# AN AGRICULTURAL GUIDE USING CLOUD COMPUTING AND BIG DATA ANALYSIS

Software Requirement Specification Document

Group-06
Maj. Ruhul Ambia Rimon (201514065)
Rishad Islam (201514168)
Shahir Rahman (201514099)
Mahdiul Islam (201514084)
Hosnee Mobashir (201514054)
Helalur Rahman Khan (201614048)

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# Contents

# Chapter 1

# Introduction

**Bangladesh is an developing country whose economy is based on agriculture. All the natural factors are combined with the better productions of crops. flood, irrigation, availability of water everything is directly and indirectly related to the production and management of crop field. Our system tries to combine these factors and present a guide to the user which will help his production to a great extent.**

## 1.1 Purpose

**This SRS describes the software functional and nonfunctional requirement for our upcoming project which includes collection data of various natural factors, storing the information in a cloud storage and using the information to provide services like early flood detection warning, weather forecast, predicting and suggesting cultivation tips to improve the production of crops. This document is intended to be used by members of the project team that will implement and verify the correct functioning of the system.**

## 1.2 Comparative Discussion

Our system intends to modify and improve the existing systems in following ways:

- Our system has integrated all natural factors like flood detection, weather, soil condition and analyzed the information to provide tips and predictions regarding the farming. Presently there are systems which can perform one particular function only like flood detection and warning or predictive farming or smart irrigation control. But our system has analyzed the effect of all those factors in a particular field and provided a summarized and well-organized display of information.
- Our system will be able to provide close range weather report for a specific area. Weather report which we get from the weather station is a huge system which is applicable for a whole city. But our system will consider only a specific region where it is deployed in a limited scope.
- Our system will control the excess water in the dam and distribute the water systematically to the fields based on the requirement of the field and different readings of flood detection and weather reports. Presently there is no system which has smart irrigation system based on the natural factors.

## 1.3 Scope

**In the project of Agricultural Guide, apart from hardware resources, software resources will be equally demanding. To fulfill the process the following software or applications will be required:**

1. We will a build an android based application for the specific users and there will be an web based application for the system developers.
2. The android applications will provide the aforementioned services to the user through their smartphones in an organized way and the web-based application will help the developers to monitor the performance of the system and different sensors and remotely control different functions of the system.
3. The ultimate objective is to provide a cultivator with a full package of information and control over his field still keeping the human factors of the cultivation intact. It will provide user the necessary time to be prepared for upcoming disasters so that the damage will be reduced to a great length.

## 1.4 Definitions, Acronyms and Abbreviations

## 1.5 References

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11. T. Rajasekaran, P. Jayasheelan, and K. S. Preethaa, "Predictive analysis in agriculture to improve the crop productivity using zeror algorithm," International Journal of Computer Science and Engineering, vol. 4, no. 2, pp. 1397–1401, 2016.

## 1.6 Overview

# Chapter 2

# Overall Description

Our system mainly deals with sensing data from nature and analysing it methodically to output various information on real time basis. The system will give early warning for flood to a particular area. The system is also intended for management and distribution of dam water in a planned way as per requirement. The system will also be able to generate weather report and various tips on farming and production of the crops based on the analysis of data.

