Kathmandu University
Department of Computer Science and Engineering
Dhulikhel, Kavre

A Project Report
on

"Weather Station"

[Course Code: COMP 207]

(For partial fulfillment of 2nd Year/ 2nd Semester in Computer Engineering)

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Submission Date:

July 23, 2019

Bona Fide Certificate

This project work titled as

"Weather Station"

has been submitted to the Department of Computer Science and Engineering for the partial fulfillment of COMP 207 as a 2nd year 2nd semester project.

This project work is the bona fide work of

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who carried out the project work under my supervision.

Project Supervisor

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Name: Assistant Prof. Sushil Nepal

Project Coordinator

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Name: Mr. Nabin Ghimire

Abstract

The project “Weather Station” is to monitor local environment variables. The environment variables include temperature, humidity, pressure and pollution index. Today, we developed own environment whether it might be farm or green house or mine etc. These environments are bounded; they should be maintained to keep the process ongoing. The ‘Weather Station” measures such variables and helps to monitor the specific area or building environment. It might include lab, manufacturing industry, farm, dairy, mine or even local community. The data is available in the weather station web page as public or private. The private data is only accessible by particular private user. The public data is visible to everyone. This system includes different sensors that intakes data about pressure, temperature, humidity, pollution. The system sends the data to the web and app where the users can access data there. We expect this project will assist to maintain the local environment.

Keywords: *Python, Django, Raspberry pi, MongoDB, Node.JS.*

ACKNOWLEDGEMENT

It is our privilege to express our sincerest regard to our project supervisor, Assistant Prof. Sushil Nepal for his appreciable guidance, encouragement, valuable inputs and productive criticism throughout the duration of the project.

We would like to thank Department of Computer Science and Engineering (DoCSE) and the whole university for providing us a chance to work on the project.

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Acronyms/Abbreviations

The lists of all abbreviations used in the documentation are:

HTML: **Hyper Text Markup Language**

CSS: **Cascading Style Sheets**

PHP: **Hypertext Preprocessor**

OS: **Operating System**

SQL: **Structured Query Language**

DB: **Data Base**

UI: **User Interface**

Chapter 1: Introduction

1.1 Background

The weather change is an inevitable process throughout the year. Observing the weather parameters variations is essential to determine the seasonal changes. There has been always a huge importance of climate influence on living brings. This have inspired many scientist studying about weather impacts in living as well as non-living beings. Now, we have artificial environments for agriculture, researching etc. Beginning, there were simple and inaccurate instruments, which were inadequate for easy reading and storing data. Nowadays, there are many advanced observatories and labs collecting the environmental parameters continuously for different applications. The weather data can also be used for the fields like agriculture, research etc.

The data obtained from the input devices are more applicable and convenient if the measured data can be transmitted fast and accurate to the users. Transmission of the measured data could be done by different means including WI-FI link, GSM/GPRS link, satellite direct link, wired link etc. This system is developed for particular purposes. Using relatively inexpensive components, the development of a prototype system for measuring temperature, humidity, pressure and air pollution is made, which could be an inexpensive module for agricultural land or green house for the environment monitoring, and forecasting the data to the server which could be viewed and used for the periodical statistical analysis of the weather data.

1.2 Objectives

We initiate this project with the following objectives:

1. To measure weather statistics of specific area, lab, industry.

2. To help industry or firm for monitoring their environment.

3. To alert and help coping about the changing climate.

1.3 Motivation and Significance

Today, we human beings develop artificial environment for different purposes. For example, green house for off seasonal plants, a lab maintained at certain environmental variables, human favorable environment in space station etc. In future we are thinking of colonizing mars artificially creating a human favorable environment. These all environment are maintained at certain range of temperature, pressure and atmosphere. These types of situation are going to increase in near future. It can be used in mines, diary, research lab, etc. The workers in mines, animals in farms, lab environment all must be favorable.

The existing systems for specific are vague and traditional. Some modern weather sites measure general parameters which is quite inaccurate in research and application level. “Weather Station” is specialized system for specific small environments. So, data measurements are accurate and fast, they can be used in research and application level.

The significances of our projects are:

1. Easy hardware installation.
2. User friendly interface.
3. Wide range applications.
4. Support future extensions.

Chapter 2: Related Works

Nowadays, there are many works in of weather data measurement. The AccuWeather, BBC Weather, The Weather Channel are providing real time approximate data in terms of global scale. These platforms not only show data, they also forecast the weather. AccuWeather is one of the most popular weather forecasting medium in the world. They uses different algorithm, satellite images to predict the weather. The data provided by these platforms are not so accurate.

In terms of small scale, there are several related works. The most popular are Dyacon and AcuRite. These are expensive platforms. The Dyacon is generally used for research purposes while AcuRite is used for home. There is no public data in these systems but in “Weather station”, where every user can access them. In Dyacon and AcuRite, sensors are fixed and one cannot remove or add. So, these systems are less versatile compared to “Weather Station”.

2.1 Dyacon

The dyacon is automatic weather stations and instruments for commercial, industrial, and research applications. It uses weather data portal in order to provide tight integration for industrial and commercial users.

Figure 2. 1: Dyacon Weather Station

2.2 Acurite

AcuRite weather instruments and home monitoring tools provide access to real-time weather data, weather trends, historical temperatures.

Figure 2. 2: AcuRite Station and Interface

Chapter 3: Design and Implementation

STEP 1: All possible requirements of the system to be developed are captured and documented in a requirement of specification of document.

STEP 2: The requirement specifications are studied. This system design and system requirements were analyzed.

STEP 3: The system's front end is developed first and then back end is developed, which are integrated in the next phase.

