)+32.0);
lcd.print((char)223);
lcd.print("F");
delay(2000);

}
```

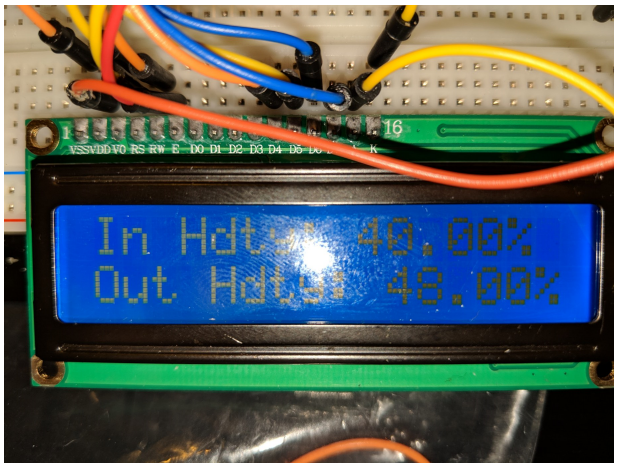
Built Prototype

Wiring the Circuit for the Arduino Weather Station:

LCD D7 –>DIGITAL PIN 2
LCD D6 –> 3
LCD D5 –> 4
LCD D4 –> 5
LCD E – > 11
LCD RS –> 12
LCD VDD –> (+) RAIL BREADBOARD
LCD A –> (+) RAIL BREADBOARD
LCD VSS –> (-)RAIL BREADBOARD
LCD K –>(-)RAIL BREADBOARD
LCD RW –> (-)RAIL BREADBOARD
LCD VO –> Potentiometer Middle Pin


Outside Temp:
18.00°C, 64.40°F


Inside Temp:
16.00°C, 60.80°F


In Hdt.: 40.00%
Out Hdt.: 48.00%