## 2.1 System Environment

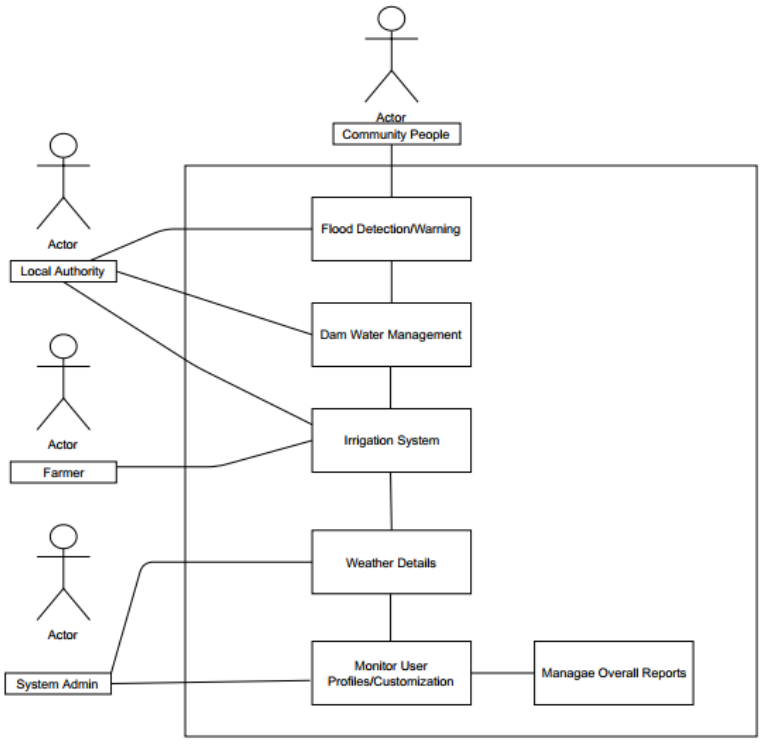


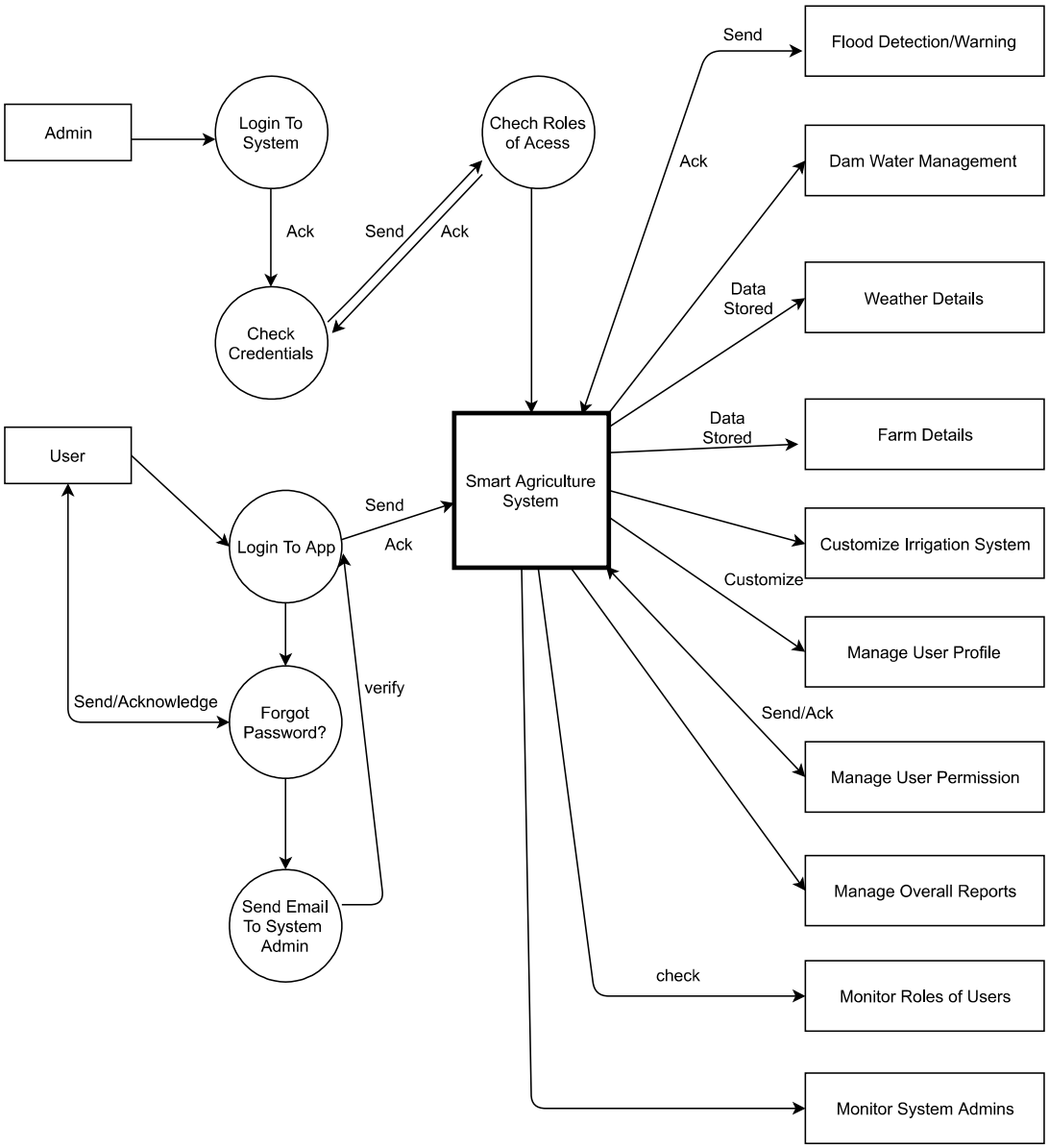

Figure 2.1: System Environment

1. There are total Four different actors working in the system environment. System Administrator, who is overall responsible for creating and maintaining the system.

2. Farmers, is the main focus audience who basically deals with different functions. He creates his profile and updates the system. This information sharing is done through the cloud database.
3. Local Authority basically receives warning about the flood and the potential dangerous areas so that they can devise a plan early to reduce the damage inflicted by the flood.
4. The community people, which are basically users of our system or the nearby contacts of our system user who are affected by the flood. All of them receive guidance after the detection and warning of flood.

### 2.1.1 Context Diagram

The context diagram of our system which describes the flow of information among the integral parts of our system is given below:


Admin
Login To System
Chech Roles of Acess
Ack
Send
Ack
Check Credentials
Send
Ack
Flood Detection/Warning
Dam Water Management
Data Stored
Weather Details
Data Stored
Farm Details
User
Smart Agriculture System
Send
Ack
Login To App
Customize Irrigation System
Customize
Manage User Profile
Send/Acknowledge
Forgot Password?
verify
Send/Ack
Manage User Permission
Manage Overall Reports
Send Email To System Admin
check
Monitor Roles of Users
Monitor System Admins

## 2.2 Functional Requirements Specification

**This section outlines the use cases for each of the actors separately.**

### 2.2.1 Feature List

1. Early flood detection using various sensors and cloud data analysis to provide early warning and awareness through application software.
2. Using the dam/reservoir water for irrigation of agricultural field in a certain area in an efficient way for maximum usage of resources.
3. Using Big Data analysis and sensor data predictions will be given for a particular land for maximum utilization of resources available.
4. Forecasting weather using available data from the sensor and alerting user about upcoming weather situation.

### 2.2.2 Use Case Diagram and Tabular Description

### User Profile Management Use Case

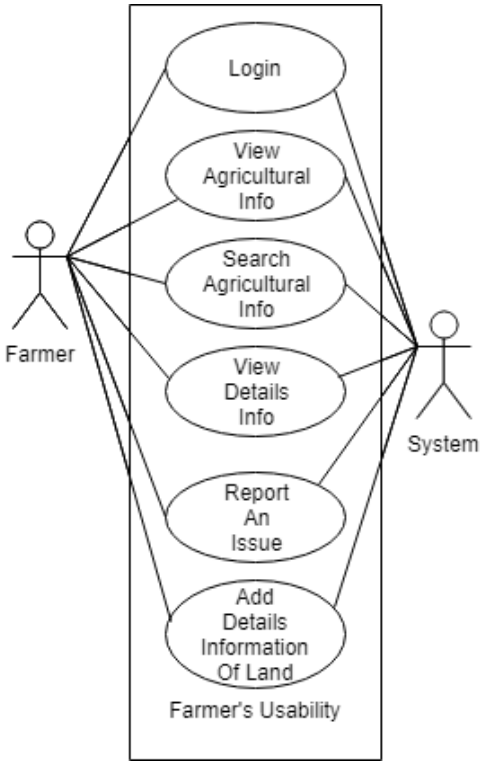



Figure 2.2: User Profile Management

**Brief Description**

1. User requests to be an user, system verifies the user, user can get various information provided by the system, reports any issue to the system and can manage personal information.

### Initial Step-By-Step Description

1. User requests for verification to the system
2. System verifies the user.
3. User can see information regarding agriculture, weather details, flood detection, irrigation control through the system interface.
4. User can report an issue that he/she faced during the interaction with the system
5. User can customize and update his/her profile

### Tabular Description

| User Profile Management Use Case | |
|---|---|
| Actors | Farmers |
| Description | User requests to be an user, system verifies the user, user can get various information provided by the system, reports any issue to the system and can manage personal information. |
| Data | User gets verification of username and password from the system, can update and customize user profile |
| Stimulus | User gets verification from the system, can view necessary information, can update and customize profile |
| Response | User profile is created in database and user use the system. User update is changed accordingly and stored in the database |
| Comments | User can only view certain information. Can edit personal information. User can control and customize certain viewing of information. |

## System Admin Management Use Case

### Brief Description

1. Admin validates user and provides user name and password, monitors performance of the system and user, can report resolved issues, checks event details and provides online videos tutorial for usage of the system.

