System Requirement Specification

Green Core

The Smart Gardener

Submitted To: Dr Dinuni K Fernando

Version: 0.3

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Document Change History

No.	Description	Requested By	Document Version
01	Initial SRS with functional requirements	Client	V0.1
02	Screens for functional requirements	-	V0.2
03	Final SRS	Client	V0.3
04			
05			

Functional Items Summary

BR No.	BR Description	Functional Item No.	Functional Item Description
1	Green Core – Mobile App	FR1	Register User
		FR2	User Login
		FR3	View User Details
		FR4	Update User Details
		FR5	Change Password
		FR6	Forgot Password
		FR7	Navigation
		FR8	Link Units
		FR9	View All Units
		FR10	View Single Unit Details
		FR11	Control Actuators
		FR12	Send New Message
		FR13	View All Messages
		FR14	View Single Message
		FR15	Reply Message
		FR16	Alerts
	Green Core – Web App	FR17	Register User (Admin)
		FR18	User (Admin) Login
		FR19	Forgot Password
		FR20	Reset Password

		FR21	View User (Admin) Details
		FR22	Update User (Admin) Details
		FR23	Change Password
		FR24	Navigation
		FR25	View Users
		FR26	Search Users
		FR27	View Single User
		FR28	Search Units
		FR29	View All Units
		FR30	View Single Unit
		FR31	View Vulnerable Units
		FR32	Send Message
		FR33	View All Messages
		FR34	View Single Message
		FR35	Reply Message
		FR36	View New Messages
		FR37	Plant Tips

Abbreviations

Abbreviation	Explanation
FR	Functional Requirement
MSG	Message
IoT	Internet of Things
AWS	Amazon Web Services
MERN	MongoDB, Express, React, Node.js

1. Introduction

1.1. Problem Domain

With busy lifestyles people tend to stay at home leisurely for limited time. However, with the current sustainable trend, people tend to grow their own produce. With this growing trend, people with limited time should have a feasible way of gardening with a minimum effort. So, there should be a convenient way of getting organic produce to the household with a minimum effort. Also, an agricultural revolution is going on these days because of the pandemic which occurred in the recent past. But after this is gone people may not have time to take care of their plants. For the above problem, we introduce a smart garden concept which is an automated way of gardening by using a mobile phone.

1.2. Current System & limitations

Though there are systems developed to automate small scale indoor gardens, there are no automated systems to control outdoor gardens. Even in the indoor automated gardens we must use their smart garden environment. We cannot plug in the system to our garden directly.

Limitations of Current system

- Not applicable for outdoor gardens.
- Must use their pots to plant.
- Only small plants are possible.

1.3. Vision

Achieve sustainable crops even if you have a lack of knowledge or time.

1.4. Goals and Objectives

The main goal is to develop a smart garden environment that allows the user to provide a real-time gardening experience via a mobile phone.

Objectives

- People can get fresh vegetables and food from their garden with the aid of a Mobile Application.
- Track the progress/ status of each individual unit’s status.
- Adjust the growing environment remotely and in an automated way.
- Get periodic notifications of individual plant status via Mobile Application.
- Administrators can collect, view data of all gardens via Web Application.

1.5. Proposed Solution

A smart Garden which allows the users to control their garden while they are away. The automatic gardening feature will check the environmental conditions and maintain the conditions required for the plants to grow. Manual method allows the users to control the plant conditions which will give full remote control of the garden to the user. This includes an IoT device, a Mobile Application, and an admin portal.

The system mainly consists of two main deliverables,

Mobile Application and IoT Device

- System for the user consists of one or more IoT device units and a Mobile Application. The users can register to the system using the app and then connect the units for their account. A unit contains multiple sensors and actuators which are used to control the garden.
- Using the Mobile Application, the users can control actions such as adding nutrients, watering the plants when the soil moisture level is low, changing lighting conditions, etc. With the help of our Mobile Application users can get fresh vegetables and food from their garden. They can track the progress of their harvest, adjust input levels and growth settings remotely.

Web Application

- Web Application helps administrators to manage user accounts, devices and get statistics about them. This also helps to collect data from our users' gardens. This data collection will help us to improve our system in terms of better predictions. Users' privacy will be retained safely and only sensor readings will be utilized for statistics and future predictions.

1.6. Scope Overview

Users (possible actors) of the system:

- Admins - Web Application
- Users - Mobile Application

1.6.1. In Scope

- Mobile Application
    - Control and get feedback of the IoT units
    - Manages IoT units
    - Manage the settings related to user accounts
    - Show notifications related to IoT devices
    - View the status of the garden (water levels, moisture levels)
    - Give planting tips to users

- IoT Device
    - Plant watering system
    - Lighting system
    - Add nutrients

- Web Application
    - Analyze the data from all the gardens with Web Application
    - Manage Plant Data (Admin)
    - Monitor each IoT device's health and notify if something is wrong
    - Manage the data related to the tips provided by the Mobile Application

1.6.2. Out of Scope

- Train a machine learning model using the data gathered by the sensors to predict optimal conditions to grow specific plant types
- Monthly report generation for Mobile Application
- Live view of the garden via a Mobile Application
- Track harvest

1.7. Objective (document)

This document explains the functionality of the process of "Green Core" that is built to control gardens remotely. Focus of this document is to explain each functionality in detail, for the purpose of system development and provide an understanding of the proposed "Smart Garden" to all the stakeholders of the project.

2. Assumptions and Dependencies

2.1. Assumptions

- Necessary AWS environments will be provided on time.
- Necessary access for the email gateway integrations will be provided on time.
- The admin users will be using standard and latest browsers to access the system (The web system may give some issues with older browser versions such as IE 8 and earlier versions).
- Track progress of each plant depending on the user (different unit sizes).
- Users will use an internet enabled device to access the Mobile Application.

2.2. Dependency

- Availability of hosting environment and access for third-party integrations.

3. Limitations and Constraints

- Multi Language support will not be available.
- Adding only liquid fertilizer.
- Mobile Application needs internet connection to work.

4. Feasibility Study

4.1 Technical Feasibility

- The main product of Green Core is an IoT device built using NodeMCU and an Arduino and a Mobile Application developed by using React Native, JSX and for the backend, we will be using Node.js and for the database, we will be using MongoDB. Most of these technologies are freely available or could be bought for a low cost.
- For the administration, we are using another Web Application. It is hosted using a dedicated AWS server which is also available for free for a year. After a year we will have to pay and upgrade or look for another server to host our application. The dedicated hardware of 1GB RAM and 1 core CPU will be sufficient at the start. But as the user base grows, we will have to opt for a more powerful server. But for development purposes, these technologies are certainly sufficient.

4.2 Schedule Feasibility

- Green Core should finish development by the end of August. And since we are following agile methodology for development, requirement gathering also happens continuously parallel to development.
- It means more and more features may get added from time to time. But in the current context, considering the number of features that we must implement as at now it will be possible. Also, it is worth noting that since we are using MERN stack, Arduino, NodeMCU, and AWS it makes development much easier and hassle-free which accelerates the development time to make it possible to be done by the deadlines.

4.3 Economic Feasibility

- As we are developing this project with profitable motive the production cost should be much lower
    - The Web Application is hosted in the AWS free-tier server, which is provided by AWS for free for one year and this bears zero cost for the first year of operation.
    - As we use MongoDB for our database which is free and there are 25Million database operations provided for the free tier
    - The Web Application should have a domain and we will have to pay a small annual subscription for the domain. ($12 per year)
    - The development tools like visual studio code Arduino IDE can be used free of charge for the project.
    - As we use NodeMCU and Arduino for the IoT units the cost will be around 15$ per unit
- Publishing an Android app requires a developer account which we will have to make a one-time payment for the account. ($25 one-off payment)
- Since it is developed only by a team of university students, development cost also can be factored as none.
- Therefore, in the short run, the development takes a very small cost ($37 + costs for units) (if we did not factor the developers cost). But in the long run, as the system grows, we may have to bear a moderate cost for hosting fees in AWS as well as to allow more capacity in MongoDB.

4.4 Legal and Ethical Feasibility

- Sensitive information will not be published to the outside world by the system
- Users are visible only for the admins

4.5 Operational Feasibility

- We have surveyed over 100 people from different areas of the island who have started farming in their home gardens after the pandemic started. We let them know about the idea of this system and asked whether they think it would be useful for them in their field. Over 85% of the participants of this survey gave positive feedback saying they are interested in such an idea and it would solve most of their problems.

- As most of the fruits and vegetables we buy from the markets are heavily treated with pesticides and various types of chemicals, people are much willing to grow their own food. But the real issue occurs when it comes to time. As this system solves the time issue more people are willing to use this kind of solution.

