Software Requirements Specification

for

SMART WEATHER STATION

Version 1.0 approved

Prepared by ***M.H.A. Ahmed & N.M.Hafeel***

Team Data Pirates

24-05-2022

Table of Contents

Revision History

Name	Date	Reason For Changes	Version

1. Introduction

1.1 Purpose

This project is to build up a smart weather station. 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 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 advancement of this project.

1.2 Intended Audience

1. Public
   The public could be aware of the climate conditions of their area, so that they could plan their life accordingly. Harsh climate condition warnings provided by the system would be useful for the public. The farmers and fishermen would be much benefited from this project as their activities rely on climate conditions.

2. Meteorological Department
   The meteorological department would be able to collect data from locations more accurately from the smart weather stations data pertaining to each specific location.

1.3 Hardware 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

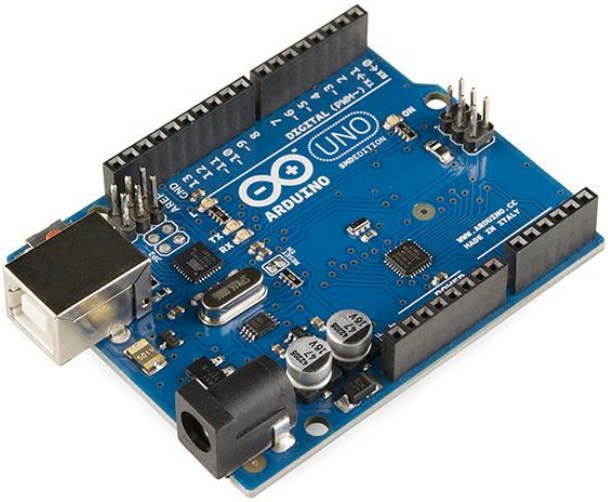
2. Wind Speed and Direction Sensor

The sensors accurately measure the wind speed and wind direction, providing output signals compatible with most DDC controllers.Intended for applications where external weather conditions influence the building control strategy, such as for the automatic closing of windows in high wind conditions.

3. Rain Detection Sensor

A rain sensor or rain switch is a switching device activated by rainfall. There are two main applications for rain sensors. The first is a water conservation device connected to an automatic irrigation system that causes the system to shut down in the event of rainfall

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

1.4 System Overview

In the weather station, battery or Power supply could be used as solar cells would be insufficient power generation during some months. The power demand of the system needs to be maintained for effective working of the device. The power station designed in this project would be able to be used 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 need 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.

2. Overall Description

2.1 Product Perspective

The smart weather station is a self-contained standalone product with 3 major components.

1. Microcontroller
2. Collection of Sensor Components
3. Remote server

4. Web User Interface

    - The sensor components are integrated to the arduino mega microcontroller.
    - The remote server is updated with the real time data from the sensors and is used to render the user interface.
    - The web user interface displays the real-time weather information and the prediction of the chance of rainfall using the Random Forest Classifier algorithm of Machine Learning.

2.2 Product Functions

- Getting the real time weather information from the sensors to the server.
- Prediction of the chance of rainfall using a machine learning model
- Rendering of the weather information and prediction to a web user interface

2.3 User Classes and Characteristics

- Users - The users would be able to view the web interface and get the information about the weather and predictions on weather.
- Embedded Technician / Engineer - The product needs to be maintained. The technician / engineer would be given access to the software and hardware components for modification , development and maintenance of the product.

2.4 Operating Environment

The hardware component of the product consisting of the sensors and the microcontroller would be placed outside. Thus, the hardware component may need to be operated under harsh climate conditions as well. The software part consisting of the web user interface and the server should be prone to traffic and overloading which could not likely happen.

2.5 Design and Implementation Constraints

This device needs to measure the weather information correctly and accurately. The sensors need to be accurate, thus an accurate sensor data could be obtained. Thus, the prediction would also be accurate. The possibility of the damage of sensors in harsh conditions could lead to explicitly false sensor data. Thus, the need to check whether the data from the sensor is within the range of the possible data values for the weather parameter obtained from the respective sensor.

There will always be an error associated with functionality of the device as the sensor data would be of some small error. The power too seems to be a constraint to the system. As the device is stationary, a household / direct supply could be given to the device.

2.6 User Documentation

A detailed instruction manual of the parts of the embedded device will be provided along with the model details used. This would be provided in English.

3. External Interface Requirements

3.1 User Interfaces

The main user interface to access the smart weather station is a webpage. The webpage is developed by using react js.The web page will show sensor data details like Humidity,temperature,wind speed and wind direction.It also displays the chances for the rain today.

The webpage will get details from the database and it will update it every 5 minutes.

3.2 Hardware Interfaces

The device must connect to the internet to download to locations.

3.3 Software Interfaces

Software Used	**Description**
Database	To save the sensor details we have chosen SQL database.
Visual Studio Code	Visual Studio Code is used to code the webpage
React JS	For the user interface
Node JS	Server

3.4 Communications Interfaces

There is a weather station webpage to interact with our system.

4. System Features

Following are the functionalities of the Accuweather application that are required for the system to work properly, to fulfill its purpose, and provide a desirable output.

4.1 Hourly Weather Update

The web application displays the latest weather information collected into the server. The server is updated with weather information every hour.The database is updated hourly and the web a[pplication is automatically refreshed displaying the latest information.The screen that appears is of current weather. It shows us weather in words with degrees outside. So that we can easily know what type of weather it is. There is a small pane on the right side that shows us details of current weather and the prediction of rainfall.

4.2 Cloud Saving

All the weather information would be stored in the database to be used as datasets for further advancement of the system.

4.3 Weather Prediction

The information saved in the database would be used to make a machine learning model that predicts the chance of rainfall.

5. Other Nonfunctional Requirements

5.1 Performance Requirements

At least ten people should be able to use the system at the same time. Every day, data should be safeguarded and backed up. The software has a response time of less than 5 seconds. The software should be available 24 hours a day, 7 days a week, and in real time. This software application will not become stuck or cease when doing any action.

5.2 Safety Requirements

The sensors will be protected.Therefore,the Weather will not damage or affect the sensors and the performances. The web page can be only viewed. Thus, editing access is not given for any individual.

5.3 Security Requirements

Messages should be sent and received over a Reliable Data Transfer connection.

5.4 Software Quality Attributes

The graphical user interface (GUI) design by usability .The app is user friendly and organized in this style that the user finds it attractive to observe. There will be no notifications about the latest weather forecast as the weather forecast is usually checked when only needed. For flexibility and

adaptability if the user disconnect with the internet or having weak connectivity the user still able to view the interface till the connection established.

6. Other Requirements

- The sensors should be replaceable.
- Should be able to transfer the whole device from one place to another.

Database

Entity		
	Humidity	numeric(8,2)
	Temperature	numeric(8,2)
	Water level	numeric(8,2)
	Wind speed	numeric(8,2)
	Wind direction	char(10)

Data Flow Diagram