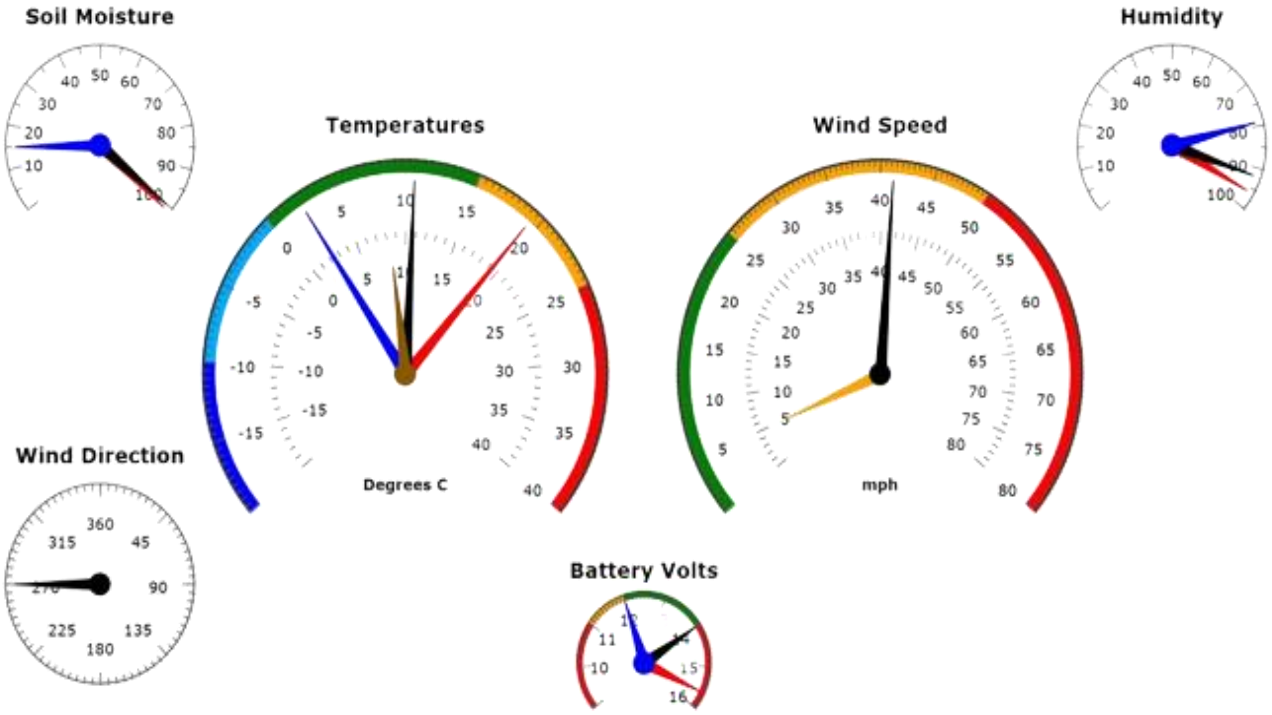
CS2982-Automation Challenge II

LOW POWER WEATHER STATION



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Overview

This project is to build up a weather station that operates with low power. The weather station would require a power source suitable to provide the energy demand of the weather station. The wind speed, wind direction, humidity, temperature, rainfall along with air quality are measured using sensors. The data from the sensors are collected and are displayed in real time interactive plots that illustrate the variations in the environmental parameters that impact on weather. The data collected are preserved for further processing of data to derive predictions on weather using machine learning algorithms as a possible future advancement of this project.

The idea is to use solar panels to provide power to the weather station. A limited amount of power could be generated to limit the cost, so the power extracted from the solar cells by the other devices should be sufficient. So, the other devices need to be of low power. Battery or Power supply could be used as backup as solar cell would be of insufficient power generation during some months. Though lower power is used, the power demand of the system needs to be maintained for effective working of the device. Though, the power station designed in this project is of low power, we would be still able to use it connected to household power supply as a weather station is often at a fixed location.

The cost of the components (sensors) used needs to be low in order to design the weather station within an affordable budget and to afford any replacement of the sensors if needed. Thus, reducing the maintenance cost of the station.

The devices used in this project needs to be of excellent measurement accuracy to ensure the effectiveness of the system. In order for the measurements of data to be precise and accurate , the sensors need to be having a stable calibration. The station also needs to be stable and durable.