5. Functional Requirements – Mobile Application

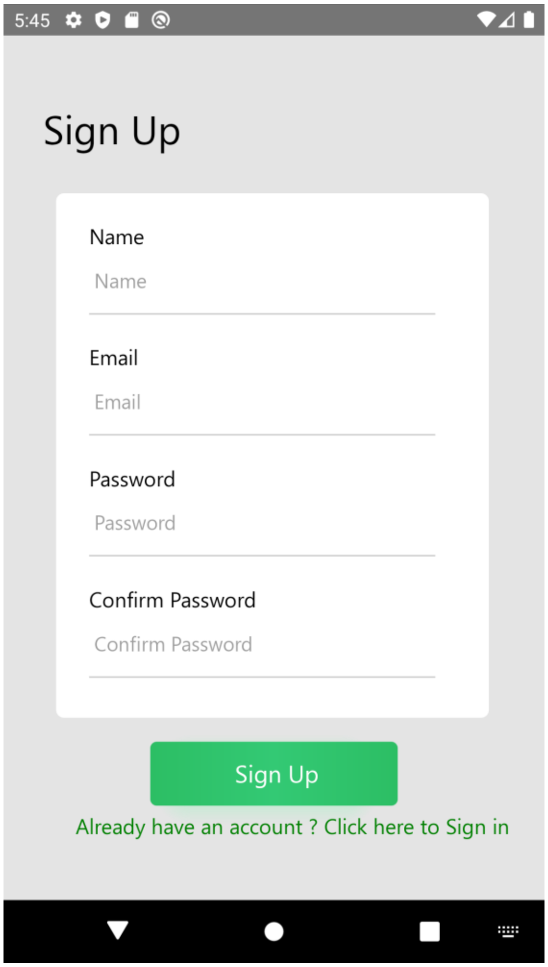
5.1. Manage User

- Through this function Users can be viewed, created, updated, and deleted from the system.

5.1.1 Register User (FR1)

- When a new user installs the Green-Core app, the user needs to register for an account creation.
- User details will be saved in the database upon the click on “Sign Up” button, only if verification is successful. If not, the user will get an error message.

Mockup of the ‘Registration’ function is given below.



Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			
Name	To enter User's name	Field type - Text Box Field Length - Maximum 255 Data type - String Mandatory	
Email	To enter user's email address	Field type - Text Box Field Length - Maximum 255 Data type - email Mandatory Valid email address	When email is already exists in the database, "Email Already exists" inline error message should prompt.
Password	To enter user's	Field type - Text Box	

	password	Field Length - Maximum 16 & Minimum 6 Data type - String Mandatory	
Confirm Password	To re-enter user's password	Field type - Text Box Field Length - Maximum 16 Minimum 6 Data type - String Mandatory	Check whether the two passwords entered are the same. If not display error message "Confirm password should be a match"
Buttons			
Sign Up	To save the user details	Field Type - Button	Upon click, the user should be successfully saved in the system

Table 5.1.1:1: Input Field Validations for Sign Up

5.1.1.1 Basic flow of events

- The use case starts when the user clicks on the 'Don't have an account click here to Sign Up' text available in the 'Login' screen.
- User views the 'Sign Up' screen.
- User Enter the Name, email, password, confirm password.
- User clicks on the 'Sign Up' button.
- User directs to the 'login' screen.
- The use case gets the end.

5.1.1.2 Alternative Paths

- When User clicks on "Already have an account? Click here to Sign In" text, user will navigate to Login Screen.

5.1.1.3 Validations

- Refer the input field validation table for validations (Refer table 5.1.1:1).

5.1.1.4 Actions

- Refer the input field validation table for button actions (Refer table 5.1.1:1).

5.1.1.5 System integrations

- N/A

5.1.1.6 Negative Paths

- If the user clicks on the 'Sign Up' button by leaving the Mandatory fields empty. System should display the error messages.

5.1.1.7 Messages

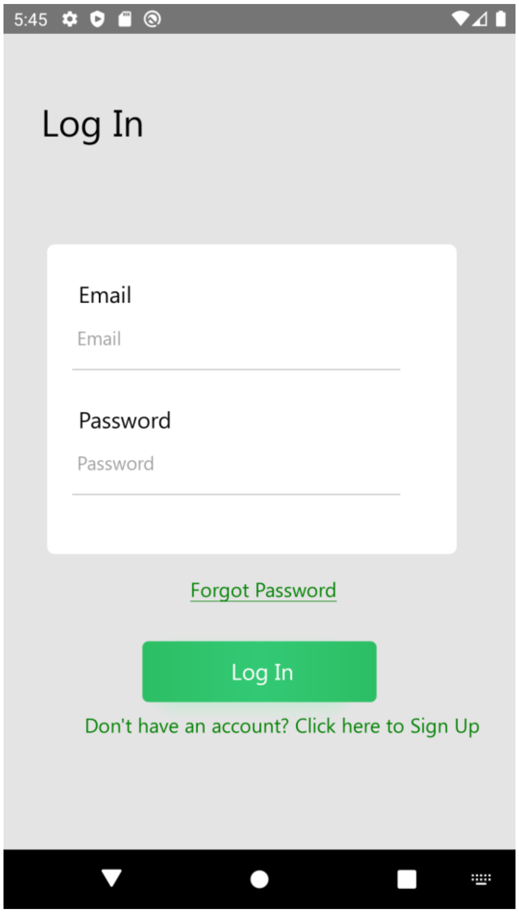
Message ID	Description	Message Type	Content
FR1-MSG1	Empty Username	In-line message	“Name is required”
FR1-MSG2	Empty Email	In-line message	“Email should be Valid”
FR1-MSG3	Empty password	In-line message	“Password must be at least 6 character long”
FR1-MSG4	Empty confirm password	In-line message	“Password confirmation is required”

Table 5.1.1:2 Messages for Sign Up

5.1.2 User Login (FR2)

- Users can log in to the system by entering valid email and password.
- System will generate a token on login and the user will keep logged in until the token expires.

Mockup of the ‘Login’ function is given below.



Don't have an account? Click here to Sign Up

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			
Email	To enter user’s email address	Field type - Text Box Field Length - Maximum 254 Data type - email Mandatory Valid email address	
Password	To enter user’s password	Field type - Text Box Field Length - Maximum 16 Minimum 6 Data type - String Mandatory	
Buttons			

Sign In	To log in the to the system	Field Type - Button	Upon click, the user should be successfully logged in to the system
Forgot Password	To allow the user to reset password	Field Type – Text	Upon click user will be directed to request password change screen
Signup	To allow a new user to register	Field Type – Text	Upon click the user will be directed to the signup screen

Table 5.1.2:1: Input Field Validations for Login

5.1.2.1 Basic flow of events

- The use case starts when the user opens the app or expiration of a token.
- User views the ‘Login' screen.
- User Enter the email, password.
- User clicks on the ‘Sign In’ button.
- User directs to ‘Home’ screen..
- The use case gets the end

5.1.2.2 Alternative Paths

- Users can click on “Don’t have an account click here to Sign Up” text available in the Sign Up screen, the user will navigate to Sign Up Screen.
- Users can click on “forgot password” and the user will direct to the forgot password screen.

5.1.2.3 Validations

- Refer the input field validation table for validations (Refer table 5.1.2:1).

5.1.2.4 Actions

- Refer the input field validation table for button actions (Refer table 5.1.2:1).

5.1.2.5 System integrations

- N/A

5.1.2.6 Negative Paths

- If the user clicks on the ‘LogIn’ button by leaving the Mandatory fields empty. System should display the error messages.
- If a user enters an incorrect email or password, System should display the error messages.

5.1.2.7 Messages

Message ID	Description	Message Type	Content
FR2-MSG1	Incorrect Email and password	Alert message	"Incorrect email or password"

Table 5.1.2:2: Messages for Login

5.1.3 Forgot Password (FR3)

- When the user forgets his/her password, the user can click on "forgot password" in the Login screen and request for a password reset.
- Then the system will send an email including a verify token.
- Users can enter the verify token in "verify token" screen and navigate to "reset password" screen.

Mockup of the 'Forgot Password' function, "Verify Token" screen is given below.

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			
Verify Token	To enter verify token	Field type - Text Box Field Length - Maximum 4 Data type - String/Number Mandatory	
Buttons			
Submit	To send the token for password reset request	Field Type - Button	Upon click, the user should navigate to reset password screen.

Table 5.1.3:1: Input Field Validations for Forgot Password

Mockup of the ‘Forgot Password’ function, “Reset Password” screen is given below.

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			
New Password	To enter new password	Field type - Text Box Field Length - Maximum 16 Data type - String Mandatory	
Re Enter New Password	To reenter the new password	Field type - Text Box Field Length - Maximum 1 Data type - String Mandatory	Check whether the two passwords entered are the same. If not display error message
Buttons			
Save Changes	To save the updated password	Field Type - Button	Upon click, the password should be successfully updated in the system

Table 5.1.3:2: Input Field Validations for Forgot Password

5.1.3.1 Basic flow of events

- The use case starts when the user clicks on the ‘Forgot Password’ button available in the ‘Login’ screen.
- User views the ‘Verify Token’ screen.
- User enters verify Token.
- User clicks on the “Submit” button.
- User navigates to the “Reset Password” screen.
- User enters the new password.
- User reenters the new password.
- User clicks on the ‘Save Changes’ button.
- User navigates to the login screen.
- The use case gets the end.

5.1.3.2 Alternative Paths

- Users can click on the “Resend Token” button in the “Verify Token” screen.

5.1.3.3 Validations

- Refer the input field validation table for validations (Refer table 5.1.3:1).

5.1.3.4 Actions

- Refer the input field validation table for button actions (Refer table 5.1.3:1).

5.1.6.5 System integrations

- N/A

5.1.3.6 Negative Paths

- If the user clicks on the ‘Save Changes’ button in the “Reset password” screen by leaving the Mandatory fields empty. System should display the error messages.
- If a user clicks on the “Submit” button in the “Verify token” screen by leaving it empty, the system should display the error messages.

5.1.3.7 Messages

Message ID	Description	Message Type	Content
FR3-MSG1	Empty New Password	In-line message	‘New Password is required’
FR3-MSG2	Empty Re Enter New Password	In-line message	‘Re Enter password’
FR3-MSG3	Empty verify Token	In-line message	‘Verify Token is required’

Table 5.1.3:3: Messages for Forgot Password

5.1.4 View User Details (FR4)

- Upon a click on the ‘View profile’ function, the list of existing users in the system should be displayed along with the search facility.

