MAKERERE  **UNIVERSITY**

Design of a Weather Station.

By

Muhairwe Arnold

Email: engineer.arnoldmuhairwe@gmail.com Tel: +256755230906

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Background

Internet of Things (IoT), refers to a network of physical objects, “things” that are embedded with sensors, software and other technologies to allow connectivity and data capture and exchange with systems via/over the internet.

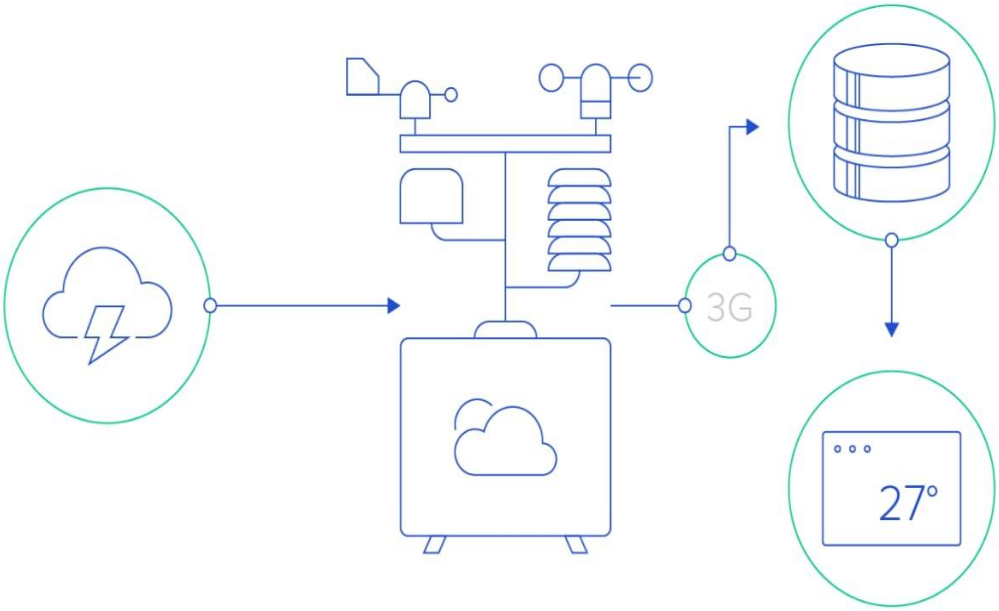
Weather can be defined as the state/condition of the atmosphere with respect to conditions such as temperature, humidity, rainfall, pressure, wind direction and wind speed among others. These conditions are ever changing and are also important in agriculture, given that it depends on such conditions, hence the need for weather stations.

Due to the limited nature of the power sources, coupled with the power-hungry activities, the automatic weather stations usually go offline, leading to data losses. Data losses create data gaps in collected weather data, which limits the quality of weather forecasts, hence affecting the quality of weather predictions. In such scenarios, remotely deployed weather stations face downtime and hence, the useful weather data is in fact lost.

Also, majority of these remotely deployed weather stations are often times left in the care of untrained personnel due to the rather long distances that must be trekked during routine maintenance. This means that recovery from small faults is therefore not possible since they are untrained, hence revealing the need for resource awareness in IoT weather stations.