### Initial Step-By-Step Description

1. Admin validates the user and provides username and password.
2. Admin monitors the user and can remove, delete or modify access of the user.
3. Admin monitors the overall performance of the system.
4. Admin provides reporting regarding resolved or unresolved issues.
5. Can check details of event occurring throughout the system.
6. Provides online tutorial to system for use by the users.

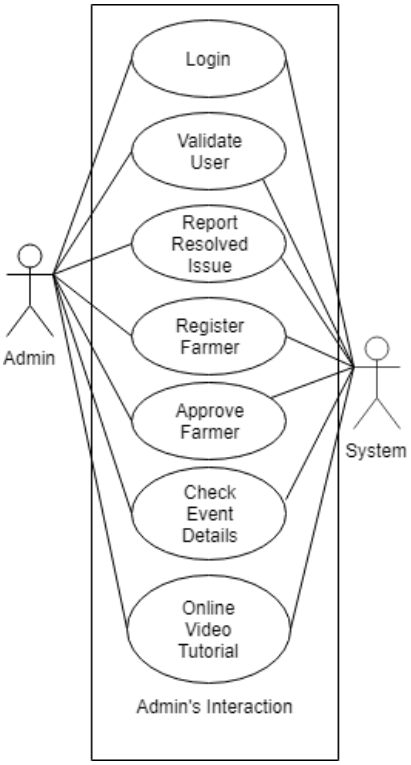



Figure 2.3: System Admin Management

**Tabular Description**

| System Admin Management Use Case | |
|---|---|
| Actors | System Admin |
| Description | Admin validates user and provides user name and password, monitors performance of the system and user, can report resolved issues, checks event details and provides online videos tutorial for usage of the system. |
| Data | Admin provides username and password to the user through system. |
| Stimulus | Admin can can update access, delete and remove users. |
| Response | User profile is created in database and user use the system. Online video tutorial is stored in the database for use. |
| Comments | Admin can remove, delete or register any user. They can regulate data flow and check information for smooth running of the system. |

## Local Authority-System Use Case

**Brief Description**

1. Local authority receives warning of flood detection along with the potential dangerous area.

**Initial Step-By-Step Description**

1. Local authority receives warning regarding flood detection.
2. Receives map of the potential dangerous area.
3. Can alert nearby people.

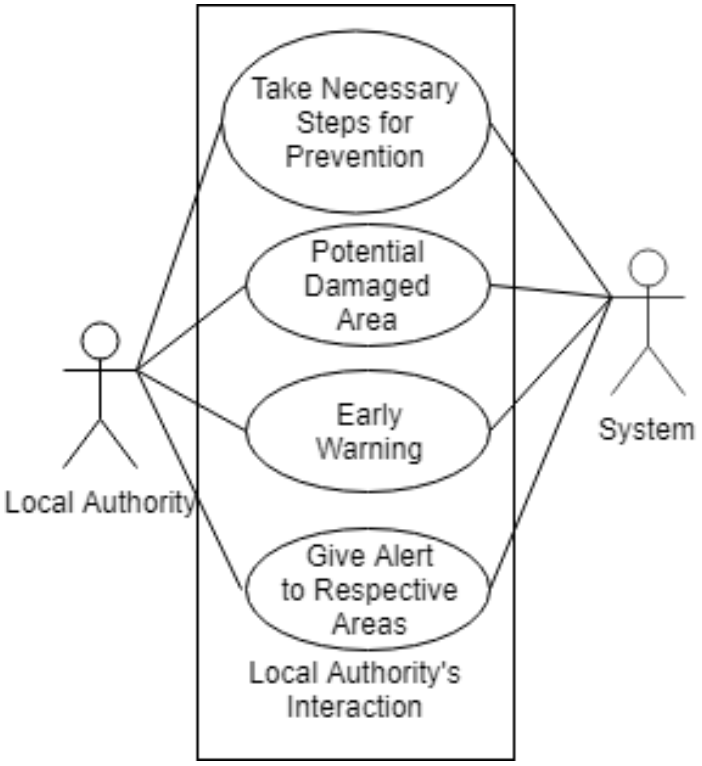



Figure 2.4: Local Authority-System

**Tabular Description**

| Local Authority-System Use Case | |
|---|---|
| Actors | Local authority |
| Description | Local authority receives warning of flood detection along with the potential dangerous area. |
| Data | Local authority receives notification regarding early warning through their device and gets the link of the map stored showing area of danger. |
| Stimulus | Local authority can alert nearby areas and take necessary preventive measures. |
| Response | Acknowledgment of notification is sent to the system and map is updated in the database. |
| Comments | After receiving the notifications local authority can start taking preventive measures. |

## User-Admin Use Case

**Brief Description**

1. User can report an issue to the admin and admin sends report on resolve issue. User request for registration is validated by user.

**Initial Step-By-Step Description**

1. User request for registration is validated by admin. Admin provides username password after validation.
2. User reports an issue to the admin.
3. Admin reports back to the user after resolving the issue.

