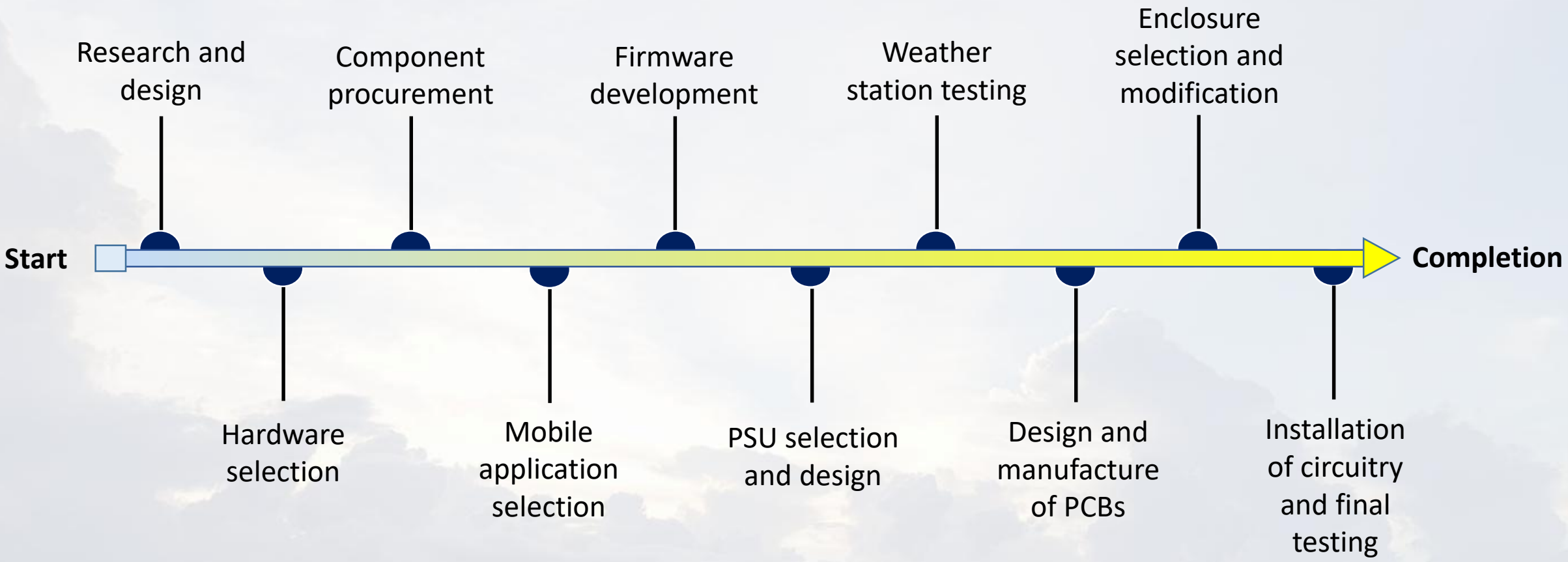
PORTABLE WEATHER MONITORING STATION

DESIGNED BY MUHAMMAD ALLI

Design process



Background

Purpose:

To design and build a portable weather station that is capable of measuring and logging weather conditions in South Africa (all weather variable ranges were informed by the extremist weather conditions ever recorded in the country up to the time when this project was completed).

Applications:

Various industries:

- Agriculture: Irrigation control;
- Construction: Ensure employee safety when working at heights;
- Aviation: Ensure safe airplane landings and take-offs;
- Meteorology: Study of local weather conditions.

Design specifications:

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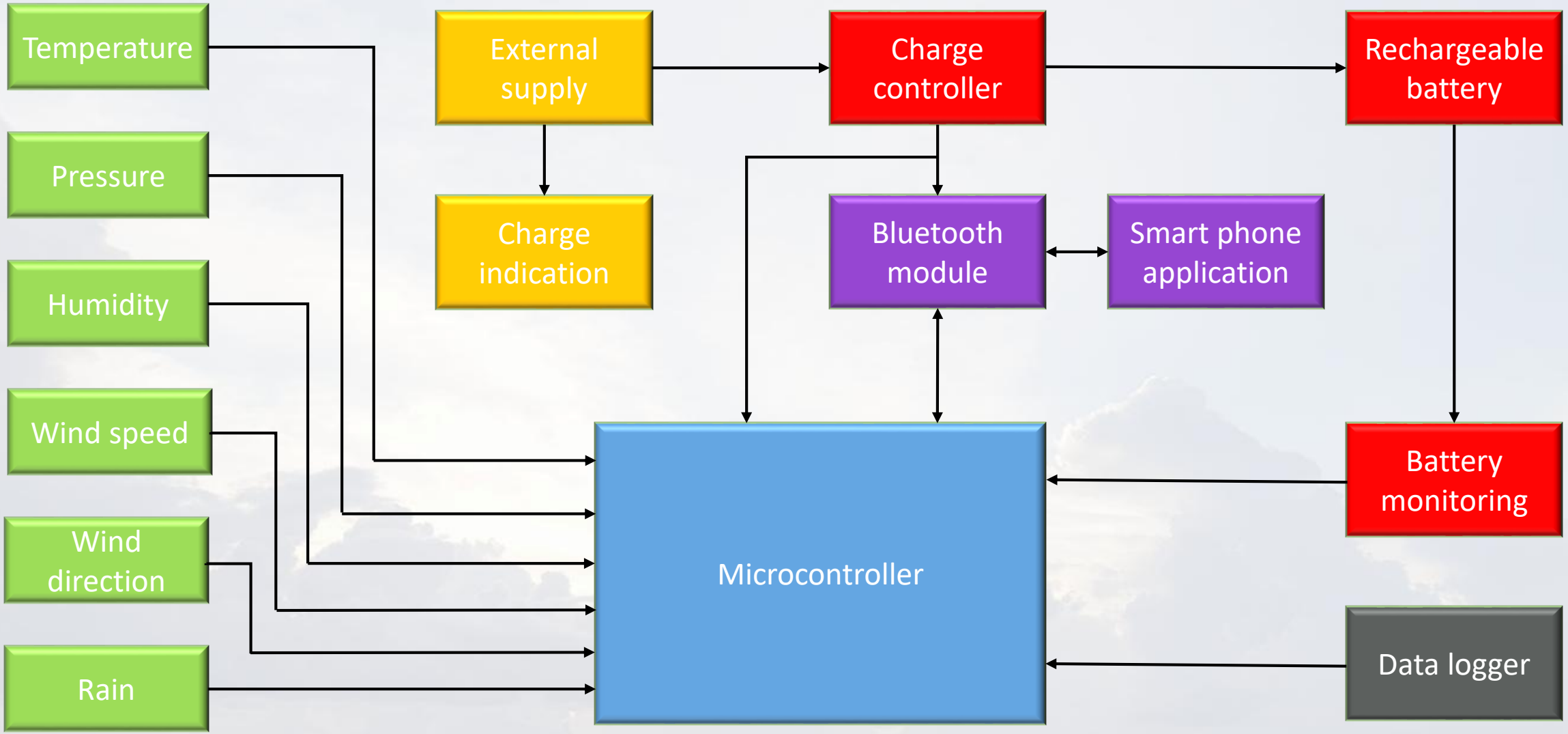
Weather Variable	Design specification	Tolerance
Temperature	-22 to 55 $°C$	2 $°C$
Pressure	600 to 1050 hPa	± 10 hPa
Humidity	0 to 100%	$\pm 5\%$
Wind speed	0 to 190 km/hr	$\pm 10\%$
Wind direction	N, NE, E, SE, S, SW, W, NW	$\pm 5\%$
Rain	0 to 28 mm/hr	± 2 mm/hr

- communicates sensor data to a mobile application via Bluetooth;
- has a 12-hour minimum period of operation;
- is able to log timestamped weather data.