STEP 4: Each part is developed and tested for its functionality. Then these sections were combined and tested.

STEP 5: The product is developed in the customer environment.

3.1 Use Case Diagram

The use case diagram of "Weather Station" is as shown below:

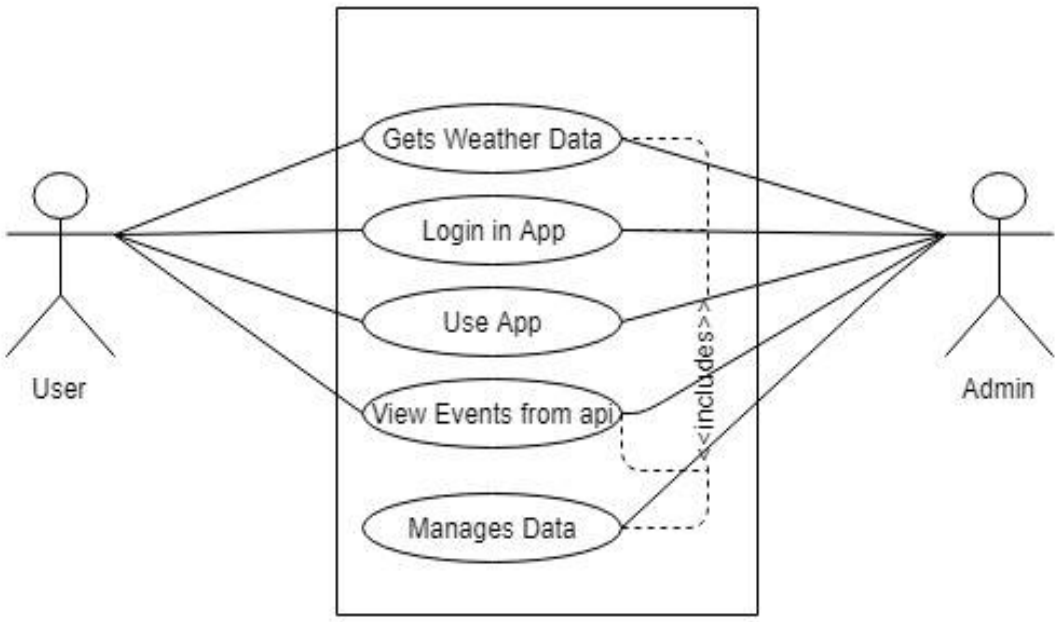
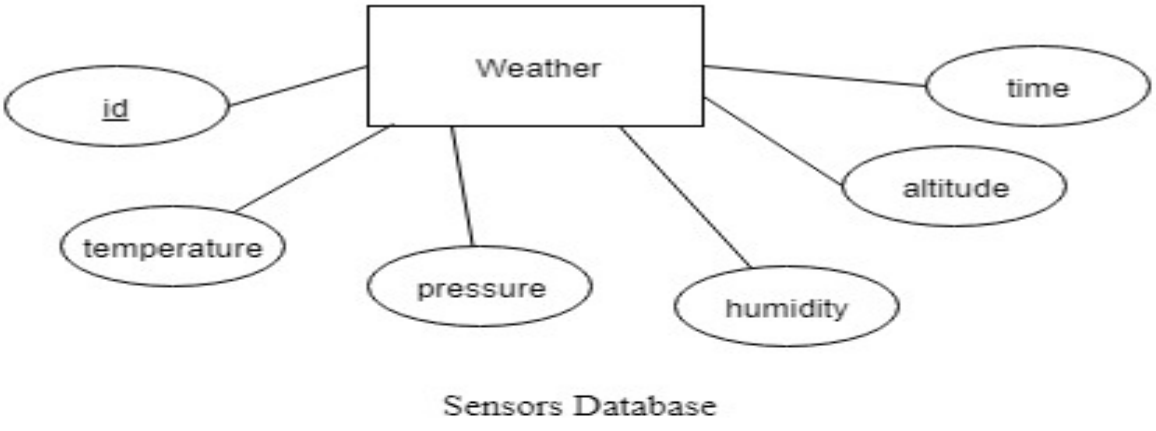


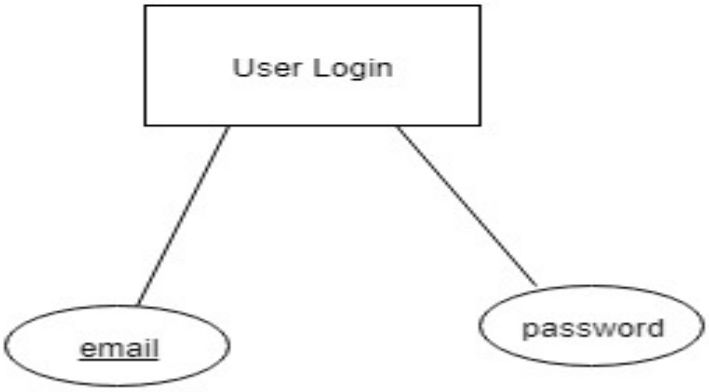
Figure 3. 1: Use Case Diagram of Weather Station

3.2 Entity Relationship Diagram

The ER diagram of databases of “Weather Station” is as shown below:



Sensors Database



Login Database

Figure 3. 2: ER Diagram

3.3 System Requirement Specification

3.1.1 Software Specification

3.1.1.1 Webpage

3.1.1.1.1 Front End Tools

1. HTML: HTML is used to write structure in the website.

2. CSS: CSS is used to style the components in the website.

3. JavaScript: JavaScript is used to handle events and perform certain actions on those events.

3.1.1.1.2. Back End Tools

1. MongoDB: MongoDB is a cross-platform document-oriented database program.

2. Node.js: Node.js is an open-source, cross-platform JavaScript run-time environment that executes JavaScript code outside of a browser.