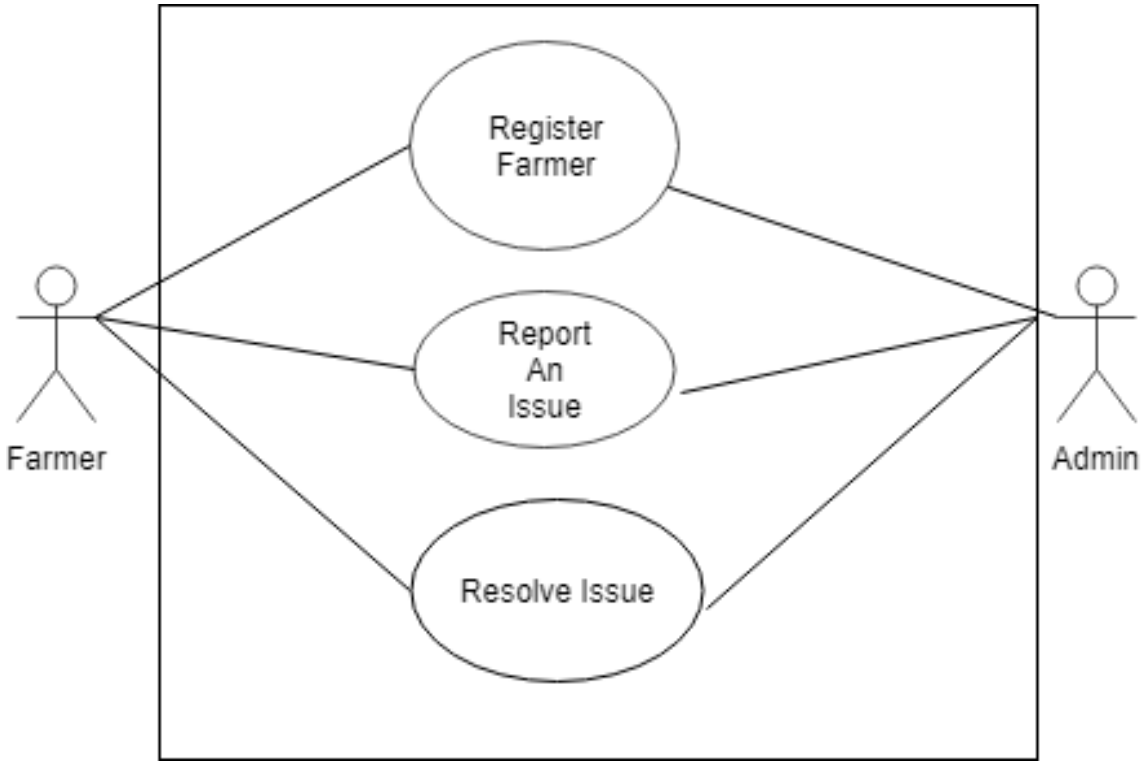



Figure 2.5: User-Admin

**Tabular Description**

| User-Admin Use Case | |
|---|---|
| Actors | Admin, User |
| Description | User can report an issue to the admin and admin sends report on resolve issue. User request for registration is validated by user. |
| Data | Admin sends username and password after validation of user registration request, user reports issues and admin reports back after resolving the issue. |
| Stimulus | Admin can register, delete, remove users. Admin and user can interact regarding solving an issue regarding system. |
| Response | System is updated as per the solution of the issue reported by user. User is created after validation of registration request. |
| Comments | System admin can remove, update, delete, register new user. User can report an issue and admin communicates or reports back to the user in regards to the solution. |

## Local Authority-Community People Use Case

**Brief Description**

1. Local authority provides early warning to the nearby people after getting notification from the system.

**Initial Step-By-Step Description**

1. Local authority receives warning regarding flood detection.
2. After that provides alert to nearby areas and their people.

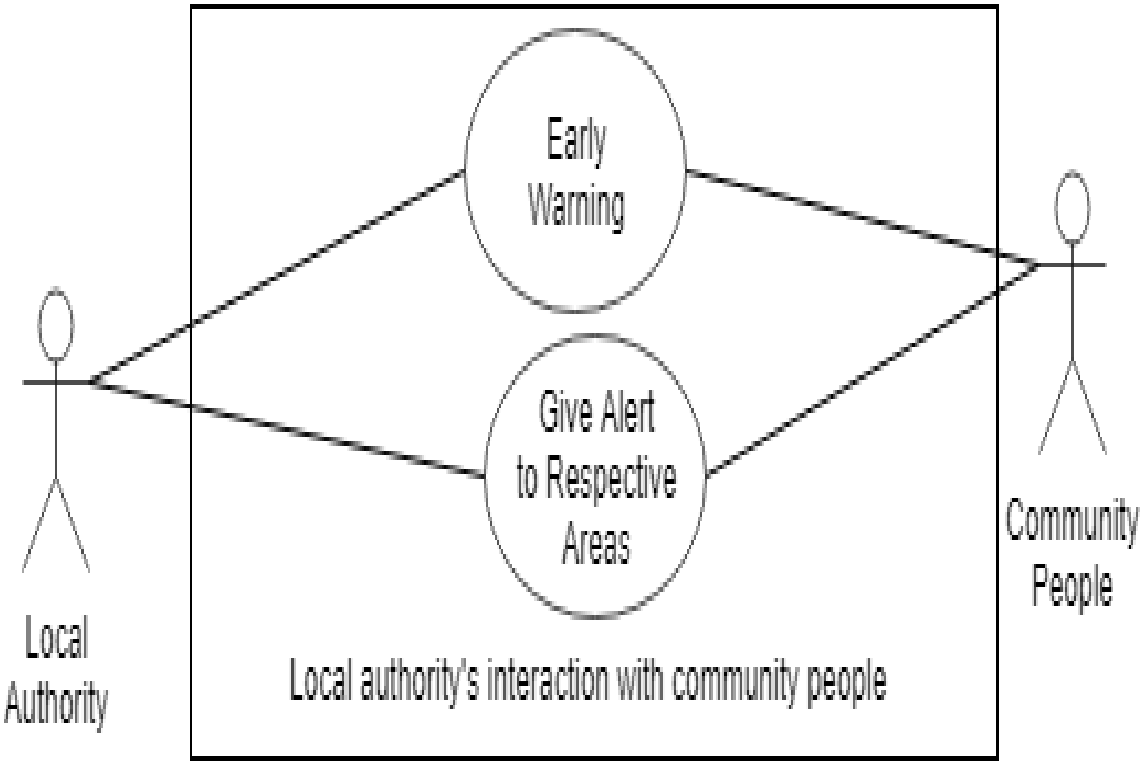



Figure 2.6: Local Authority-Community People

**Tabular Description**

| Local Authority-Community People Use Case | |
|---|---|
| Actors | Local authority, Community people |
| Description | Local authority provides early warning to the nearby people after getting notification from the system. |
| Data | Local authority receives notification regarding early warning through their device and provides alert to nearby people |
| Stimulus | Local authority can alert nearby areas and take necessary preventive measures. |
| Response | Acknowledgment of notification is sent to the system. System also provides its notification to the community people. |
| Comments | After receiving the notifications local authority can start taking preventive measures. |

### 2.2.3 Data Flow Diagram

The following Data Flow Diagrams(DFD) will describe the interaction between various actors and system graphically.