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Card			
Card	This table should display a list of details related to the user account	Non-editable	Details such as username, email telephone number and location
Fields			
Email	Display the email associated with the current account	Non-editable Display only	
Username	Display the username associated with the current account	Non-editable Display only	
Telephone number	Display the telephone number associated with the current account	Non-editable Display only	

Table 5.1.4:1: Input field validations for View User Details screen

5.1.4.1 Basic Flow of events

- When the user clicks view profile in the drawer menu user will navigate to this screen

5.1.4.2 Alternative Paths

- The user clicks on the back button

5.1.4.3 Validations

- N/A

5.1.4.4 Actions

- N/A

5.1.4.4 System integrations

- N/A

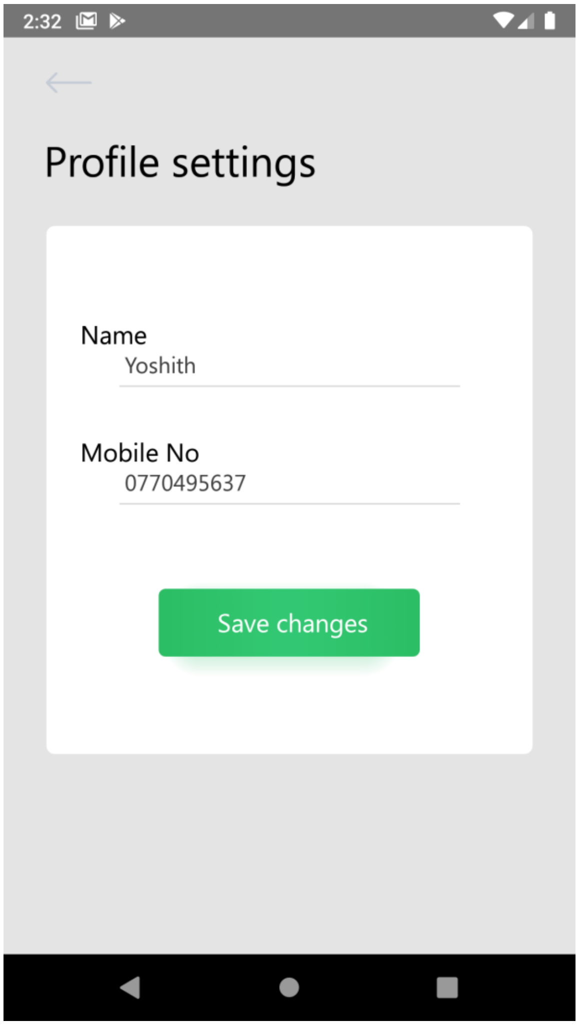
5.1.4.2 Negative Paths

- N/A

5.1.5 Update User Details (FR5)

- User details must be able to be updated upon click on the 'Edit Details' button on the 'View User Details' screen.
- Through the edit user details function, the User's name and the mobile number should be able to update.

Mockup of the 'Update User Details' function is given below.



Profile settings

Name
Yoshith

Mobile No
0770495637

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			
Name	Display User's name	Field type - Text Box Field Length - Maximum 255 Data type - String Default Value – Selected Username Mandatory	
Mobile Number	Display user's mobile number	Field type - Text Box Field Length - Maximum 20 Data type - String Default Value – Selected User's Mobile number	
Buttons			
Save Changes	To save the updated user details	Field Type - Button	Upon click, the user should be successfully updated in the system

Table 5.1.5:1: Input Field Validations for Update User Details

5.1.5.1 Basic flow of events

- The use case starts when the user clicks on the 'Edit Details' button available in the 'View User Details' screen.
- User views the 'Update User' screen.
- User updates the Name.
- User updates the Mobile number.
- User clicks on the 'Save Changes' button.
- The use case gets the end.

5.1.5.2 Alternative Paths

- N/A

5.1.5.3 Validations

- Refer the input field validation table for validations (Refer table 5.1.5:1).

5.1.5.4 Actions

- Refer the input field validation table for button actions (Refer table 5.1.5:1).

5.1.5.5 System integrations

- N/A

5.1.5.6 Negative Paths

- If the user clicks on the ‘Save Changes’ button by leaving the Mandatory fields empty. System should display the error messages.

5.1.5.7 Messages

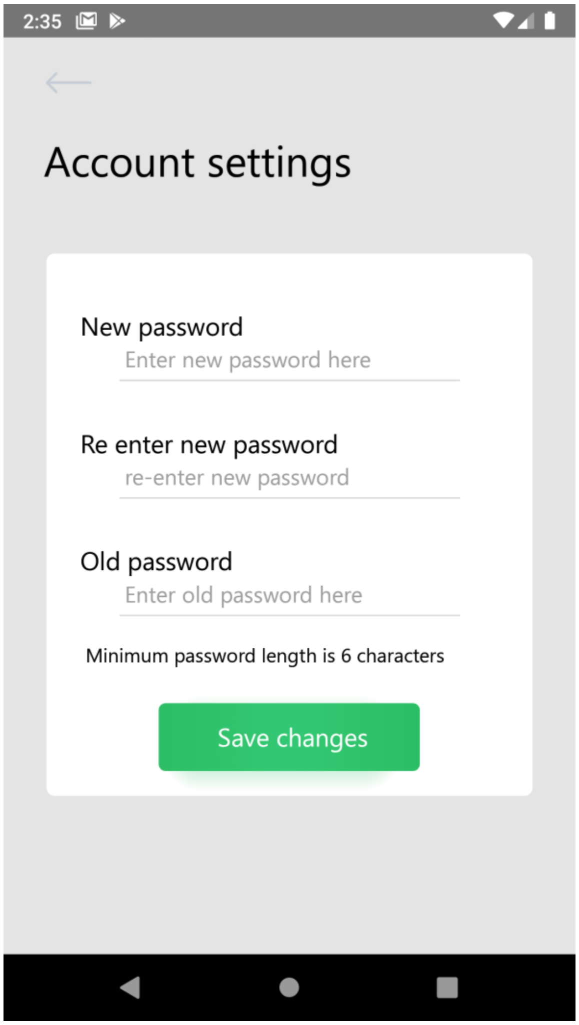
Message ID	Description	Message Type	Content
FR5-MSG1	Empty User Name	In-line message	‘User’s name is required’

Table 5.1.5:2 Messages for Update User Details

5.1.6 Change Password (FR6)

- Users should be able to update their Password upon clicking on the ‘Change Password’ button on the ‘View User Details’ screen.
- Through the ‘Change Password’ function, the password should be able to update.

Mockup of the ‘Change Password’ function is given below



Account settings

New password

Enter new password here

Re enter new password

re-enter new password

Old password

Enter old password here

Minimum password length is 6 characters

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			
New Password	To enter new password	Field type - Text Box Field Length - Maximum 255 Data type - String Mandatory	

Re Enter New Password	To re enter the new password	Field type - Text Box Field Length - Maximum 255 Data type - String Mandatory	Check weather the two passwords entered are the same. If not display error message
Old Password	To re enter the old password	Field type - Text Box Field Length - Maximum 255 Data type - String Mandatory	Check whether the entered old password is valid. If not display error message
Buttons			
Save Changes	To save the updated password	Field Type - Button	Upon click, the password should be successfully updated in the system

Table 5.1.6:1: Input Field Validations for Change Password

5.1.6.1 Basic flow of events

- The use case starts when the user clicks on the ‘Change Password’ button available in the ‘View User Details’ screen.
- User views the ‘Change Password’ screen.
- User enters the new password.
- User reenters the new password.
- User enters the old password.
- User clicks on the ‘Save Changes’ button.
- The use case gets the end.

5.1.6.2 Alternative Paths

- N/A

5.1.6.3 Validations

- Refer the input field validation table for validations (Refer table 5.1.6:1).

5.1.6.4 Actions

- Refer the input field validation table for button actions (Refer table 5.1.6:1).

5.1.6.5 System integrations

- N/A

5.1.6.6 Negative Paths

- If the user clicks on the ‘Save Changes’ button by leaving the Mandatory fields empty. System should display the error messages.

5.1.6.7 Messages

Message ID	Description	Message Type	Content
FR6-MSG1	Empty New Password	In-line message	‘New Password is required’
FR6-MSG2	Empty Re Enter New Password	In-line message	‘Re enter password’
FR6-MSG3	Empty Old Password	In-line message	‘Old password is required’

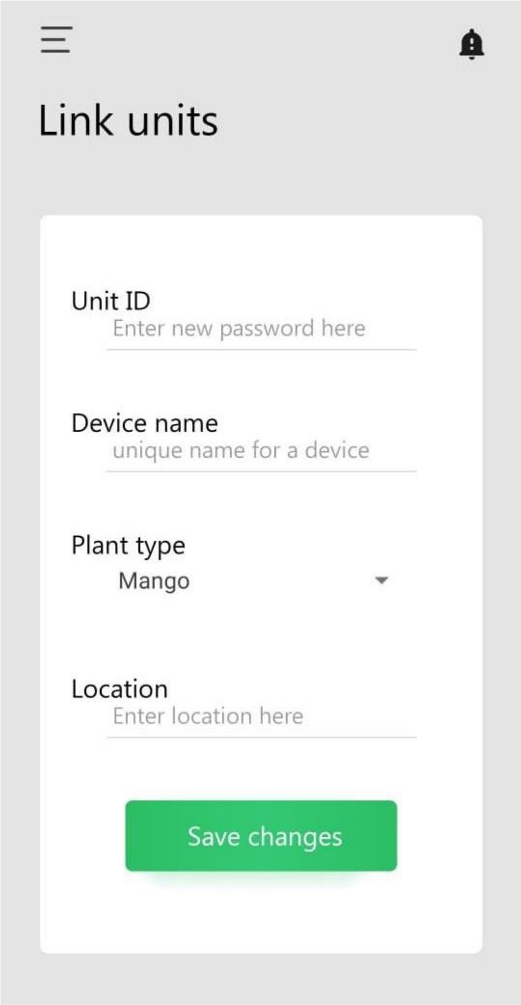
Table 5.1.6:2 Messages for Change Password

5.2. Manage Units

- Through these functions users can manage and receive notifications from the IoT units which are connected with his/her account

5.2.1 Link Units (FR8)

- Any registered user can link units.
- Upon clicking on the ‘Link Unit’ button in the navigation menu, the following mock-up should be displayed.