Components

1. Humidity and Temperature Sensor - DHT22 (MD0229)

The DHT22 Temperature and Humidity sensor is quite common. It's inexpensive, simple to operate, and the specifications claim high precision and accuracy. A capacitive humidity sensor and a thermistor are included in the DHT sensors. In addition, there is a chip inside that converts analog to digital and emits a digital signal with the temperature and humidity. Any microcontroller can read the digital signal reasonably easily .

Characteristics of the DHT22

- Low cost
- 3 to 5V power and I/O
- 2.5mA max current use during conversion
- 0-100% humidity readings with 2-5% accuracy
- -40 to 125°C temperature readings ±0.5°C accuracy
- Slow - A little slow where you can't query them more than once every second. This would be sufficient as weather parameters like temperature, humidity, rainfall etc. do not vary that much in a second.

Cost: Rs.1250.00

2. **Wind Speed and Direction Sensor** (Anti-corrosion Wind Speed Sensor 0-360degree Polycarbonate Wind direction sensor Anemometer Speed Measuring Tool Eight Direction)

Moudle	Wind speed sensor	Moudle	Wind direction sensor
power supply	10 ~ 30V DC	power supply	10 ~ 30V DC
Measuring range	0 ~ 60m / s	Measuring range	8 indicate the direction
Accuracy	± (0.2+0.03V) m/s	Working Temp	-20℃~+60℃, 0%RH~80%RH
Resolution	0 .1 m / s	Parameters	485 (modbus) protocol Baud Rate: 2400, 4800 (default), 9600 Data bit length: 8 Parity: none Stop bit length: 1 The default ModBus Address: 1 Support Function code: 03
power consumption	0.4W		
Response Time	≤ 0.5s		
Start wind speed	≤ 0.2m / s		
Working Temp	-20℃~+60℃ , 0%RH~80%RH	response speed	≤ 0.5s
Output signal	RS485/Analog/Pulse	Output signal	RS485/Analog

Cost: Rs.5000.00

3. Rain Detection Sensor - MD0207

- Operating voltage: 5V
- Operating current: less than 20mA
- Sensor Type: Analog
- Detection Area: 40mmx16mm
- Production process: FR4 double-sided HASL
- Operating temperature:10-30
- Humidity: 10% -90% non-condensing
- Product Dimensions: 62mmx20mmx8mm

Cost: Rs.80.00

4. Arduino

Arduino UNO is a low-cost, versatile, and easy-to-use open-source programmable microcontroller board that may be used in a wide range of electrical applications. This board can operate relays, LEDs, servos, and motors as an output and can be interfaced with other Arduino boards, Arduino shields, and Raspberry Pi boards.

Cost : Rs.1500.00

5. Sign Solar Panel Arduino DIY Cell Photovoltaic

- Output power: 1W
- Rated voltage: 6V
- Rated current; 166 mA DC
- Size: 110 x 60mm

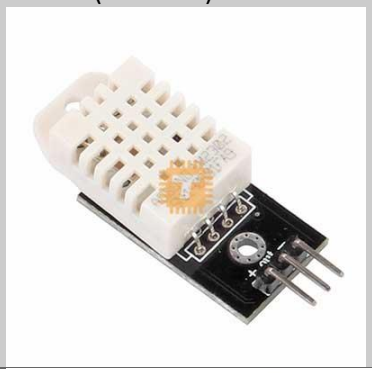
Cost: Rs. 1000.00

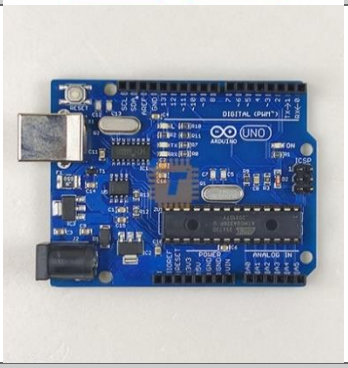
6. SIM900A GSM GPRS Module with Antenna (MD0506)

- Single supply voltage: 3.4V – 4.5V
- Power saving mode: Typical power consumption in SLEEP mode is 1.5mA
- Transmitting power: Class 4 (2W) at EGSM 900, Class 1 (1W) at DCS 1800
- Built-in Network Status LED
- Download transfer max is 85.6KBps
- Upload transfer max 42.8KBps