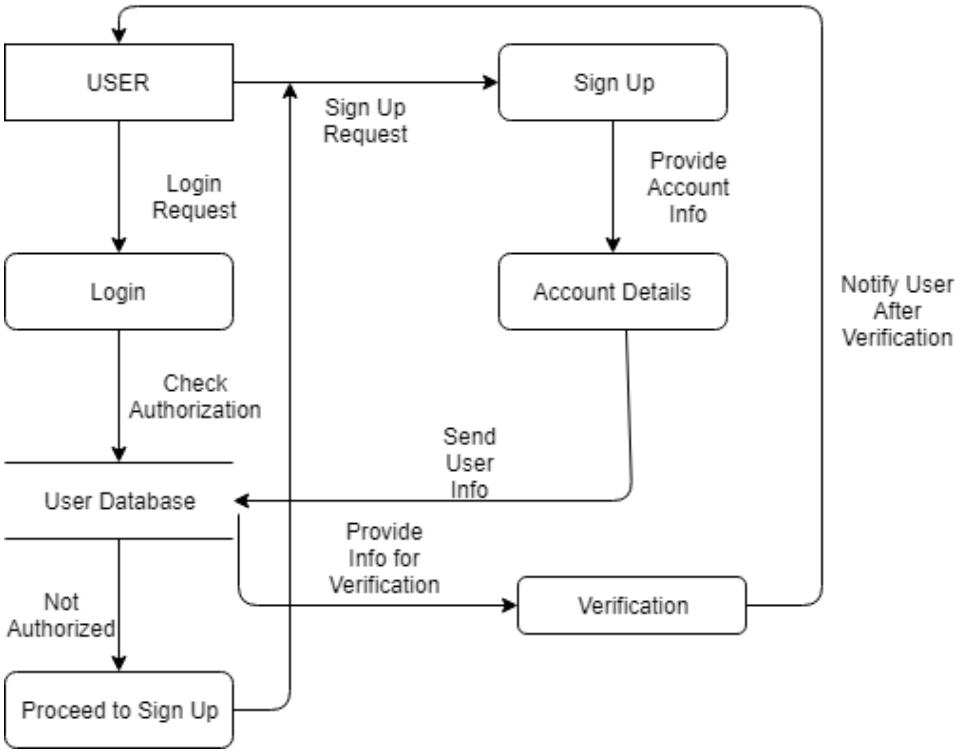



Figure 2.7: User Sign Up

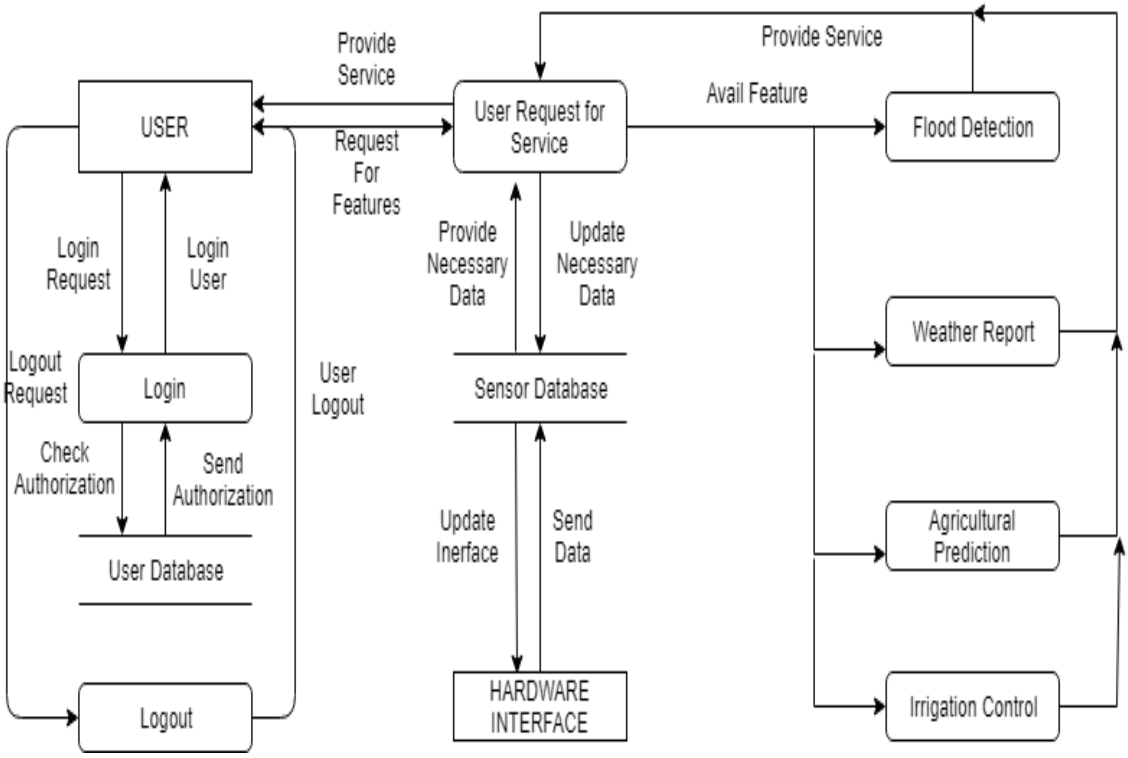



Figure 2.8: User System Access DFD

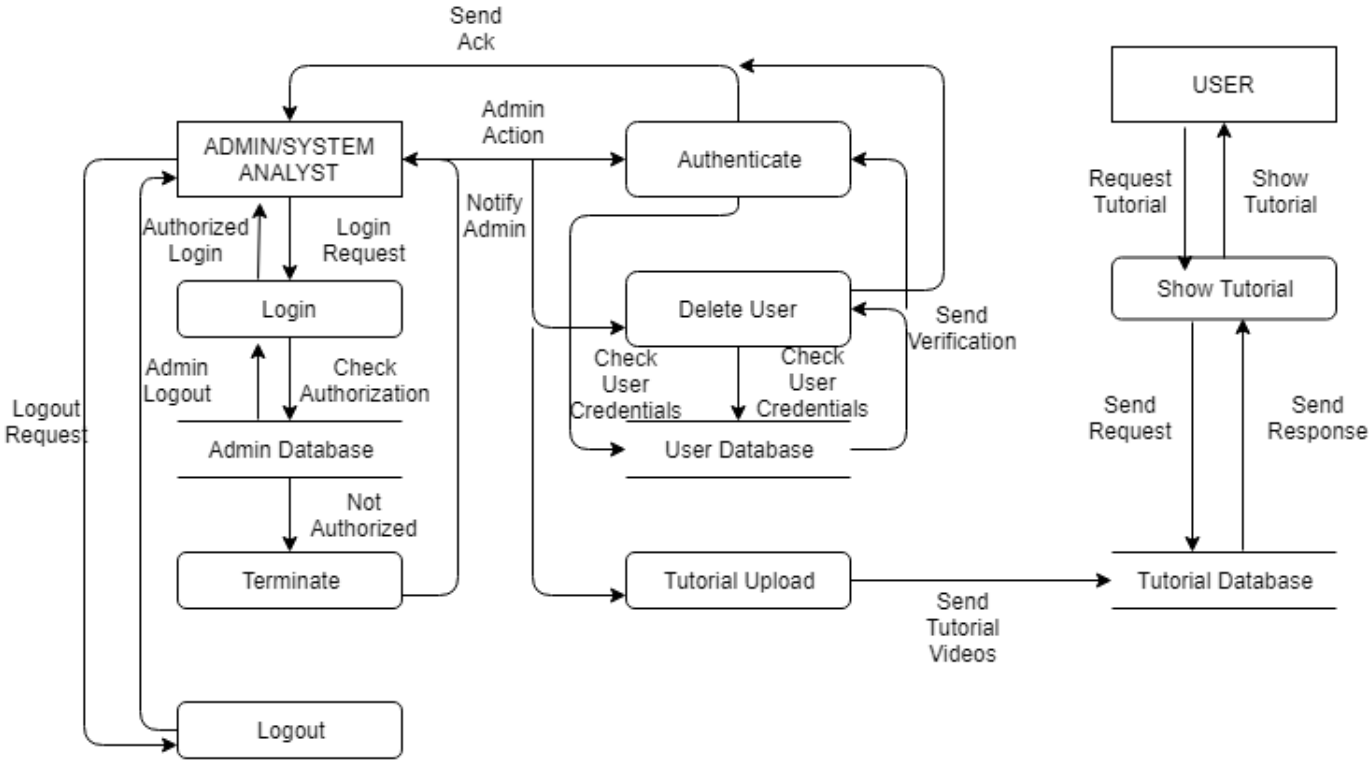



Figure 2.9: System Admin System Access DFD

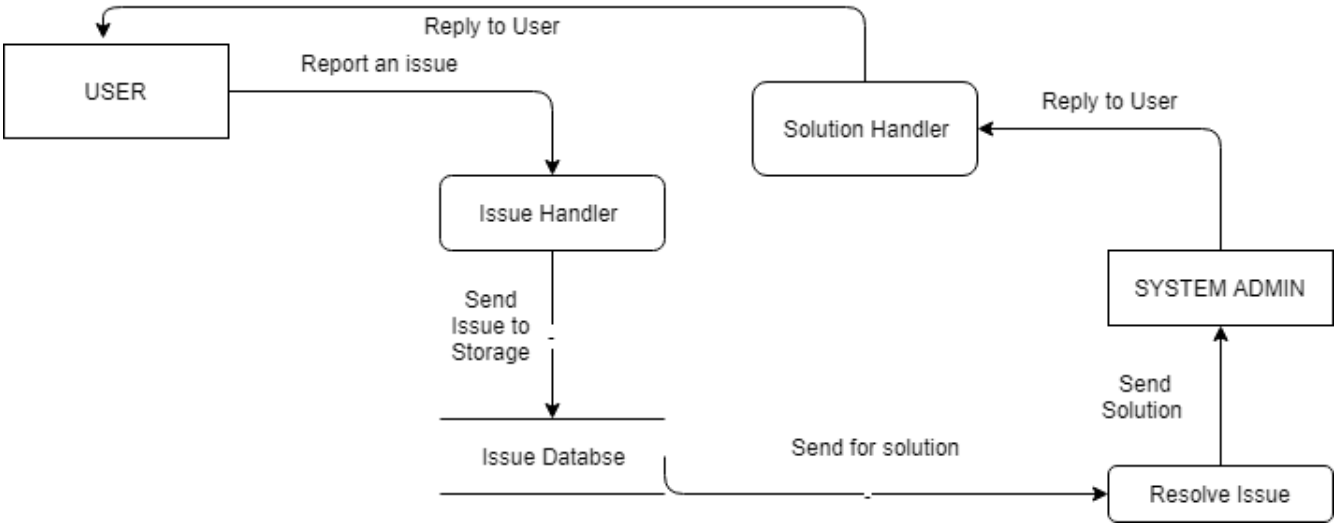



Figure 2.10: Issue Handling DFD

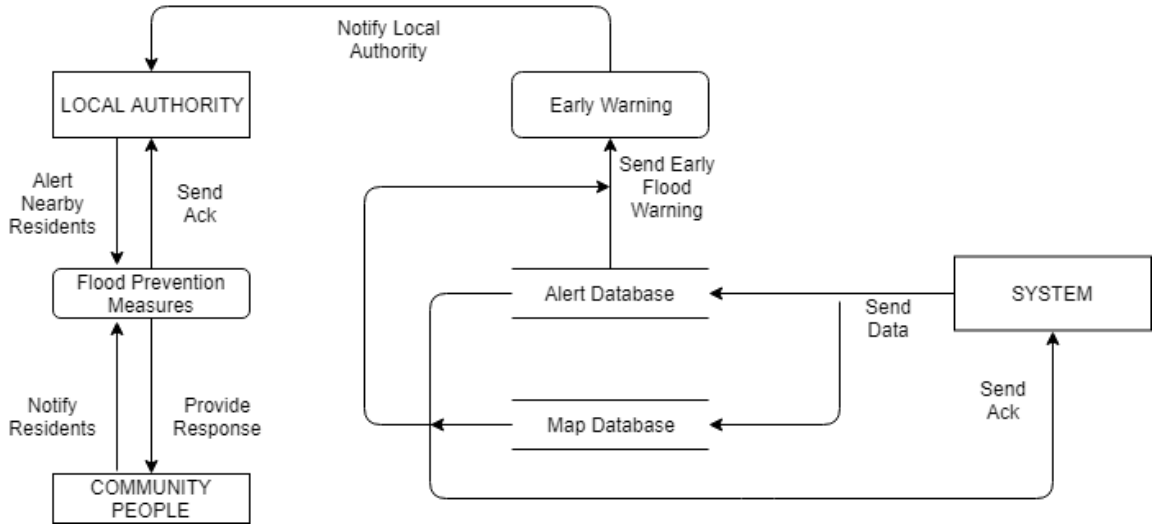



Figure 2.11: Local Authority DFD

## 2.3 User Characteristics

1. The Farmer is expected to be smart phone literate that means can operate a smart phone skillfully. They are expected to understand the information provided by the system. They can either be owner of the land or worker of the land. They may have problem regrading internet access or suitable smartphone access.