3.1.1.2. Native Application

1. Dart: Dart is a client-optimized programming language for fast apps on multiple platforms.

2. Flutter: Flutter is an open-source mobile application development framework created by Google.

3.1.1.3. Raspberry Pi

1. Raspbian: Raspbian is free OS for Raspberry pi hardware.

2. Python: Python is an interpreted, high-level programming language. It interacts with hardware and intakes data.

3.1.2 Hardware Specification

The hardware requirements include the following:

1. **Raspberry Pi:** Raspberry Pi is a card-sized ARM powered Linux computer development board.
2. **MQ- 135:** The MQ- 135 Gas sensor used to measure pollution and gases in environment. It measures in ppm.
3. **AM2320 Digital Temperature and Humidity Sensor:** It measures the air temperature and humidity.
4. **BMP180 Pressure Sensor:** It measures the atmospheric pressure.

For webpage it requires smartphone or computer that can run web browsers smoothly and for android/ios application it requires a mobile phone having 1 GB ram.

3.2 System Design

3.2.2 System Architecture

The flow chart is as shown below:

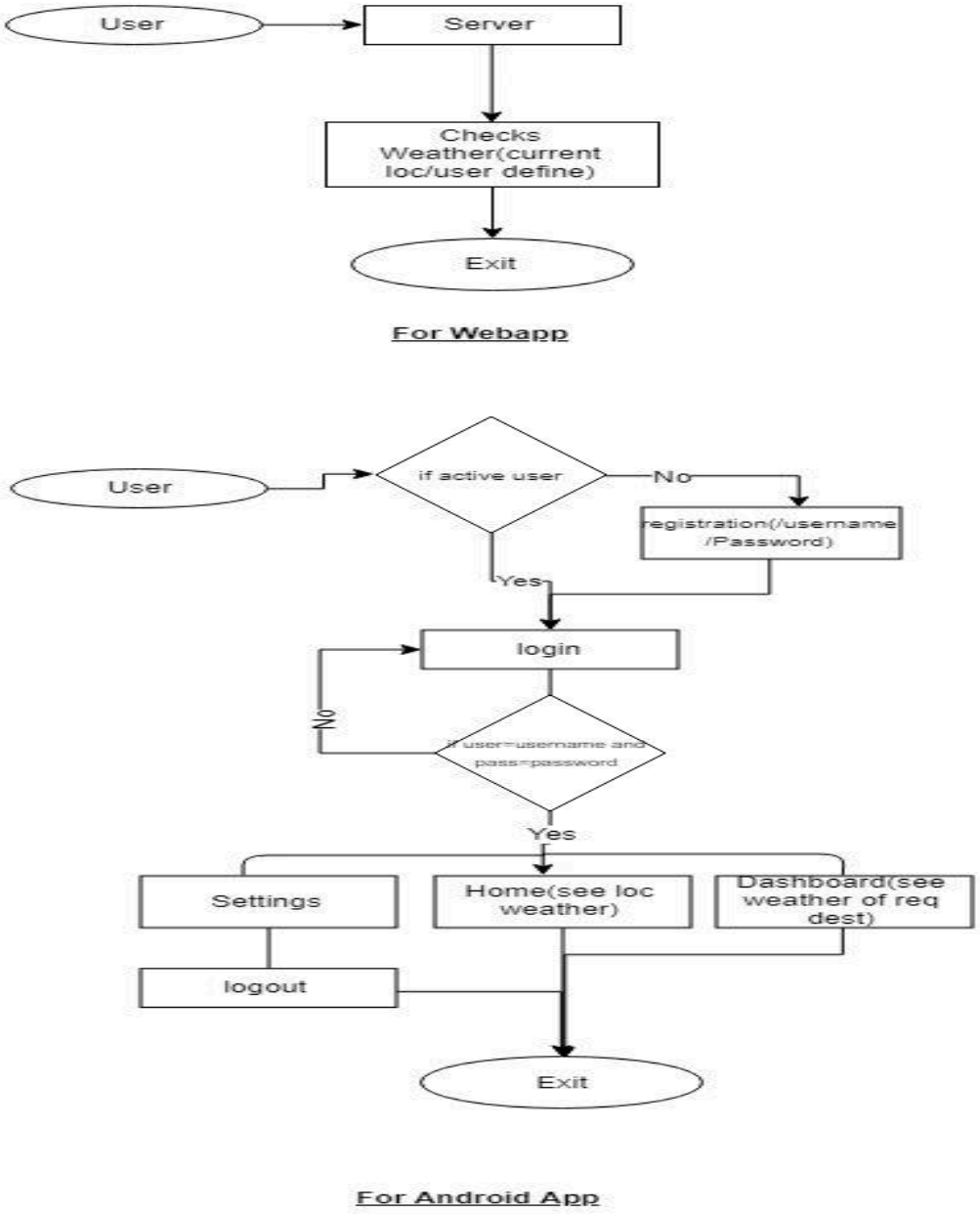


Figure 3. 3: Flowcharts

Chapter 4: Discussion on the Achievements

4.1 Challenges Faced

There were several problems which were hard to tackle, some of them are as follows:

-It was difficult to connect the data from sensors to database.

-This project is a web and mobile based application, so we need to code in two different platform.

-We spent a lot of time for learning backend programming language like Python, MongoDB, Node.Js, Dart etc. So time management was challenging for us.

4.2 Features

The following are the features of “WEATHER STATION”

- It measures temperature, pressure, humidity, pollution.
- The time interval between consecutive data can be customized.
- The database can store large amount of data.
- We can easily add or remove sensors easily depending upon our requirements.

