

# Software Requirements Specification

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## Cyber Environment

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## Revision History

Revision	Date	Reason for changes
1	2/17/18	Initial creation of SRS
2	3/7/18	Expanded on assumptions and dependencies
3	4/4/18	Revision history on separate page
4	4/9/18	Fixing grammar and other small mistakes

# 1. Introduction

## 1.1 Purpose

This document will cover the software requirements and specifications for the water weather station and accompanying phone application, database, and website. The rest of this section outlines the overall scope of the project.

## 1.2 Document Conventions

Term	Definition
BLE	Bluetooth low energy
Launchpad	Texas Instruments cc2650 or cc2340 Launchpad
MCU	Microcontroller unit
Station	The water bottle, MCU, sensors, batteries, and other pieces that come together to complete a single water weather station

Table 1 - Definitions

## 1.3 Audience

This document is intended for anyone who is interested in the water weather stations and accompanying software for the purposes of teaching, or general use. The primary users are middle school students that take the stations home from summer camp. Other users are teachers and staff at the summer camp who will be using the stations to teach concepts of cyber security while relating to marine ecosystems, as well as developers and others who are interested.

## 1.4 Scope

Dr. Erik Frethiem and the Sea Discovery Center are looking for a way to teach kids about the concepts of cybersecurity at a marine biology summer camp in July 2018. They are hoping to use a series of compact waterproof container weather stations that will be able to collect and store data, then upload that data to a smartphone application which will verify the data before sending it to be stored in a centralized database. After the data has been added to the database, it will be available for viewing in a friendly format on any web browser. A login will be added for security to protect data from corruption or unwanted access. The designs and software will be made available and should be basic to use for teachers and students so that in the future, many stations could be set up in different locations that will all contribute to an ever growing database of ocean climate data.

The array of sensors on each station will periodically read and store Data will include measurements of salinity, turbidity, air temperature, surface water temperature, and the water temperature at depth. Readings will occur every 5 minutes. If the memory limit of the device is reached, readings will be overwritten with emphasis on maintaining a record of changes for the entire logging period.

**1.5 References**

None at this time

## 2. Overall Description

### 2.1 Product

The software and hardware developed for this project is intended for use as a tool to teach middle schoolers (grades 6-8) about cybersecurity and learn about changes in the ocean environment. Students will learn how to use the weather station, accompanying app, and website so they can take their own weather station home to collect and view data. Existing software for the station MCU and Android application will be modified to suit this purpose.

### 2.2 Project

- Design weather stations that collect and store data from a variety of sensors.
- Updating a pre-existing android app to wirelessly retrieve data from stations, verify the user, and send the data to a database.
- Creating a database to store all of the collected data.
- Creating a website to act as an interface to the database where users can download open weather data.

### 2.3 User Classes

We have a few different types of users that will be interacting with the hardware and software that we design; students, teachers, and developers.

Users - are the primary users of the stations. They will be collecting data from the stations using the phone application, and viewing the data collected by their station on the website.

Administrators - Teachers and staff will also be direct users, their interactions with the products will be geared towards teaching the students concepts of cybersecurity. They will have to learn how to use the products.

The developers of the project will be users. They will be interacting with the products for the development and testing phases of the products, but in the end will transition to a role of fixing and maintaining the systems that they design and create.

### 2.4 Operating Environment

Stations will be run by a Texas Instruments wireless MCU Launchpad, and will collect data with an array of attached sensors. The firmware on each MCU will be loaded by connecting the Launchpad to a computer with a USB cable. An Android smart device with a custom application will be used to connect to stations using BLE transmission. The app will be responsible for verifying the user, and uploading data to a MySQL relational database. The database will initially be hosted on a WWU CS server and eventually transition to a permanent location. A web interface will allow users to view collected data.