Cost: Rs. 2000.00

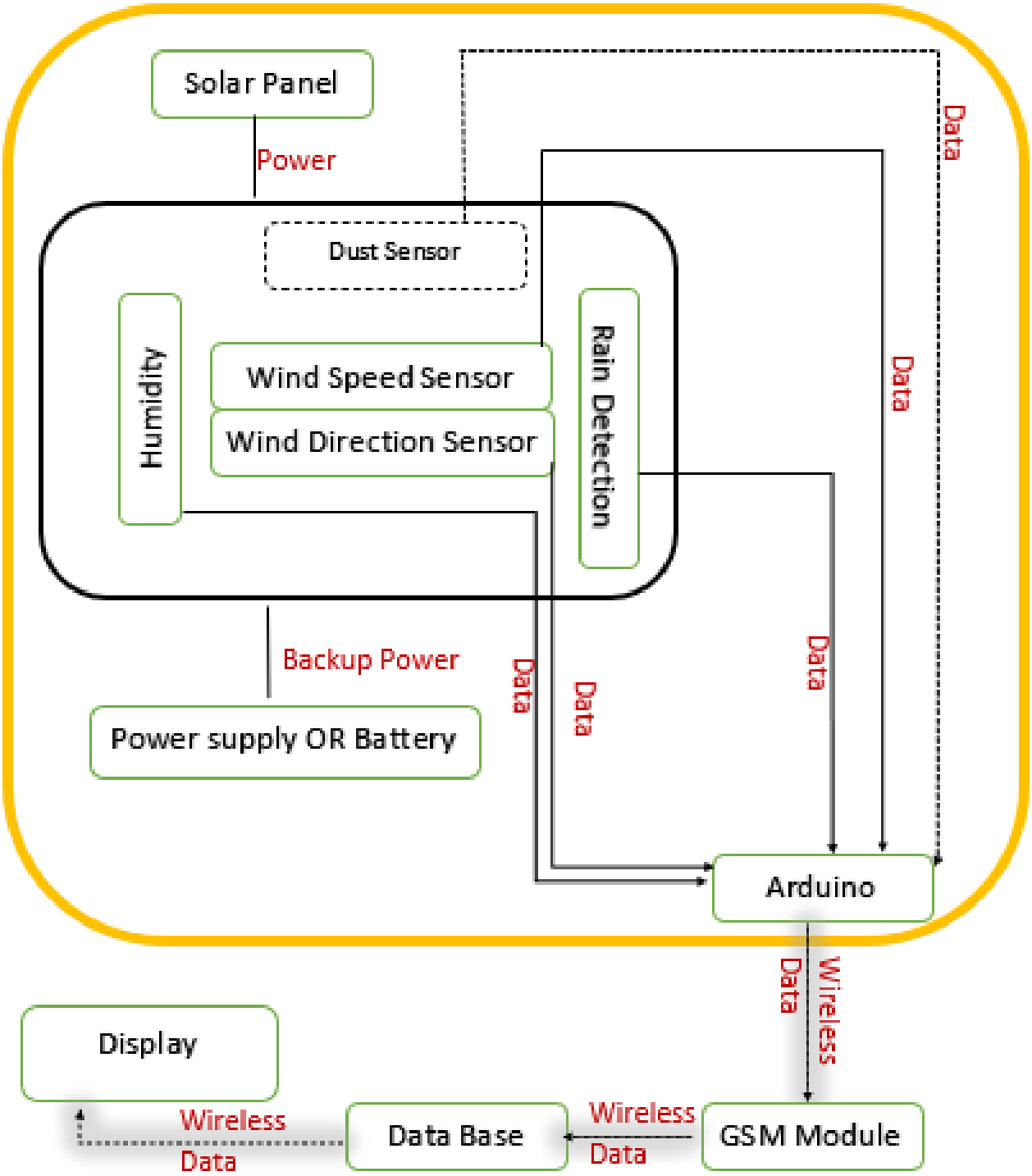
Budget

COMPONENT	IMAGE	PRICE
Humidity and Temperature Sensor	DHT22 (MD0229) 	1250/=
Wind Speed and Direction Sensor		5000/=