Chapter 5. Project Planning and Scheduling

We divide our whole projects into seven basic tasks and planned it to complete with in sixteen weeks. The timeframe for this project is divided as:

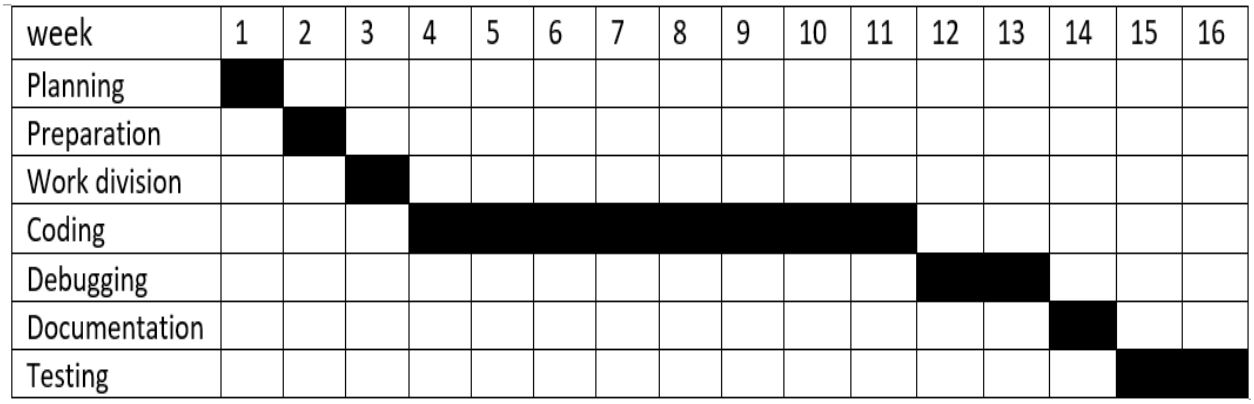


Figure 5. 1: Gantt chart

Chapter 6: Conclusion and Recommendation

The “Weather Station” is an environment monitoring system consisting of web page, mobile application, and hardware i.e. sensors and raspberry pi. In present context, the users either have to depend upon approximate global scale data or traditional way of monitoring system. So, for specific area they can get accurate and real time data using “Weather Station”.

6.1. Limitations

- It cannot predict weather.
- While adding new sensors, programing is required.

6.2. Future Enhancement

In future, with different algorithms the “Weather Station” can be used for weather forecasting of small area. We can add or remove sensors according to our requirement of type of data.

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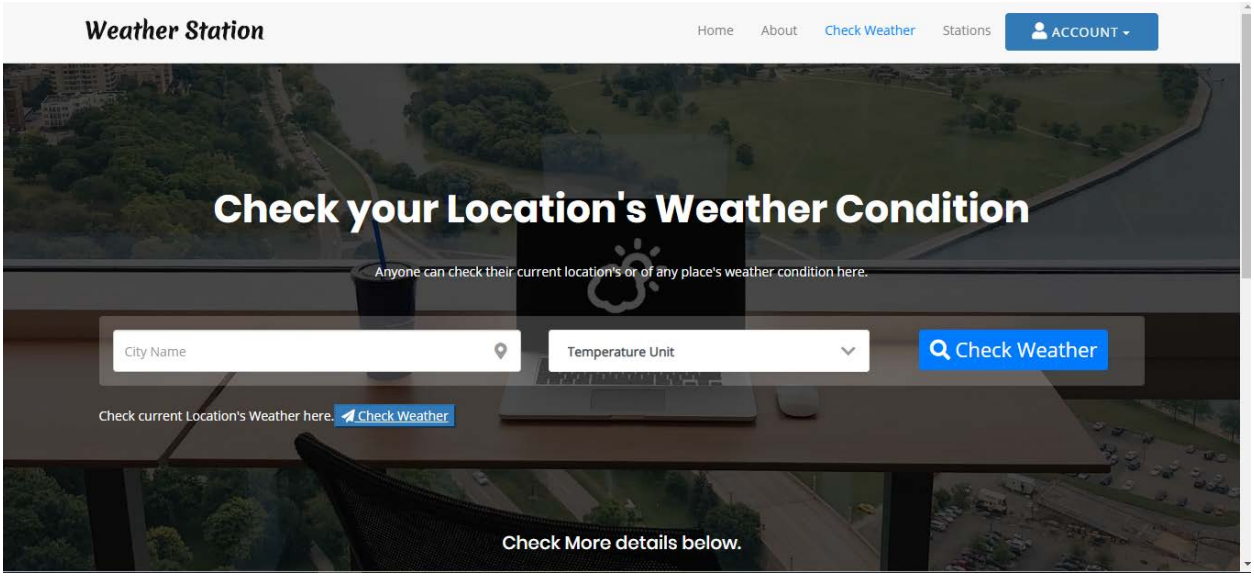
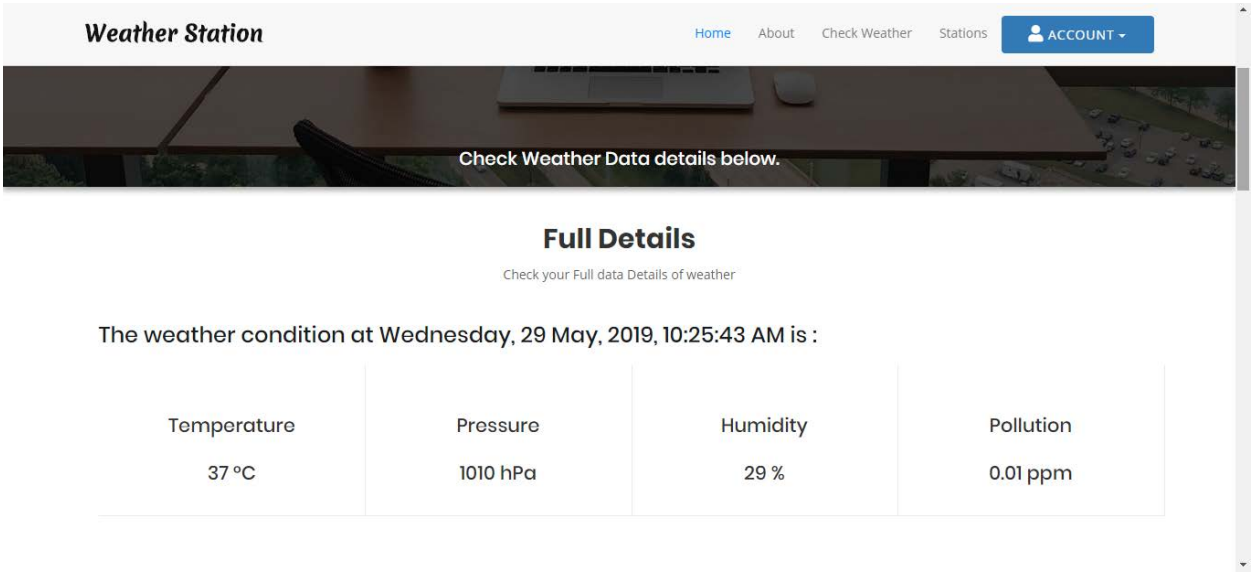
Appendices