Design

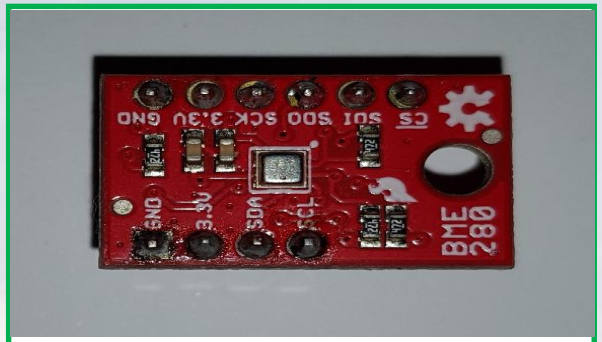
Block diagram:



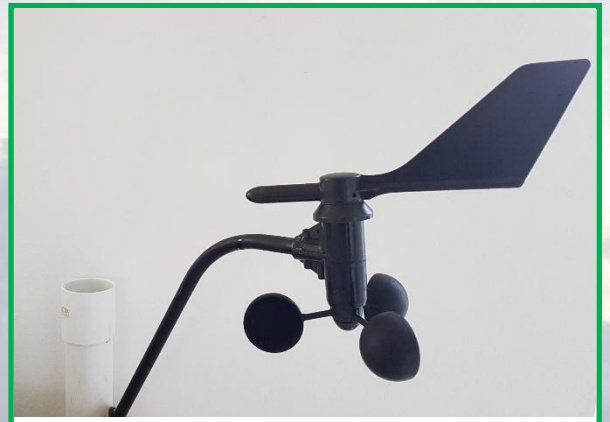
Sensor selection

Sensors:

BGT WS-601ABS2 Rain Sensor



BME280 pressure, temperature and humidity sensor



Davis 6410 wind speed and direction sensor

Technical summary:

Sensor	Sensor Resolution	Sensor Range	Design specification
BME280: Temperature	0.01 $°C$	-40 to 85 $°C$	-22 to 55 $°C$
BME280: Pressure	0.18 Pa	300 to 1100 hPa	600 to 1050 hPa
BME280: Humidity	0.008%	0 to 100%	0 to 100%
Davis 6410: Wind speed	0.905 km/hr	0 to 322 km/hr	0 to 190 km/hr
Davis 6410: Wind direction	1^o	0 to 360^o	N, NE, E, SE, S, SW, W, NW
BGT WS-601ABS2: Rain	0.8 mm/hr	0 to 240 mm/hr	0 to 28 mm/hr