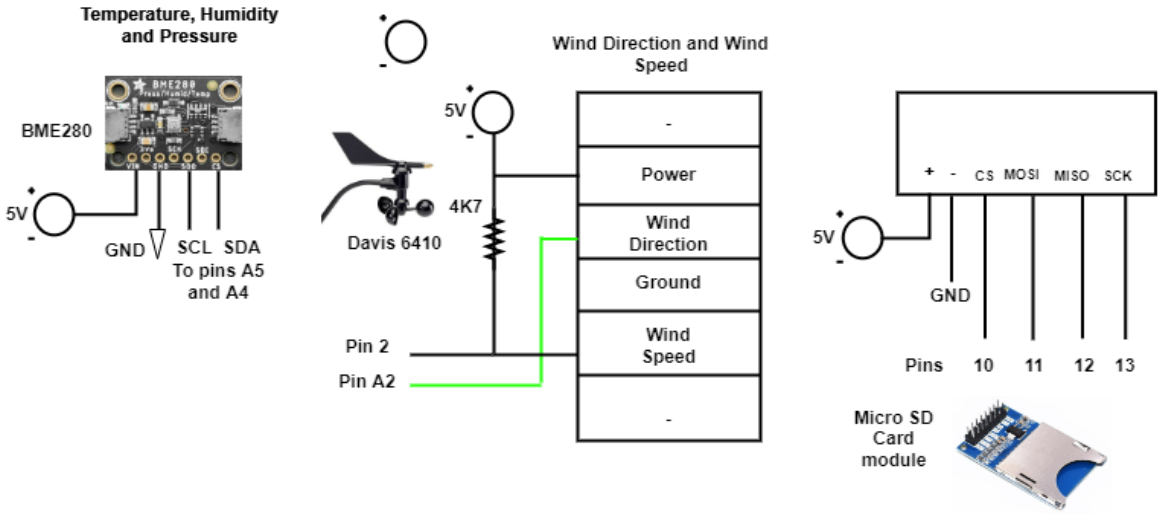
2.0 FUNCTIONS

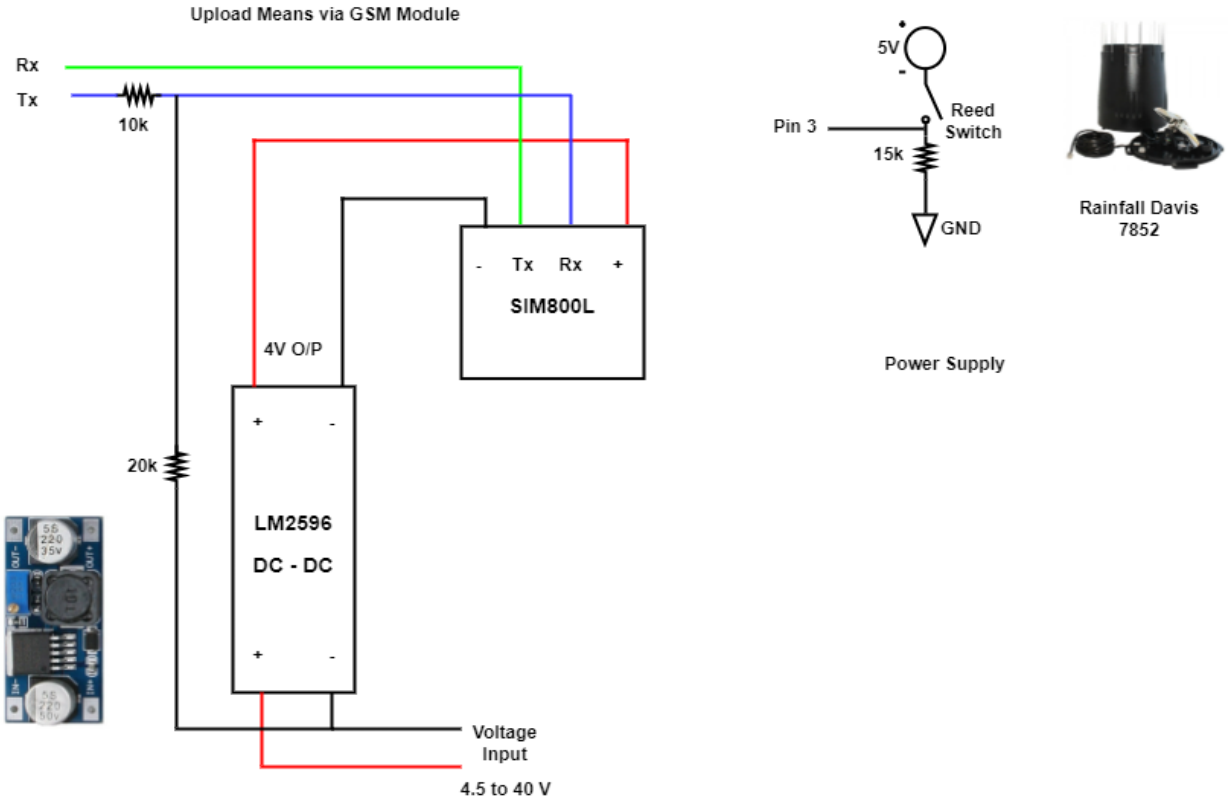
The weather station will be able to measure temperature, humidity, pressure, wind speed, wind direction and rainfall(precipitation).



The sensors are to be mounted directly onto the printed circuit board, and others, plugged into peripherals provided on the board. The sensors will interact with the Atmega328 microprocessor via different protocols such as TWI, SPI, I2C and also reading Analog values and utilising an SD Card for local storage of weather data.