Link units

Unit ID
Enter new password here

Device name
unique name for a device

Plant type
Mango

Location
Enter location here

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			
Unit ID	The unit ID in the IoT device is added here	Field type - Text Box Field Length - 13 (fixed) Data type - String Mandatory	
Device Name	The name of the unit	Field type - Text Box Field Length - Maximum 255 Data type - String Default: Unit Id	If the user doesn’t enter a name unit id will be considered as the name
Plant Type	To select the plant type	Field Type – Dropdown	

		Default Value - Select Type Mandatory	
Location	To enter the location of the unit	Field Type – Dropdown Default value – Colombo Mandatory	
Buttons			
Add	To complete unit linking process	Field Type - Button	Upon click, the unit should be successfully connected with the user and the user is redirected to the view all units screen.

Table 5.2.1:1: Input Field Validations for Link Unit

5.2.1.1 Basic flow of events

- The use case starts when the user clicks on the 'Link Unit' button in the Navigation menu.
- User enters the Unit ID.
- User enters the Device Name.
- User enters the Plant Type.
- User enters Location.
- User clicks on the 'Add' button.
- The use case ends.

5.2.1.2 Alternative Paths

- The user clicks on the back button.

5.2.1.3 Validations

- Refer the input field validation table for validations (Refer table 5.2.1:1).

5.2.1.4 Actions

- Refer the input field validation table for button actions (Refer table 5.2.1:1).

5.2.1.5 System integrations

- N/A

5.2.1.6 Negative Paths

- If the user clicks on the 'Add' button by leaving the Mandatory fields empty. System should display the error messages.

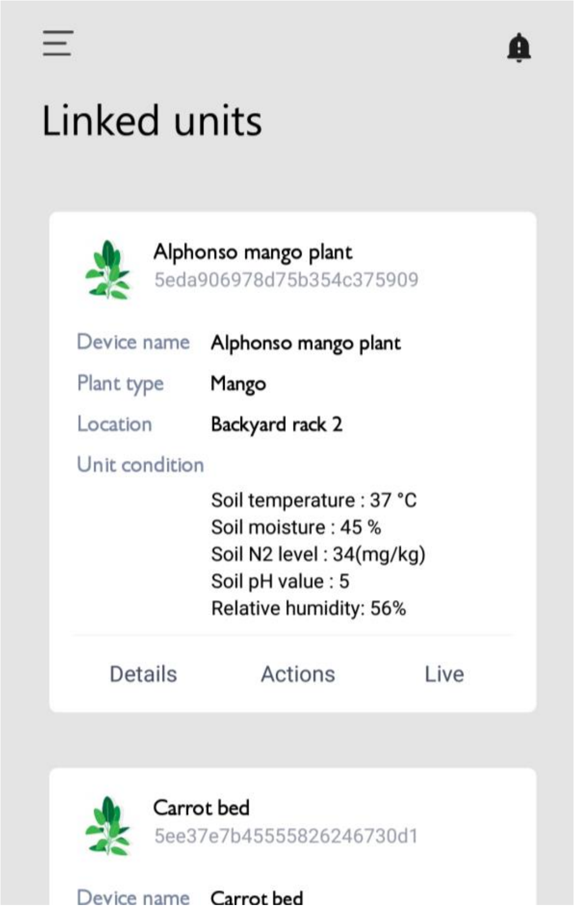
5.2.1.7 Messages

Message ID	Description	Message Type	Content
FR8-MSG1	Empty Unit ID	In-line message	‘Unit ID is required’
FR8-MSG2	Incorrect Unit ID Length	In-line-message	‘Incorrect Unit ID’
FR8-MSG3	Empty Plant Type	In-line message	‘Selection is required’

Table 5.2.1:2: Messages for Link Units

5.2.2 View All Units (FR9)

- After pressing view all units in the drawer menu, the system should navigate to this screen.



Linked units

Alphonso mango plant
5eda906978d75b354c375909

Device name Alphonso mango plant
Plant type Mango
Location Backyard rack 2
Unit condition
Soil temperature : 37 °C
Soil moisture : 45 %
Soil N2 level : 34(mg/kg)
Soil pH value : 5
Relative humidity: 56%

Carrot bed
5ee37e7b45555826246730d1

Device name Carrot bed

Table 5.2:2.1: View all linked units screen

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Card			
Title	Name of the plant	N/A	The name user set for the unit (Usually a plant name)
ID	Unit id	Length: 16 characters	This should be placed right under the plant name
Mini image	Image related to the selected plant type	N/A	Align with the title
Device name	Same as the title	N/A	Same as the title
Location	Location of the unit set by the user to identify a plant specifically	Type: String or null	This could be an empty string if the users didn't set that
Unit condition	Current sensor values of the unit	Data type: Double	This contains some details about current sensor readings of the unit. 6 readings from the sensors
Buttons			
Details	Navigate to the View Single Unit details screen	Field Type – Button	Upon click, the user should be redirected to the view Single Unit details screen
Actions	Navigate to the control actuators screen	Field Type – Button	Upon click, the user is redirected to the control actuators screen.

Table 5.2.2:1: Input Field Validations for View All Units

5.2.2.1 Basic Flow of events

- The use case starts when the user clicks on the 'View all units' at the drawer menu.
- The user clicks on the search button.
- The user views the search results on the table.

- The use case gets the end.

5.2.2.2 Alternative Paths

- N/A

5.2.2.3 Validations

- As the page loads, the table should be filled with existing Unit details in the system.

5.2.2.4 Actions

- Refer the input field validations in the table for button actions (Refer Table 5.2.2:1)

5.2.2.5 System integrations

- N/A

5.2.2.6 Negative Paths

- N/A

5.2.3 View Single Unit (FR10)

- Upon a press on the ‘Details’ text in a card which is assigned to a device user should be navigated into a screen which consists of several graphs.

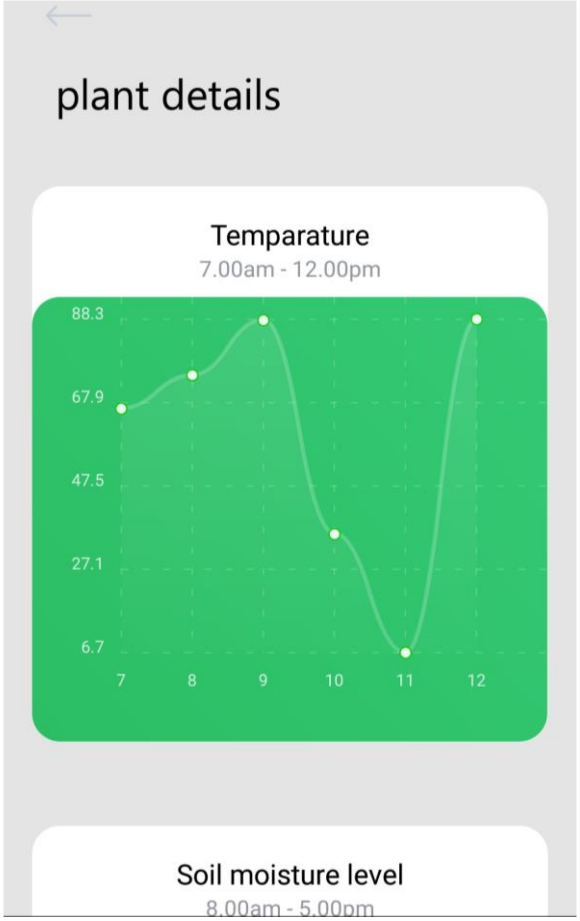


Table 5.2.3:1: Plant details screen

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Cards			
Sensor readings over time	Change of sensor readings over time	N/A	Users can view values related to soil moisture sensor, humidity sensor etc.
Fields			
Title	Title of the sensor reading	N/A	The title should clearly describe the sensor type

Time duration	The time gap between the first and the last reading	Should dynamically change according to time	The starting time should be 5 horse before the current time
Graph	To show the sensor readings over time	N/A	Readings should evenly be distributed over time

Table 5.2.3:1: Fields related to a single card

5.2.3.1 Basic Flow of events

- When the screen is initiated all the graphs should be populated with the values fetched from the server according to units.

5.2.3.2 Alternative Paths

- N/A

5.2.3.3 Validations

- If there is no such data present in the API response there should be a message which shows that error in the space dedicated for the graph.

5.2.3.4 Actions

- N/A

5.2.3.5 System integrations

- N/A

5.2.3.6 Negative Paths

- N/A

5.2.3.7 Messages

Message ID	Description	Message Type	Content
FR10-MSG1	Empty Result Set	In-line message	‘No Units’

Table 5.2.3:2: Messages for View Single Unit

5.2.4 Control Actuators

- Through these functions' users can control their IoT units if they are set to manual configuration. and also, can change the configuration to automatic and give the number of times to perform each action.
- Upon clicking on the 'Actions' button in the 'View Unit' details screen, the following mock-up should be displayed.