2. The system admin is the owner and developer of the system and fully knowledgeable to the know how of the system. They are expected to have a well expertise on handling such complex system. They may have problem regarding the hazardous situation like damage of the hardware equipment.

3. The local authority are expected to be the people inside the local government office. They should be vigilant enough to act upon the warning received from the system.

4. The community people are the residents of the area who will also be notified of the warning of upcoming disaster.

# Chapter 3

# Specific Requirements

## 3.1 External interfaces

### 3.1.1 User Interface


Figure 3.1: Greetings Page


Figure 3.2: Greetings Page

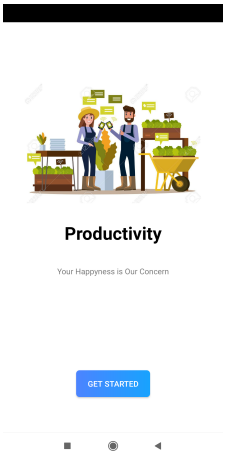



Figure 3.3: Greetings Page

These three pages gives a little introduction of our effort towards our project and greets the user. After clicking 'Get Started' they will be directed to the login and sign up portion.


Figure 3.4: Start Page

This page is the initial page of our app. If it is a new user then they need to click 'Join us' to join our app and proceed further. And if he/she is already our member then they can go directly to LogIn page by clicking 'Login'

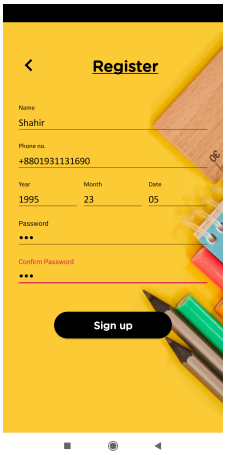



Figure 3.5: Registration Page

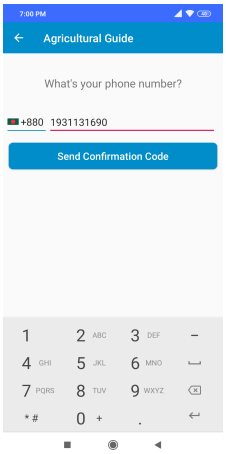



Figure 3.6: Providing Phone Number

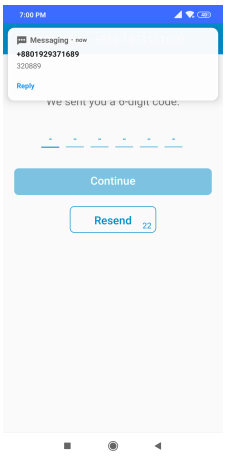



Figure 3.7: Verifying Phone Number

This is our registration page. Before joining our user need to provide these basic information. The account will be created on the basis of phone number. After filling out the information and clicking the 'Sign Up' button a six digit verification code will be sent to the given number. After providing the verification code the user will now be a member of our app.

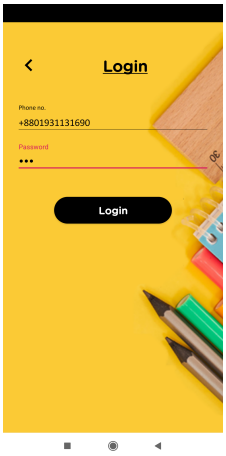



Figure 3.8: Login Page

In this page the verified and authenticated user can log in to our system using the phone number and password.

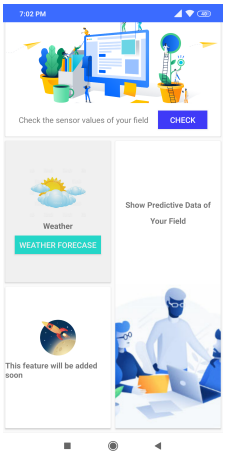



Figure 3.9: Home Page

This is the home page of our app. We can get different services which will be provided by our system. We can see the real time reading of the sensors of our project and also get the weather forecast.

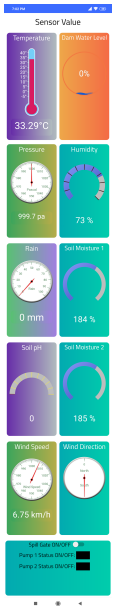



Figure 3.10: Real Time Sensor Value and Control

If user wants to see the real time sensor value then he/she will be directed to this page. Here they can control the flow of water in their land by switching on or off the spill gate. Also if the water level reaches the value 100 then user will be given a warning both through text message and the app.

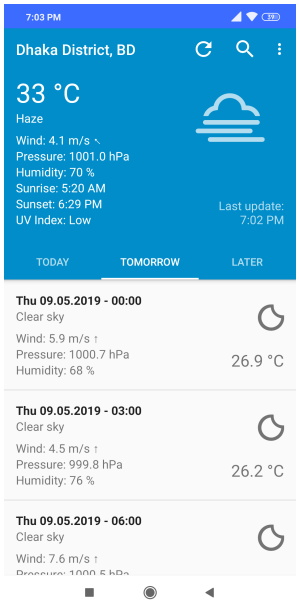



Figure 3.11: Weather Forecast

If user wants to watch the weather forecast then they will be directed to this page.

### 3.1.2 Hardware Interface

We designed a system architecture for the hardware portion of our project.