Rain Detection Sensor	MD0207 	80/=
Arduino uno		1500/=
Solar Panel	DIY 	1000/=

GSM Module		2000/=

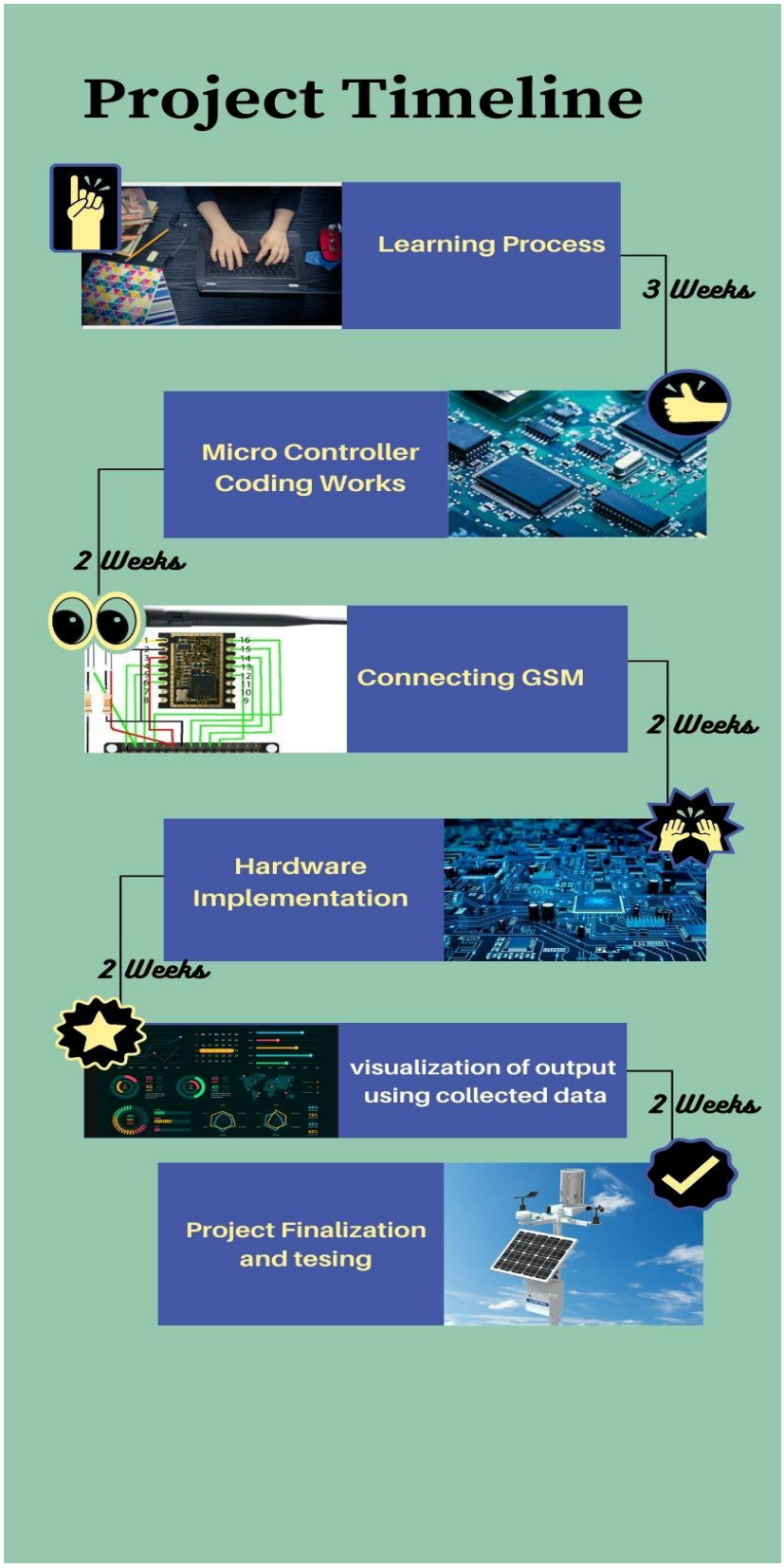
Block Diagram of the Station



How this works?

- The power for the station is provided by solar panel. Power supply and battery could be used as backup supply.
- The sensors are positioned and the data from the sensors are extracted into the Arduino and is transferred to the database using gsm/gprs module.

Project Timeline



Integrating Machine learning to the project

The low power weather station could be enhanced by adding feature of weather prediction. This project tries to use a machine learning algorithm to predict weather using the data extracted from the sensors which are updated into a database. This could also be displayed along with the sensor data.