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			
Action Type	The type of action ex: Watering plants, Changing Lighting condition, Switch on Buzzer, Add Fertilizer.	Field type - Label Data type - String	Display all the actuators
Type	Specify the type Automatic or Manual	Field type - Radio Button Data type - Boolean Default: Manual	If the user selects Automatic for an action type then the Automatic section will be visible to the user. If manual is selected then the manual section will be visible.
Automatic			
No of times	To set the number of times to perform this action	Field Type – Dropdown Default Value - 2	Users can set the number of times to perform that action in automatic configuration. ex: Water the plants twice a day etc.
Confirm	Button to confirm automatic configuration	Field Type – Button	Upon Click the section will be closed and the configuration will be updated in the system
Manual			

Button	A button to perform the task at that moment.	Field Type - Button	Upon click, the unit should perform the specific task. And the section will be closed

Table 5.2.4:1: Input Field Validations for Control Actuators

5.2.4.1 Basic flow of events

- The use case starts when the user clicks on the ‘Link Unit’ button in the Navigation menu.
- User enters the Unit ID.
- User enters the Device Name.
- User enters the Plant Type.
- User enters Location.
- User clicks on the ‘Add’ button.
- The use case ends.

5.2.4.2 Alternative Paths

- The user clicks on the back button.

5.2.4.3 Validations

- Refer the input field validation table for validations (Refer table 5.2.4:1).

5.2.4.4 Actions

- Refer the input field validation table for button actions (Refer table 5.2.4:1).

5.2.4.5 System integrations

- N/A

5.2.4.6 Negative Paths

- If the user clicks on the ‘Add’ button by leaving the Mandatory fields empty. System should display the error messages.

5.2.4.7 Messages

- N/A

5.3 Chat Module

5.3.1 Send New Message (FR12)

- Users can send messages to the admins regarding issues with their units. Upon clicking on the 'Send Message' button, the following mock-up should be displayed.

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			
Message	To enter the message	Field type - Text Box Field Length - Maximum 255 Data type - String Default Value - Null Mandatory	
Buttons			
Send	To complete the process	Field Type – Button	Upon click, the message should be successfully sent to user

Table 5.3.1:1: Input Field Validations for Send New Message

5.3.1.1 Basic Flow of events

- The use case starts when the user clicks on the 'Send Message' button.
- User enters the message.
- User clicks on the Send button.

5.3.1.2 Alternative Paths

- N/A

5.3.1.3 Validations

- Refer the input field validation table for validations (Refer table 5.3.1:1).

5.3.1.4 Actions

- N/A

5.3.1.5 System Integration

- N/A

5.3.1.6 Negative Paths

- If the user clicks on the 'Send' button by leaving the Mandatory fields empty. System should display the error messages.

5.3.1.7 Messages

Message ID	Description	Message Type	Content
FR12-MSG1	Empty Message	In-line message	'Value is required'

Table 5.3.1:2: Messages in Send New Message

5.3.2 View All Messages (FR13)

- Upon clicking on the 'Messages' tab in the navigation menu, the following mock-up should be displayed.

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
List			
View Messages	this List should display all messages received or sent by the user.	Field Type – List Item Order by – Received Date Non-editable	All the users should be able to view the following details in a list item; Sender's name, Date and Time, View Status
Attributes			
Sender's name	To display senders (user's or admin's) name		
Date and Time	To display date and time the message was sent		
View Status	To display weather the message is viewed or not		List item will be greyed out if it's viewed by the user
Buttons			

View	To view the complete message loop	Field Type – Button	Upon click, the user should be redirected to the detail view of the message.

Table 5.3.2.1:1: Input Field Validations for View All Messages

5.3.2.1 Basic Flow of events

- The use case starts when the user clicks on the ‘Messages’ tab in the navigation menu.
- The user views all the messages in the list.
- The use case ends.

5.3.2.2 Alternative Paths

- The user clicks on the list item (Message).

5.3.2.3 Validations

- As the page loads, the screen should be filled with existing Messages in the system.

5.3.2.4 Actions

- Refer the input field validations in the table for button actions (Refer Table 5.3.2:1).

5.3.2.5 System Integration

- N/A

5.3.2.6 Negative Paths

- N/A

5.3.2.7 Messages

Message ID	Description	Message Type	Content
FR13-MSG1	Empty Result Set	In-line message	‘No Messages’

Table 5.3.2:2: Messages for View All Messages

5.3.3 View Single Message (FR14)

- Users can view a single message by clicking the message in View All Messages screen. Accessible for all the users having existing messages.

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
List			

Name	To display user’s name	Field type – Navbar heading	
Message/Reply	To display the message or replies	Field type – List Item	
Date and Time	To display the message sent time		
Sent by	To display the user that sent the message or reply		
Buttons			
Back	Return to the previous screen	Field Type – Button	Upon click, the user should be redirected to the previous page.

Table 5.3.3:1: Input Field Validations for View Single Message

5.3.3.1 Basic Flow of events

- The use case starts when the user clicks on a message in the View All Messages screen.
- The user views all the replies and the message on the screen.
- The use case ends.

5.3.3.2 Alternative Paths

- Reply Message (FR15).

5.3.3.3 Validations

- Refer the input field validations in the table for validations (Refer Table 5.3.3:1).
- As the page loads, the screen should be filled with existing replies and the message.

5.3.3.4 Actions

- N/A

5.3.3.5 System Integration

- N/A

5.3.3.6 Negative Paths

- N/A

5.3.3.7 Messages

Message ID	Description	Message Type	Content
FR14-MSG1	Empty Result Set	In-line message	‘No Messages’

Table 5.3.3:2: Messages for View Single Message

5.3.4 Reply Message (FR15)

- Users can reply to received messages regarding their unit statuses. Upon clicking on the Message in 'View All Messages screen', the following mock-up should be displayed along with the 'View Single Message' screen.

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			
Reply	To enter the reply	Field type - Text Box Field Length - Maximum 255 Data type - String Default Value - Null Mandatory	
Buttons			
Send	To complete the process	Field Type – Button	Upon click, the reply should be successfully sent to the admin

Table 5.3.4:1: Input Field Validations for Reply Message

5.3.4.1 Basic Flow of events

- The use case starts when the user clicks on a message in the 'View All Messages' screen
- User enters the reply.
- User clicks on the 'Send' button.

5.3.4.2 Alternative Paths

- N/A

5.3.4.3 Validations

- Refer the input field validation table for validations (Refer table 5.3.4:2).

5.3.4.4 Actions

- N/A

5.3.4.5 System Integration

- N/A

5.3.4.6 Negative Paths

- If the user clicks on the ‘Send’ button by leaving the Mandatory fields empty. System should display the error messages.

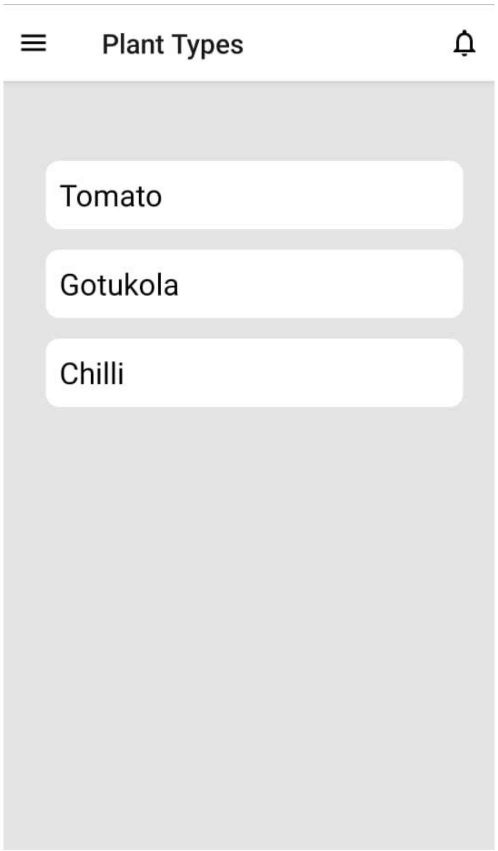
5.3.4.7 Messages

Message ID	Description	Message Type	Content
FR15-MSG1	Empty Reply	In-line message	‘Value is required’

Table 5.3.4:2: Messages in Reply Message

5.4 Planting Tips Module

5.4.1 Plant types



Plant Types

Tomato

Gotukola

Chilli

- Upon a click on the ‘Tips’ button of the side navigation menu, the list of plant types related to the user will be displayed.