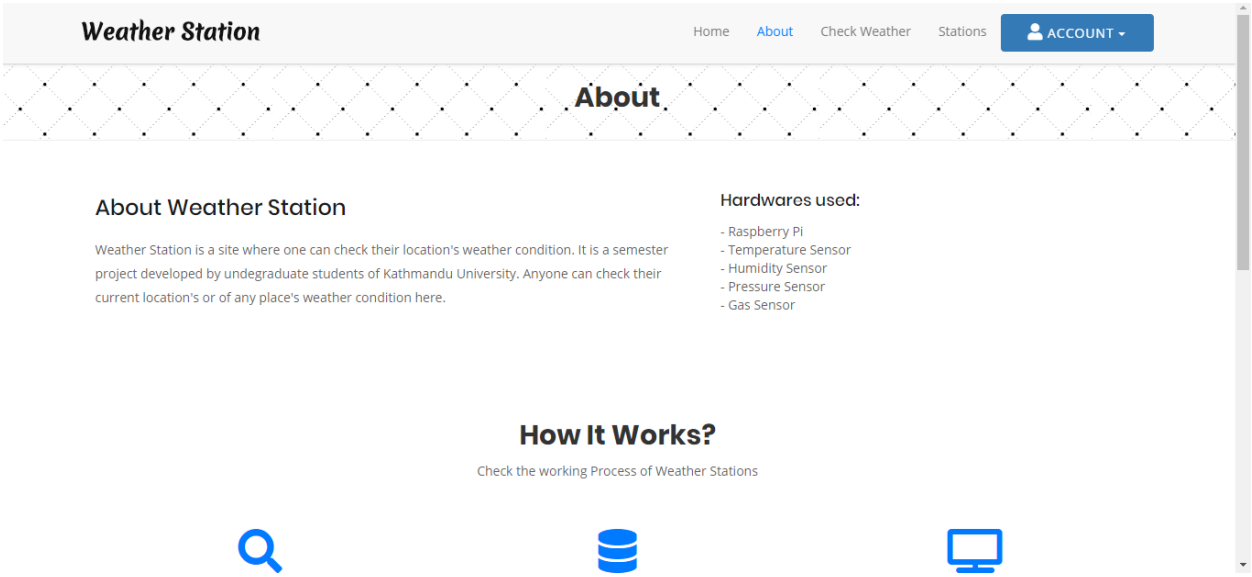


Weather by Location

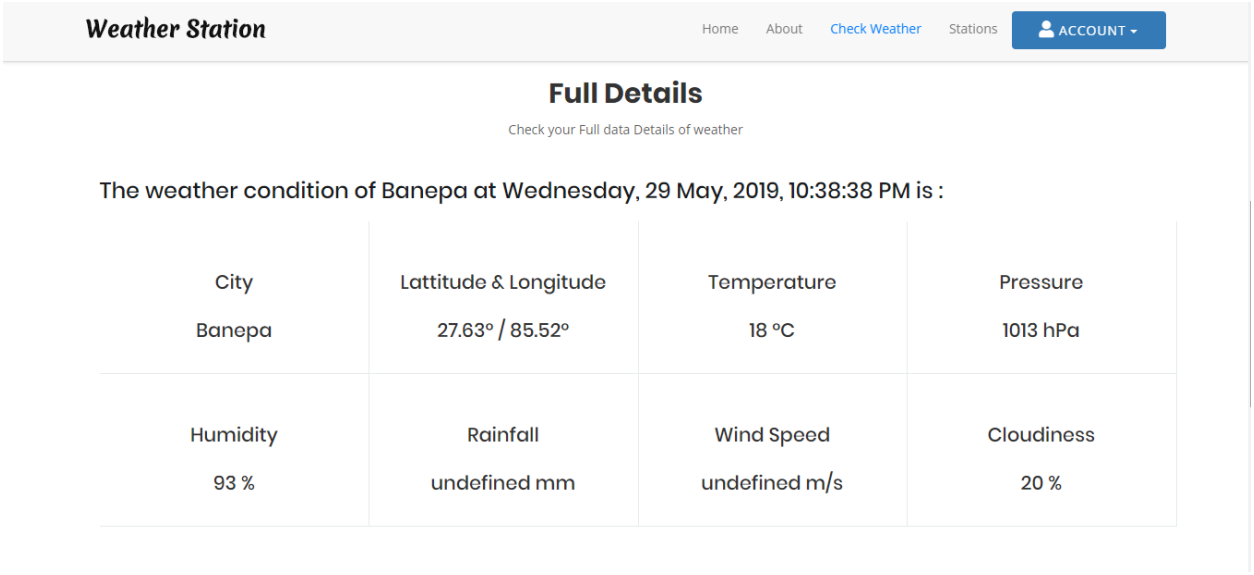
Home page



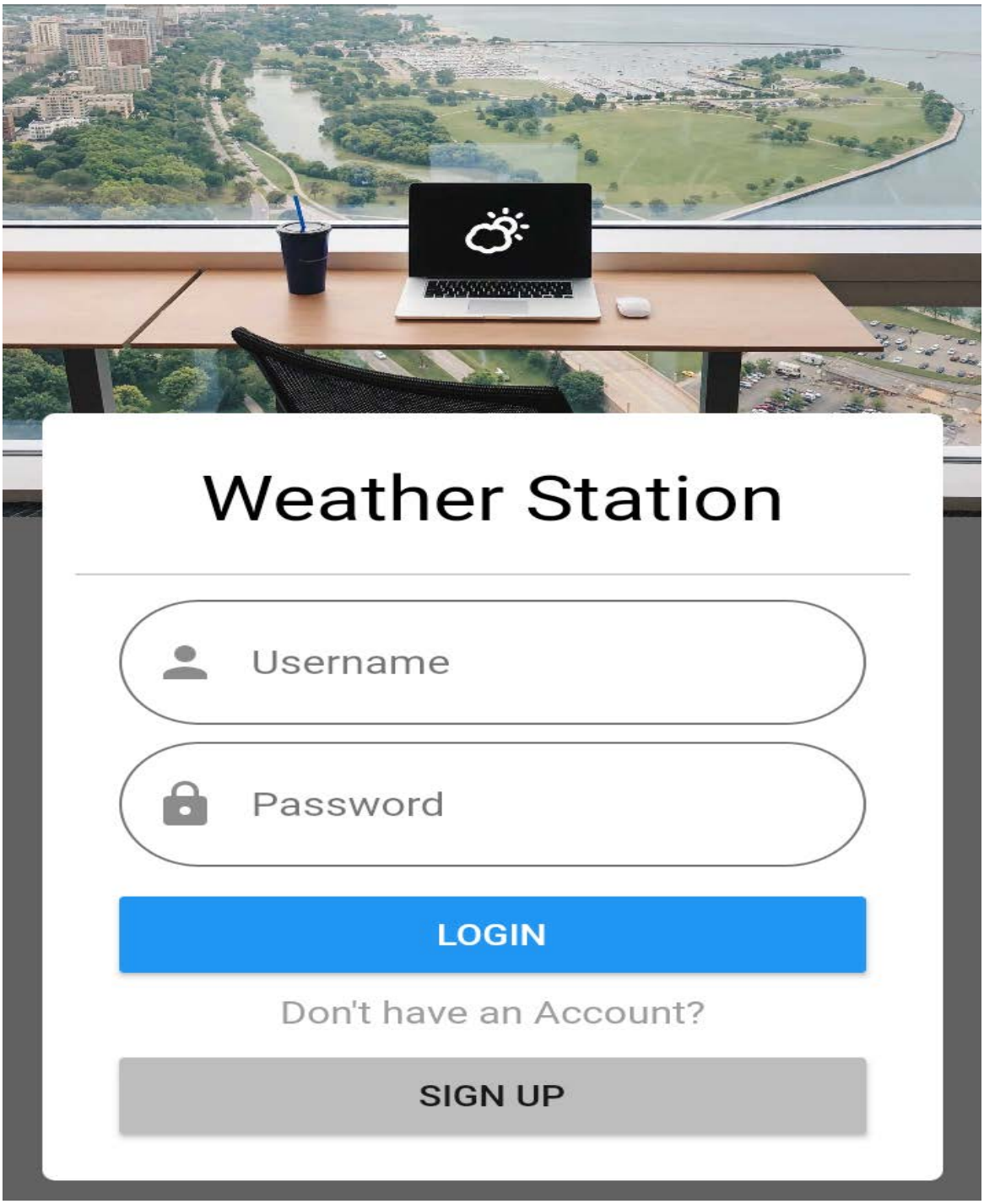
Data from Sensors