3.0 DESIGN AND SELECTION OF SENSORS



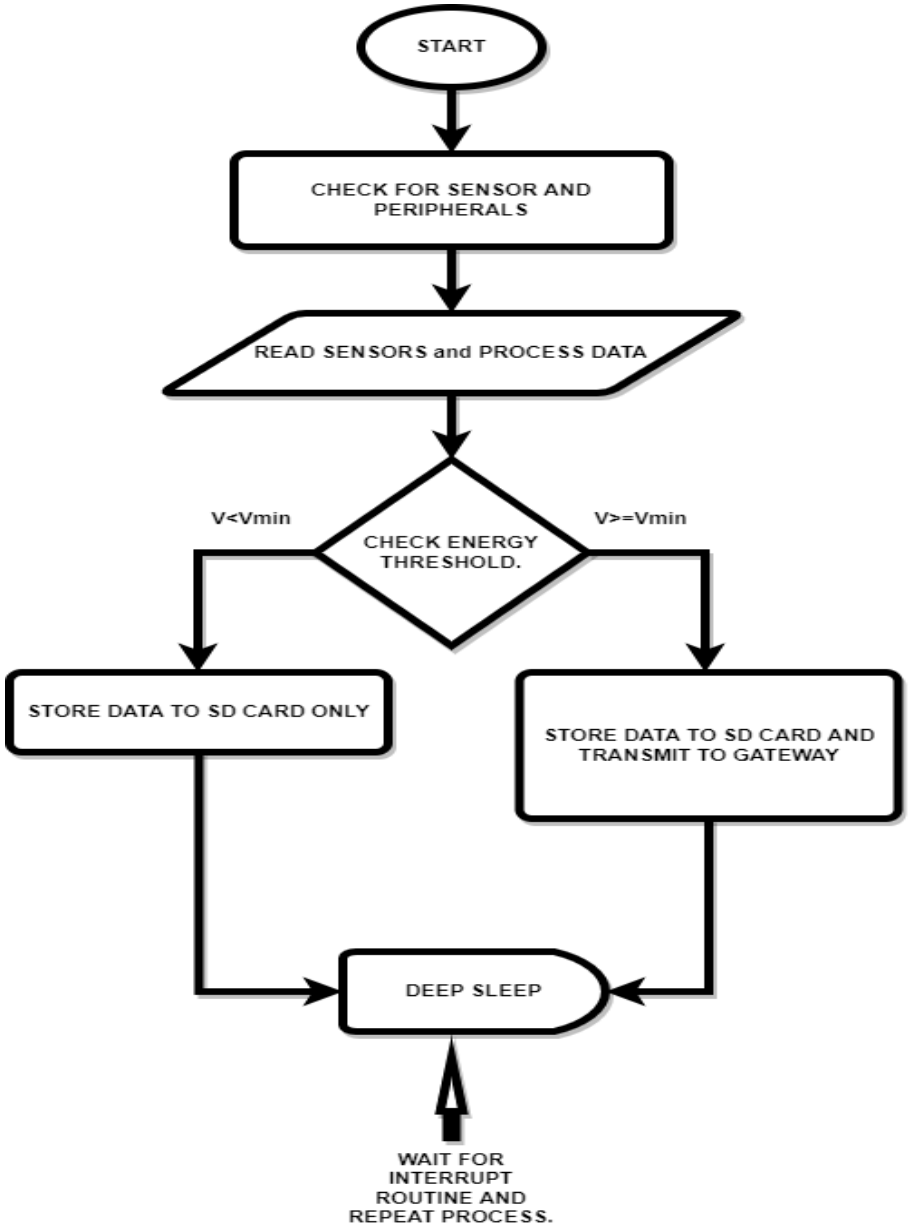


The selected sensors are chosen for their low margins of error, high accuracy, easy adaptation, plug and play and also, reliability.

WEATHER PARAMETER	SENSOR
WIND DIRECTION	SOLID STATE MAGNETIC SENSOR
WIND DIRECTION	WIND VANE with Potentiometer
RAIN	TIPPING BUCKET – 0.02MM, Magnetic Reed Switch
TEMPERATURE	PN JUNCTION SILICON DIODE
PRESSURE	PIEZO RESISTIVE PROPERTY OF SILICON and GERMANIUM
HUMIDITY	FILM CAPACITOR ELEMENT