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Card			
Card	This screen should be displayed all the plant types related to the user	Non-editable	Navigate to view plant tips screen
Fields			
Plant name	Display the name of the plant user has	Non-editable Display only	

Table 5.1.4:1: Input field validations for Planting tips screen

5.4.1.1 Basic Flow of events

- When the user clicks the name of the plant user will navigate into the detailed planting tips screen

5.4.1.2 Alternative Paths

- The user clicks on the back button

5.4.1.3 Validations

- N/A

5.4.1.4 Actions

- N/A

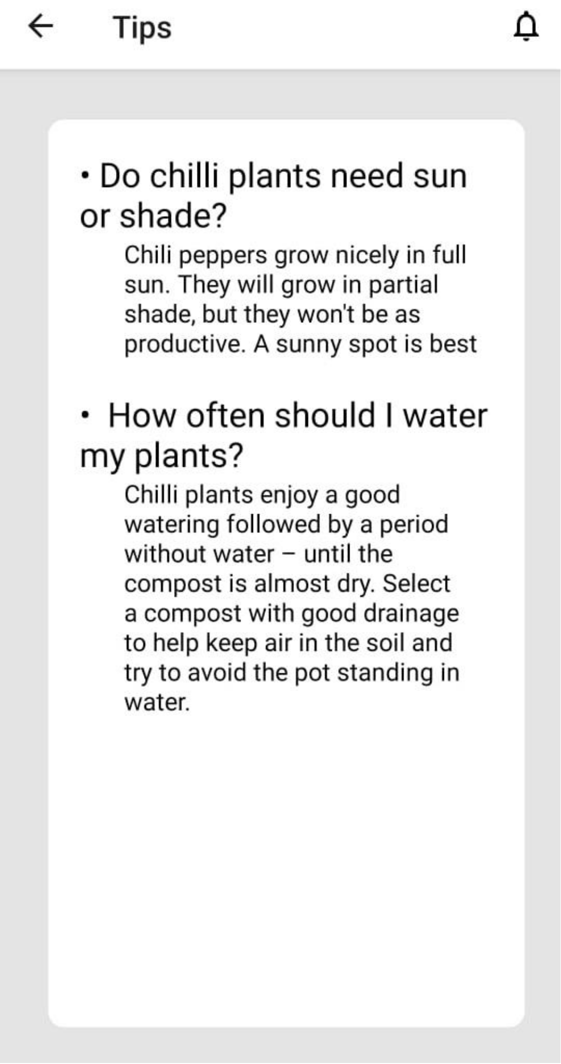
5.4.1.4 System integrations

- N/A

5.4.1.2 Negative Paths

- N/A

5.4.2 Planting tips



- Do chilli plants need sun or shade?

  Chili peppers grow nicely in full sun. They will grow in partial shade, but they won't be as productive. A sunny spot is best

- How often should I water my plants?

  Chilli plants enjoy a good watering followed by a period without water – until the compost is almost dry. Select a compost with good drainage to help keep air in the soil and try to avoid the pot standing in water.

- Upon a click on the ‘Tips’ button of the side navigation menu, the list of plant types related to the user will be displayed.

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Card			
Card	This screen should contain the list of tips related to the user	Non-editable	Planting tip’s title and description

Table 5.1.4:1: Input field validations for Planting tips screen

5.4.1.1 Basic Flow of events

- When the user clicks the name of the plant user will navigate into the detailed planting tips screen

5.4.1.2 Alternative Paths

- The user clicks on the back button

5.4.1.3 Validations

- N/A

5.4.1.4 Actions

- N/A

5.4.1.4 System integrations

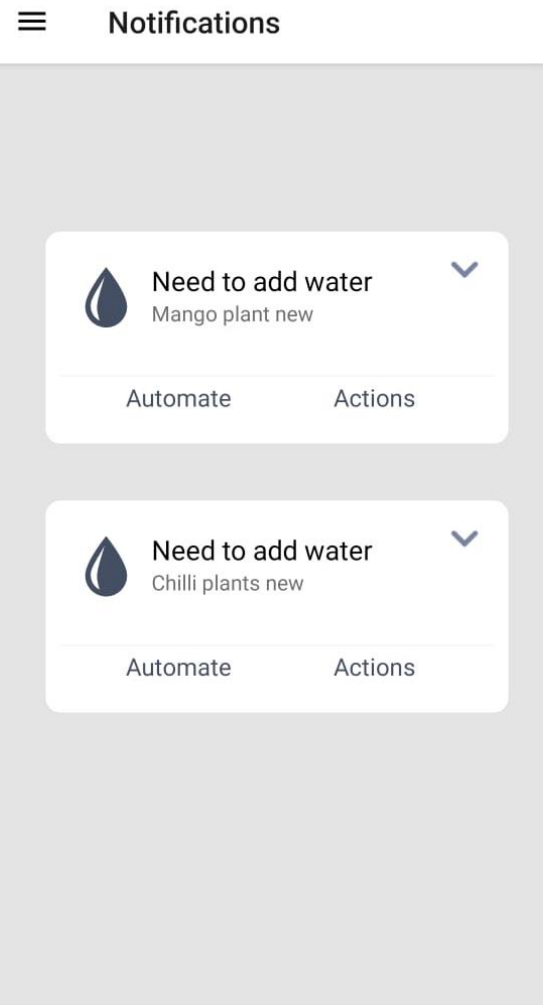
- N/A

5.4.1.2 Negative Paths

- N/A

5.5 Notifications Module

5.5.1 Notification screen



Notifications

Need to add water
Mango plant new

Need to add water
Chilli plants new

- Upon a click on the ‘Notifications’ button of the side navigation menu, the list of notifications which the user needed to know.

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Card			
Notification	Single card should contain details like sensor & condition related to one notification	Non-editable	unclickable
Buttons			
Automate	Set the related actuator to automatic activation mode	Non-editable	clickable
Actions	Navigate to the control actuators screen of the sensor module.	Non-editable	clickable

Table 5.1.4:1: Input field validations for Planting tips screen

5.4.1.1 Basic Flow of events

- When the user clicks the notifications button on side navigation bar, the user navigates to this screen. If the user clicks automate button, the notification goes away . If the user clicks actions button the user will navigate into the control actuators screen of the sensor module.

5.4.1.2 Alternative Paths

- The user clicks on the back button

5.4.1.3 Validations

- N/A

5.4.1.4 Actions

- N/A

5.4.1.4 System integrations

- N/A

5.4.1.2 Negative Paths

- N/A

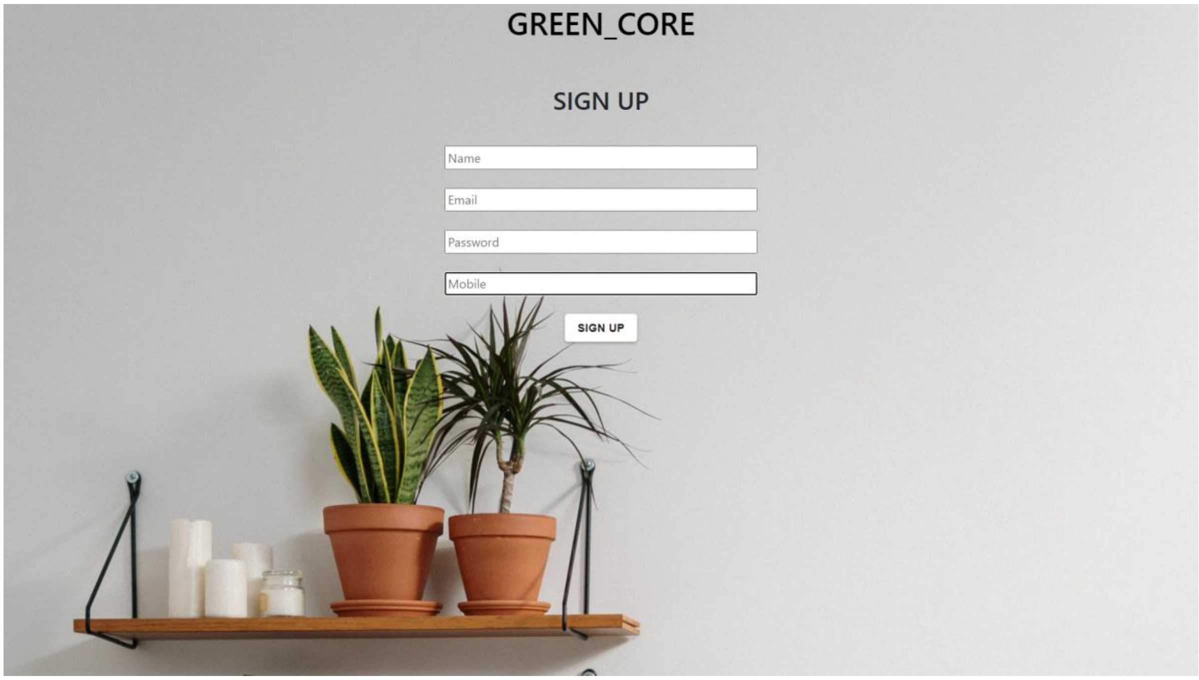
6 Functional Requirements – Web Application

6.1 Manage Users

- Through this function Users can be viewed (Existing users in the system), created, updated, and deleted from the system.

6.1.1 Register User (FR17)

- Admins should be able to register in the system. It is mandatory for the admin to register in the system to use the system functions and all the fields are mandatory.
- All the Admins can edit/update his details by accessing the 'Edit User' function (explained under the FR22).
- Upon clicking on the 'Register' button (figure), the following mock-up should be displayed. After verifying the email, the rest of the user registration process will be carried out



Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			
Name	To enter User's name	Field type - Text Box Field Length - Maximum 255 Data type - String	

		Mandatory	
Email	To enter user's email address	Field Type - Text Box Field Length - 255 Data Type - String Default Value - Null Mandatory	When email is already exists in the database, "Email Already exists" inline error message will be prompt.
Password	To enter user's password	Field Type - Text Box Field Length - 255 Data Type - String Default Value - Null Mandatory	
Confirm Password	To enter the user's confirmed password.	Field Type - Text Box Field Length - 255 Data Type - String Default Value - Null Mandatory	
Buttons			
Signup	To save the users details	Field Type - Button	Upon click, the user should be successfully saved in the system.