## **2.5 Design & Implementation Constraints**

The components that make up each station will fit inside a water bottle or other water tight container. Battery and memory on each station will be limited, but the battery for each station should be able to last for at least a month of data collection. Memory for storing logged data will not last for an entire month, so consistent data retrieval will be necessary. Otherwise some data may be overwritten which will reduce the granularity of the data. Another limitation will be the bluetooth range of the station.

## **2.6 User documentation**

Texas Instruments provides documentation and tutorials on their website through the TI resource explorer. These documents were used in the development of the stations and android application.

## **2.7 Assumptions and Dependencies**

The success of this project depends on users' continual contribution to this project. Data must be retrieved from stations on a regular basis in order to keep the public database updated. An Android device will be required for retrieving data from the station. Additionally, the batteries in these stations will need to be replaced by users.

## 3. System Features

### 3.1 Automatic data collection

Description: Deployed stations will automatically collect data on a predetermined time interval. Data will be stored from each connected sensor.

Priority: High

Stimulus and Response: Data collection will be triggered by a time interval. Data will be written to onboard memory. If memory is full, earlier data will be thinned to ensure sufficient storage capacity.

Functional Requirements: The hardware must have sufficient memory to store data at the desired time interval, as well as have enough battery power to sustain collection for an extended amount of time.

### 3.2 Data retrieval

Description: Data can be retrieved from stations on a predetermined time schedule. The station will advertise itself over bluetooth on a regular interval between the hours of 6am to 8pm.

Priority: High

Stimulus and Response: Data should be collected monthly, at the minimum. A successful transfer will be indicated.

Functional Requirements: Stations must regulate how often bluetooth is advertised to save battery life. The bluetooth connection should be password protected.

### 3.3 Data upload

Description: Data is uploaded from the Android application to a database after collecting data from the station.

Priority: High

Stimulus and Response: Once data is retrieved from a station, the data shall be signed and uploaded as soon as internet is available. A successful upload will be acknowledged.

Functional Requirements: Data must be signed on the Android device with a public key before being uploaded. The server will validate the data is coming from a user with proper credentials.

### 3.4 Publicly accessible database

Description: All data collected by the stations and stored in the database will be available through a web interface. Users can retrieve data from desired stations from a specified time window.

Priority: Medium

Stimulus and Response: Users navigate to the website, make a query, and relevant data is downloaded.

Functional Requirements: The interface must allow users to view data from a specific station and time frames. Must require users to login using unique usernames and passwords.



## **4. External Interface Requirements**

### **4.1 User Interface**

The primary features of the android application will have the ability to scan and connect to stations broadcasting a BLE signal. Once connected the application will display the status of the station's battery and memory and offer an option to collect data from the station. After data has been collected the application will attempt to upload the data to the database and alert the user of a successful or unsuccessful transfer.

The website for this project serves as a front end to the database housing data collected from the stations. Users visiting the site will be able to search and download data from desired stations over a desired time frame.

### **4.2 Hardware Interface Requirements**

Due to the operating environment of the stations there are various hardware requirements. All electrical components must fit inside a water bottle and sensors must be compatible with the on-board pinouts of the microcontroller. Because all components must be powered by a battery pack the station must also regulate data collection and BLE operation to save battery life.

### **4.3 Software Interface Requirements**

All data uploaded from the android application to the database must be signed. Before being added to the database all data will be validated, ensuring all data comes from a trusted source.

### **4.4 Communication Interface Requirements**

Communication between the microcontroller and android application will be via BLE. The phone application will upload data to the database via a TCP/IP connection.

## **5. Other non-functional requirements**

### **5.1 Performance**

- Prompt pairing time between phone and weather station in less than 20 seconds.

### **5.2 Safety Requirements**

- Users must use own judgment when choosing location of station.

### **5.3 Security Requirements**

- All data transfers must be signed with a public/private key.
- Station BLE connection must be password protected.
- User will create a unique username and password as their login information.

### **5.4 Quality Requirements**

- Weather stations must be able to collect and transmit data while ensuring battery life lasts extended amounts of time.

## **Appendix:**