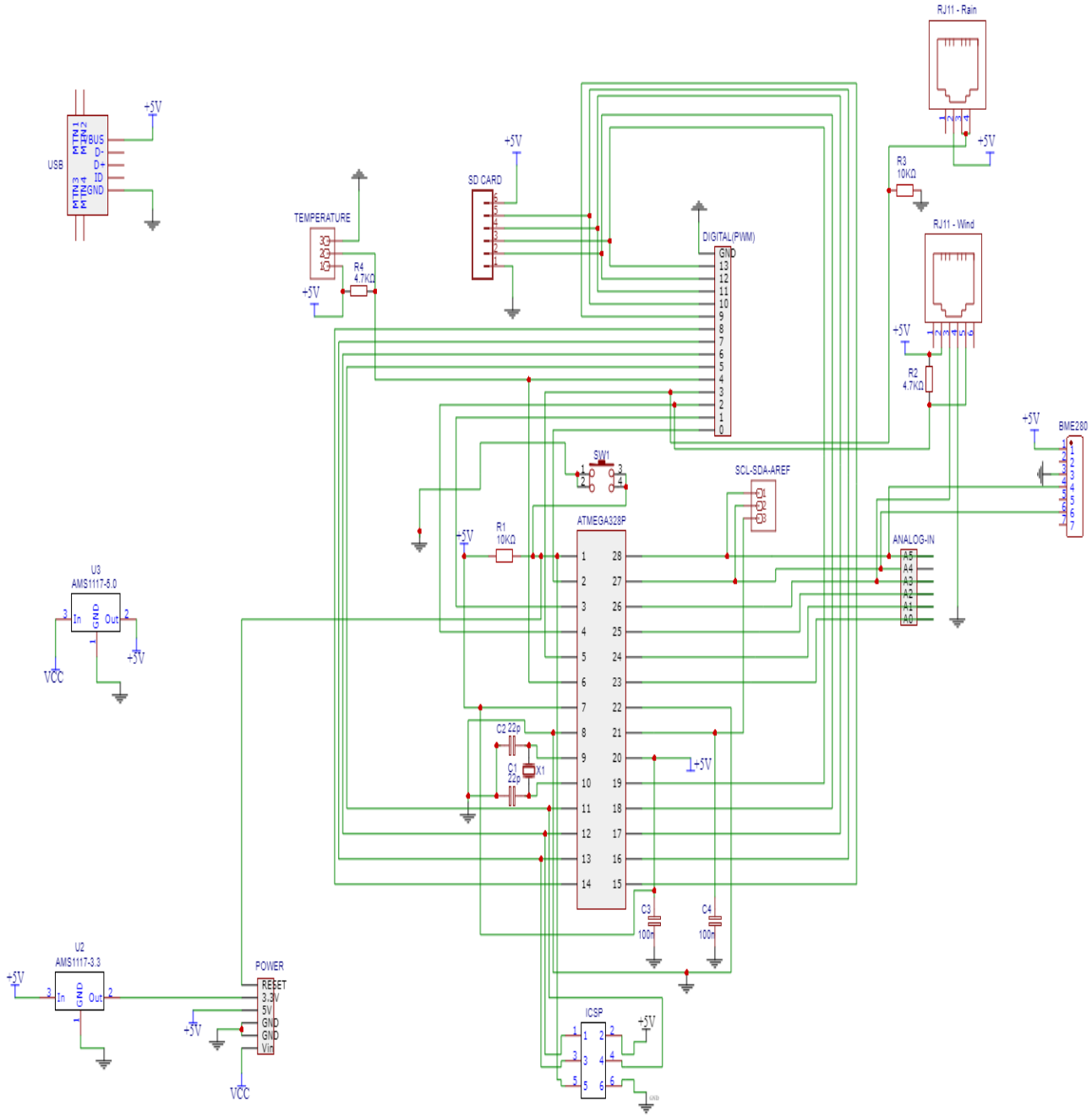
4.0 SOFTWARE AND HARDWARE DESIGNS

SOFTWARE:



The flowchart illustrates the flow of the algorithm from sensing the environment to processing of data.

HARDWARE:


RJ11 - Rain
RJ11 - Wind
USB
+5V
SD CARD
TEMPERATURE
R4
4.7KΩ
R3
10KΩ
R2
4.7KΩ
R1
10KΩ
DIGITAL(PWM)
SW1
SCL-SDA-AREF
ATMEGA328P
ANALOG-IN
BME280
U3
AMS1117-5.0
U2
AMS1117-3.3
VCC
C2 22p
C1 22p
X1
C3
100n
C4
100n
POWER
RESET
3.3V
5V
GND
GND
Vin
ICSP

5.0 CONCLUSION

The weather station is also to be tested with LoRa Radios, the RFM95W as a transmission means and an alternative taken among the available means of transmission, based on usage at hand and longevity of operation.