Table 6.1.1:1: Input Field Validations for Signup-1

6.1.1.1 Basic flow of events

- The use case starts when the user clicks on the 'Signup' button.
- User views the 'Sign Up' screen.
- User Enter the Name, email, password, confirm password.
- User clicks on the 'Sign Up' button.
- User directs to the 'login' screen.
- The use case gets the end/

6.1.1.2 Alternative Paths

- When User clicks on "Already have an account? Click here to Sign In" text, user will navigate to Login Screen.

6.1.1.3 Validations

- Refer the input field validation table for validations (Refer table 6.1.1:1).

6.1.1.4 Actions

- Refer the input field validation table for button actions (Refer table 6.1.1:1).

6.1.1.5 System integrations

- N/A

6.1.1.6 Negative Paths

- If the user clicks on the ‘Signup’ button by leaving the Mandatory fields empty. System should display the error messages.

6.1.1.7 Messages

Message ID	Description	Message Type	Content
FR17-MSG1	Empty User Name	In-line message	‘Name is required’
FR17-MSG2	Empty Email	In-line message	‘Email is required’
FR17-MSG3	Empty Password	In-line message	‘Password is required’
FR17-MSG4	Empty confirm password	In-line message	‘Passwords doesn’t match’

Table 6.1.1:2: Messages in Register Users

Email Verification

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Buttons			
Verify Email	To send a verification email	Field Type - Button	Upon click, the user will be sent a verification mail
Help Center	To access Help Center	Field Type – Button	Upon click, the user will be redirected to Help Center

Table 6.1.1:3: Input Field Validations for Verify Email

6.1.1.1 Basic flow of events

- The use case starts when the user clicks on the ‘Signup’ button (in figure 6.1.1:1).
- User clicks on the ‘Verify Email’ button.
- The use case ends.

6.1.1.2 Alternative Paths

- N/A

6.1.1.3 Validations

- Refer the input field validation table for validations (Refer table 6.1.1:1).

6.1.1.4 Actions

- Refer the input field validation table for button actions (Refer table 6.1.1:1).

6.1.1.5 System integrations

- Email Integration.

6.1.1.6 Negative Paths

- N/A

6.1.1.7 Messages

- N/A

Resend email verification mockup is as follows.

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Buttons			
Change	Allow the user to change the email	Field Type - Button	Upon click, the user should be redirected to the Signup page
Resend Link	To email the verification link again	Field Type – Button	Upon click, a verification link will be sent to the user’s email

Table 6.1.1:4: Input Field Validations for Resend Email

6.1.1.1 Basic flow of events

- The use case starts when the user clicks on the ‘Verify Email’ button (in figure 6.1.1:4).
- User clicks on the ‘Resend link’ button.
- The use case ends.

6.1.1.2 Alternative Paths

- User clicks on the ‘Change’ button.

6.1.1.3 Validations

- Refer the input field validation table for validations (Refer table 6.1.1:4).

6.1.1.4 Actions

- Refer the input field validation table for button actions (Refer table 6.1.1:4).

6.1.1.5 System integrations

- Email Integration.

6.1.1.6 Negative Paths

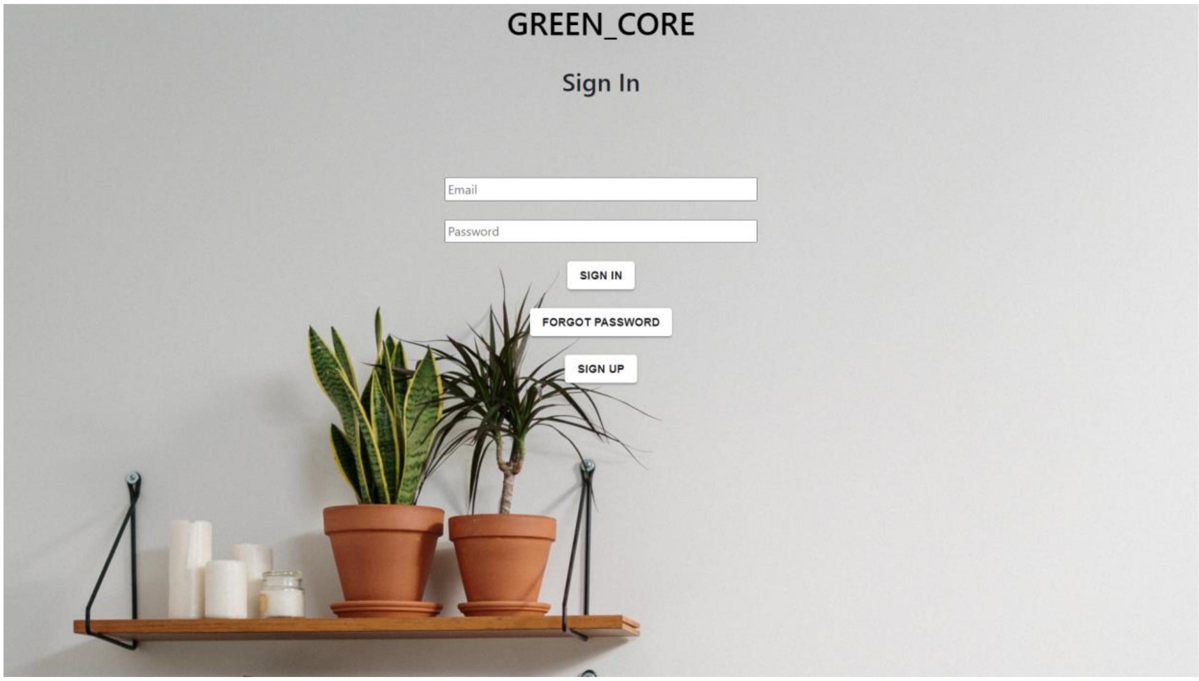
- N/A

6.1.1.7 Messages

- N/A

6.1.2 User (Admin) Login (FR18)

- Any user registered in the system should be able to login to the system.
- Users can log in to the system by entering valid email and password.



Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			
Email	To enter user’s email address	Field Type - Text Box Field Length - 255 Data Type - String Default Value - Null Mandatory Valid email address	
Password	To enter password	Field Type - Text Box	

		Field Length - 255 Data Type - String Default Value - Null Mandatory Data type - String Mandatory	
Buttons			
Sign in	To log in the to the system	Field Type – Button	Upon click, the user should be successfully logged in to the system

Table 6.1.2:1: Input Field Validations for Login

6.1.2.1 Basic flow of events

- The use case starts when the user opens the app.
- User views the ‘Login' screen
- User Enter the email, password.
- User clicks on the ‘Login' button.
- User directs to the ‘Dashboard’ screen.
- The use case gets the end.

6.1.2.2 Alternative Paths

- Users can click on “Don’t have an account click here to Sign Up’ text available in the ‘Sign Up screen, the user will navigate to Sign Up Screen.
- Users can click on the “forgot password” user will direct to the forgot password screen.

6.1.2.3 Validations

- Refer the input field validation table for validations (Refer table 6.1.2:1).

6.1.2.4 Actions

- Refer the input field validation table for button actions (Refer table 6.1.2.1).

6.1.2.5 System integrations

N/A

6.1.2.6 Negative Paths

- If the user clicks on the ‘Login’ button by leaving the Mandatory fields empty. System should display the error messages.
- If a user enters an incorrect email or password, System should display the error messages.

6.1.2.7 Messages

Message ID	Description	Message Type	Content
FR18-MSG1	Incorrect Email and password	Alert message	“Incorrect email or password”

Table 6.1.2:2: Messages in User Login

6.1.3 Forgot Password (FR19)

- When the user forgets his/her password, the user can click on “forgot password” in the Login screen and request for a password reset.
- Then the system will send an email including a verify token.
- Users can enter the verify token in “verify token” screen and navigate to “reset password” screen.

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			
Verify Token	To enter verify token	Field type - Text Box Field Length - Maximum 4 Data type - String/Number Mandatory	
Buttons			
Submit	To send the token for password reset request	Field Type - Button	Upon click, the user should navigate to reset password screen.

Table 6.1.3:1 Input Field Validations for Forgot Password

Then the system navigates to the “Reset Password” screen.

6.1.4 Reset Password (FR20)

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			

New Password	To enter new password	Field type - Text Box Field Length - Maximum 16 Data type - String Mandatory	
Re Enter New Password	To re enter the new password	Field type - Text Box Field Length - Maximum 1 Data type - String Mandatory	Check whether the two passwords entered are the same. If not display error message
Buttons			
Save Changes	To save the updated password	Field Type - Button	Upon click, the password should be successfully updated in the system

Table 6.1.4:1: Input Field Validations for Reset Password

6.1.4.1 Basic flow of events

- The use case starts when the user clicks on the ‘Forgot Password’ button available in the ‘Login’ screen.
- User views the ‘Verify Token’ screen.
- User enters verify Token.
- User clicks on the “Submit” button.
- User navigates to the “Reset Password” screen.
- User enters the new password.
- User reenters the new password.
- User clicks on the ‘Save Changes’ button.
- User navigates to the login screen.
- The use case gets the end.

6.1.4.2 Alternative Paths

- Users can click on the “Resend Token” button in the “Verify Token” screen.

6.1.4.3 Validations

- Refer the input field validation table for validations (Refer table 6.1.4:1).

6.1.4.4 Actions

- Refer the input field validation table for button actions (Refer table 6.1.4:1).

6.1.4.5 System integrations

- N/A

6.1.4.6 Negative Paths

- If the user clicks on the ‘Save Changes’ button in the “Reset password” screen by leaving the Mandatory fields empty. System should display the error messages.