About Weather Station



Public Weather Data


Weather Station
Username
Password
LOGIN
Don't have an Account?
SIGN UP

App Login

← View Weather Details

DHULIKHEL

Sunday, 7 July 2019

BROKEN CLOUDS

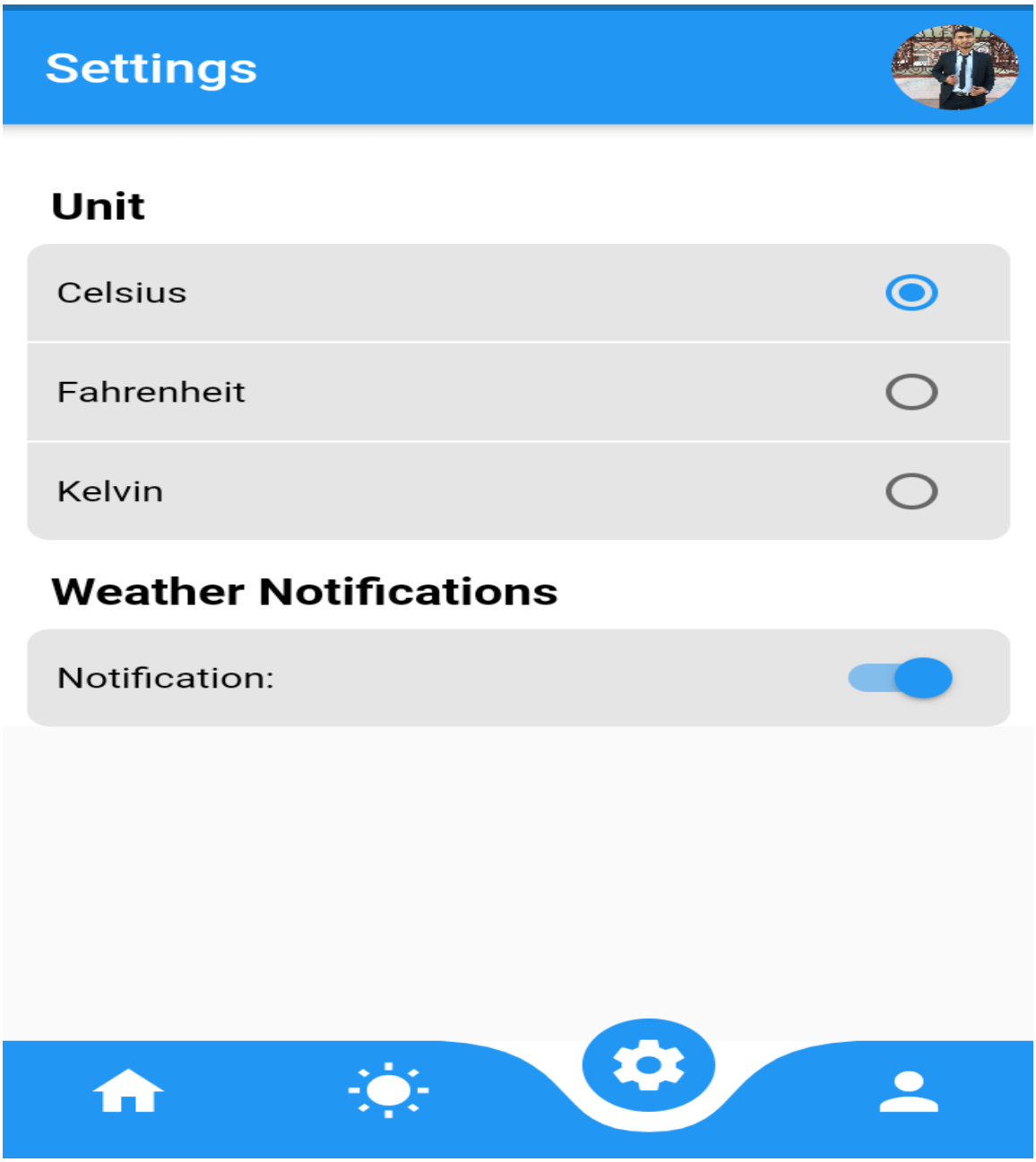
23°

Sunrise	Sunset
5:12 AM	7:02 PM

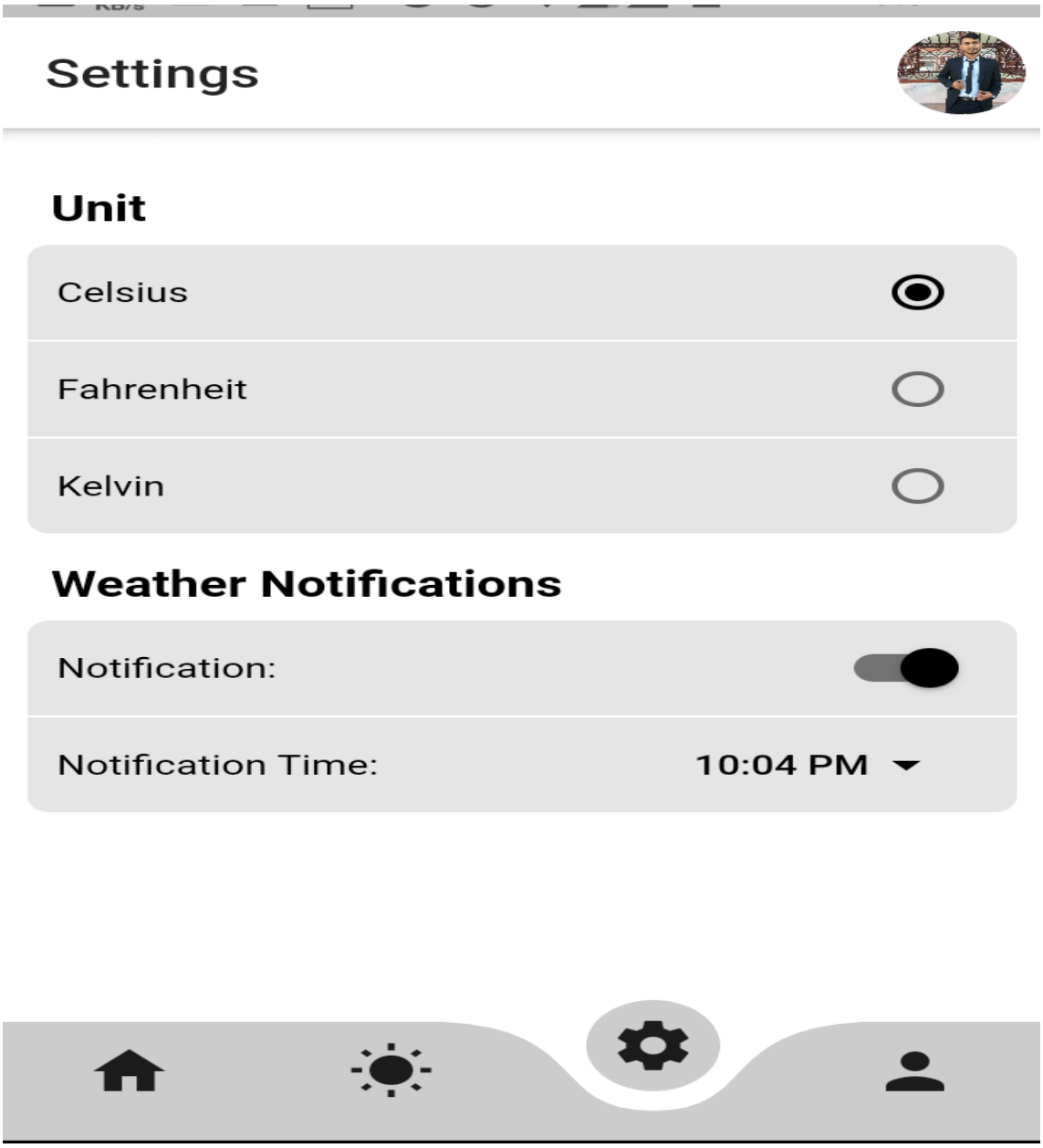
Pressure	Humidity	Wind Speed
1007 hPa	94%	0.64 m/s