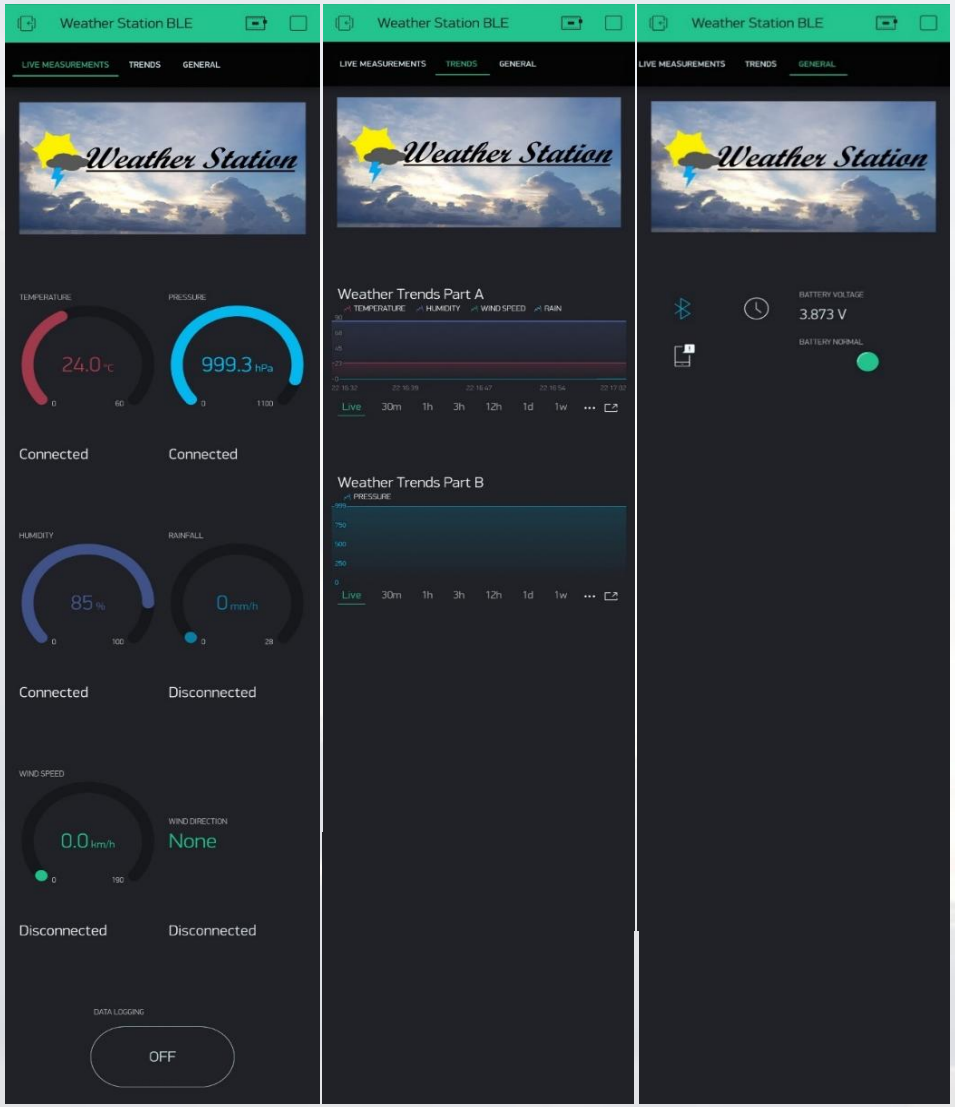
Testing Results

Sensor	Sensor error	Design Tolerance
Wind speed	8.3% (speed > 10m/s) 1m/s (speed < 10m/s)	10% (speed > 10m/s) 1m/s (speed < 10m/s)
Wind direction	4°	5°
Temperature	1.4 ℃	2 ℃
Humidity	1.75%	5%
Pressure	1.46 hPa	10 hPa
Rain	0.8 mm/hr	2 mm/hr

Operation	Desired period of operation	Actual period of operation
Without cycling sleep mode	12 hours	16 hours and 41 minutes
With cycling sleep mode	12 hours	18 hours and 17 minutes

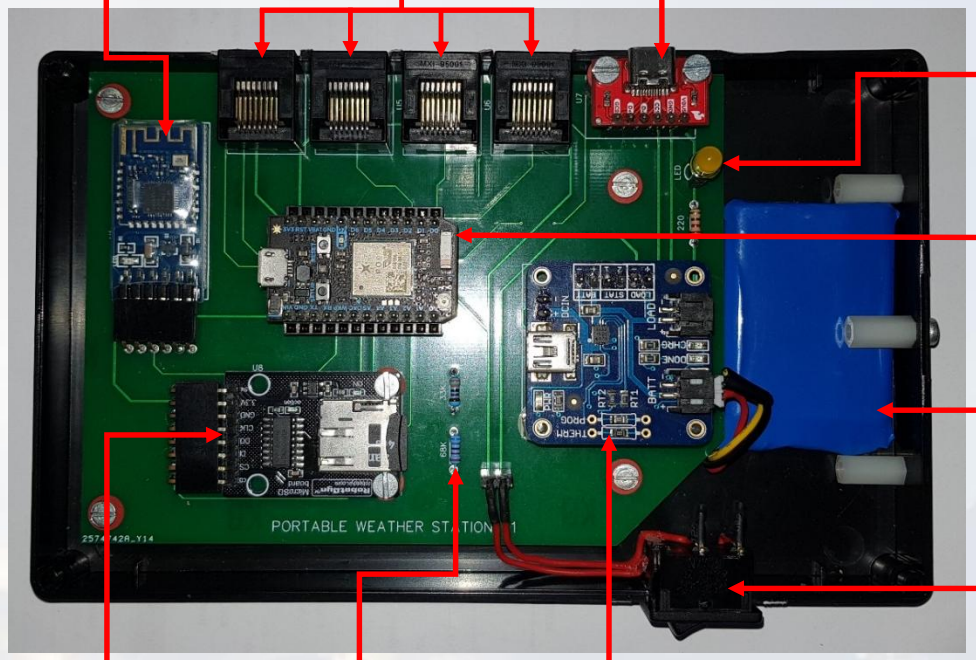
Weather station main hardware and interface

Blynk mobile application



Bluetooth communication

Weather station hardware



Enclosure


CHARGING PORT
IIC
BME280
WIND
RAIN


CHARGE INDICATION
Weather Station


OFF
ON