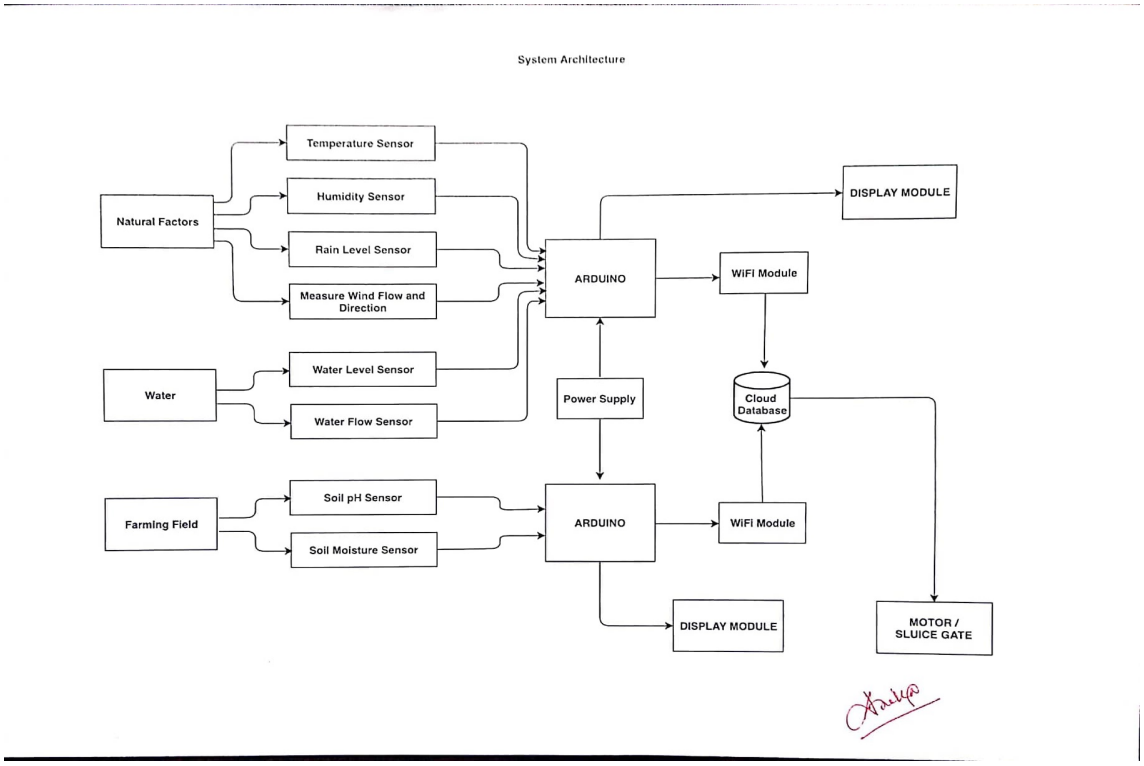



Figure 3.12: System Architecture

We connected 7 sensors in total with Arduino Mega. Among them 3 are made by us and rest are store bought. We made the wind speed, wind direction and rain sensors. The other sensors are bought from stores. We used Node MCU to send the reading to Firebase. To control the gate for irrigation control we used servo motors. We built a prototype to depict a real time scenerio.

### 3.1.3 Software Interface

1. Operating System - We have chosen android operating system of at least API 23 for its best support and user friendliness
2. Browser - any browser , ip allocated to raspberry pi on the network.
3. Database - To save the user's informations and feedbacks we have chosen firebase database.
4. Platform - To implement the project we have chosen Android Studio, Arduino IDE for its more interactive support for our website, and Java development tool kit for our application.

### 3.1.4 Communication Interface

The communication between all the subsystems and our main system is done through WiFi module. We are using Node MCU to implement the communication between the systems.

## 3.2 Design Constraints

The design constraints of the system are given below:

1. The app will be written in java code in android studio platfrom, arduino code in c and website code in laravel.
2. As database we are using firebase database.
3. There is memory requirement to insert large data of more than 15000 tuples.
4. The users must have android supported smartphone
5. Response time should be within real time and analysis should take no longer than 5 minutes.
6. A general knowledge of basic smartphone skill is required to use the product

## 3.3 Non Functional Requirements

The smartphone application will be connected to Firebase server with high speed Internet capability. The physical machine to be used will be determined by the System Admin. The software developed here assumes the use of a tool such as NodeMCU and Firebase for connection between the hardware interface and the database. The speed of the User's connection will depend on the hardware used rather than characteristics of this system.

### 3.3.1 Performance Requirements

- Input: Provide valid mobile no.
- Output: Receive confirmation text through the mobile no.

(a) Testing Type: Integration Testing. User information is taken from system and using that system a verification is done through confirmation text message. User input and confirmation text, two individual units combine to produce output.

(b) Criteria Assessment: Reliability and security. This testing verifies the user and allows authorizes user to use the system.

### 3.3.2 Log In

- Input: Provide email id and password.
- Output: Login to system.

(a) Testing Type: Integration Testing. User information is provided to system. System checks authorization of the information and validates the user.

(b) Criteria Assessment: Security and reliability. This testing allows authorized user to use the system.

### 3.3.3 Weather Data

- Input: Sensor data from hardware interface and weather database.
- Output: Display weather information.

(a) Testing Type: Integration Testing. Data is retrieved from the database and displayed.

(b) Criteria Assessment: Reliability, availability and correctness. This testing checks whether the data displayed.

### 3.3.4 Retrieving Data from Firebase

- Input: Sensor data from hardware interface and user information.
- Output: Retrieved data is used for system purposes.

(a) Testing Type: Integration Testing. Data is retrieved from the database and utilised.

(b) Criteria Assessment: Reliability, availability, correctness, response time and Data integrity. This testing checks whether the data is stored in Firebase properly and can be retrieved without any error.

### 3.3.5 Controlling Servo Motor

- Input: Turning on/off motor switch in system.
- Output: Switching on/off motor in hardware interface.

(a) Testing Type: Integration Testing. Integration between software and hardware components is being tested.

(b) Criteria Assessment: Reliability,response time and efficiency. This testing checks whether the servo motor in the hardware interface can be operated smoothly through the software.

### 3.3.6 Safety Requirements

Following safety measures are to be taken in order to use our system safely:

1. Safely set up the hardware components in proper place so that it doesn't harm anyone.
2. Place proper cover and protection for the hardware components so that it doesn't gate damaged due to natural hazards.
3. Carry out maintenance check up of the hardware components once in a month and replace or repair any faulty equipment.

### 3.3.7 Security Requirements

1. Users should provide strong password to keep the security of their account intact.
2. Users must not share the personal information regarding the app with anyone.
3. Users must provide correct information. Verification method is used to authenticate the information of the user.

### 3.3.8 Software Quality Attributes

1. Adaptability
2. Correctness
3. Maintainability
4. Portability
5. Reliability