Sun, 11PM	Mon, 2AM	Mon, 5AM	Mon, 8AM
22°	21°	21°	22°

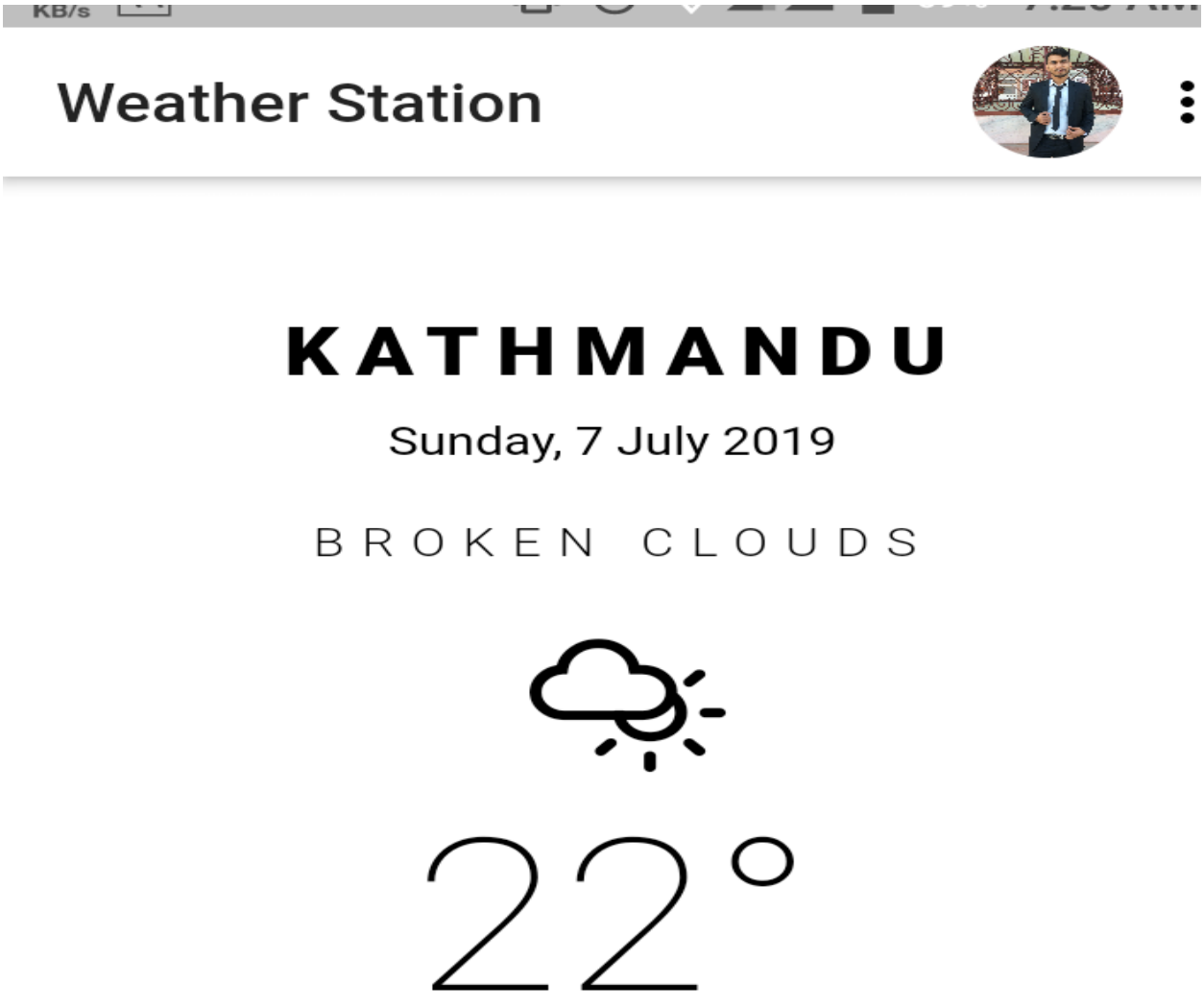
App Public Data


Settings
Unit
Celsius
Fahrenheit
Kelvin
Weather Notifications
Notification:

App Setting



App Unit Setup



App Private Data