- If a user clicks on the “Submit” button in the “Verify Token” screen by leaving it empty, the system should display the error messages.

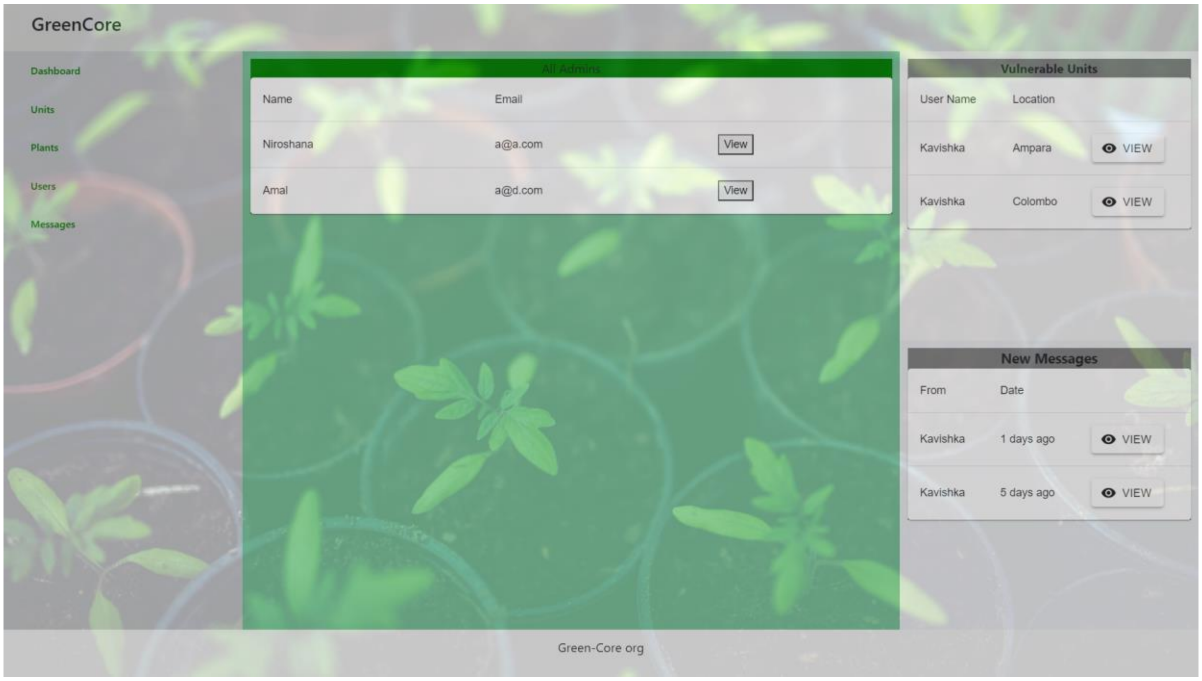
6.1.4.7 Messages

Message ID	Description	Message Type	Content
FR20-MSG1	Empty New Password	In-line message	‘New Password is required’
FR20-MSG2	Empty Re Enter New Password	In-line message	‘Re Enter password’
FR20-MSG3	Empty verification Token	In-line message	‘Verification Token is required’

Table 6.1.4.2: Messages for Change Password

6.1.5 View User (Admin) Details (FR21)

- Upon a click on the ‘Manage Users’ function and select admins, the list of admins in the system should be displayed.



All Admins

Name	Email	
Niroshana	a@a.com	View
Amal	a@d.com	View

Vulnerable Units

User Name	Location	
Kavishka	Ampara	VIEW
Kavishka	Colombo	VIEW

New Messages

From	Date	
Kavishka	1 days ago	VIEW
Kavishka	5 days ago	VIEW

Image 6.1.5:1 User interface of View User (Admin) details

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Table			
User results	This table should display a list of all admins’ details that are already registered in the system.	Field Type – Table Length – Should have pagination and 10 records per page Order by – User ID (Default) Non-editable	The user should be able to view the following details on the table; Email, Username
Columns			
Name	To display the user names of the admins	Field type - table column Non-editable Display only	
Email	To display the list of user emails	Field type - table column Non-editable Display only	
Buttons			
View	To view the detail view of the user	Field Type – Button	Upon click, the user should be redirected to the detail view of the user profile with user name, email, contact number and other available data..

Table 6.1.5:1: Input Field Validations for View User (Admin) details

6.1.5.1 Basic Flow of events

- The use case starts when the user clicks on the ‘Manage Users’ function.
- The user selects admins from the manage users menu.
- The user views the all available admin details
- The use case gets the end.

6.1.5.2 Alternative Paths

- N/A

6.1.5.3 Validations

- Refer the input field validations in the table for validations (Refer Table 6.1.5:1).
- As the page loads, the table should be filled with existing users (admins) in the system.

6.1.5.4 Actions

- Refer the input field validations in the table for button actions (Refer Table 6.1.5:1).

6.1.5.5 System integrations

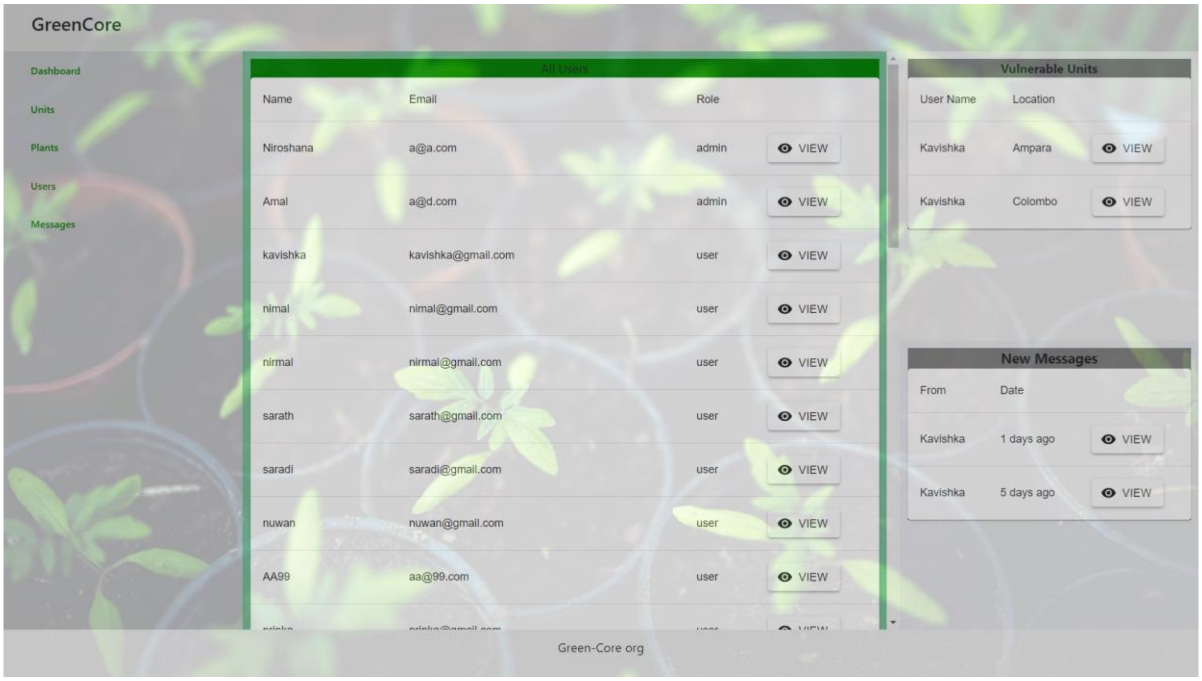
- N/A

6.1.5.6 Negative Paths

- N/A

6.1.7 View Users (FR25)

- Upon a click on the ‘Manage Users’ function and select users, the list of existing users in the system should be displayed.



All Users

Name	Email	Role	
Niroshana	a@a.com	admin	VIEW
Amal	a@d.com	admin	VIEW
kavishka	kavishka@gmail.com	user	VIEW
nimal	nimal@gmail.com	user	VIEW
nirmal	nirmal@gmail.com	user	VIEW
sarath	sarath@gmail.com	user	VIEW
saradi	saradi@gmail.com	user	VIEW
nuwan	nuwan@gmail.com	user	VIEW
AA99	aa@99.com	user	VIEW

Vulnerable Units

User Name	Location	
Kavishka	Ampara	VIEW
Kavishka	Colombo	VIEW

New Messages

From	Date	
Kavishka	1 days ago	VIEW
Kavishka	5 days ago	VIEW

Image 6.1.7:1 User interface of View Users’ details

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations

Table			
User results	This table should display a list of all user details that are already registered in the system.	Field Type – Table Length – Should have pagination and 10 records per page Order by – User ID (Default) Non-editable	The user should be able to view the following details on the table; Name, email and role
Columns			
Email	To display the list of user emails	Field type - table column Non-editable Display only	
Username	To display usernames of users	Non-editable Display only	
Role	To display user role details	Non-editable Display only	
Buttons			
View	To view the detail view of the user	Field Type – Button	Upon click, the user should be redirected to the detail view of the user profile.

Table 6.1.7:1: Input Field Validations for View User

6.1.7.1 Basic Flow of events

- The use case starts when the user clicks on the ‘Manage Users’ function.
- The user views the all available users’ details
- The use case gets the end.

6.1.7.2 Alternative Paths

- N/A

6.1.7.3 Validations

- Refer the input field validations in the table for validations (Refer Table 6.1.7:1).
- As the page loads, the table should be filled with existing users in the system.

6.1.7.4 Actions

- Refer the input field validations in the table for button actions (Refer Table 6.1.7:1)

6.1.7.5 System integrations

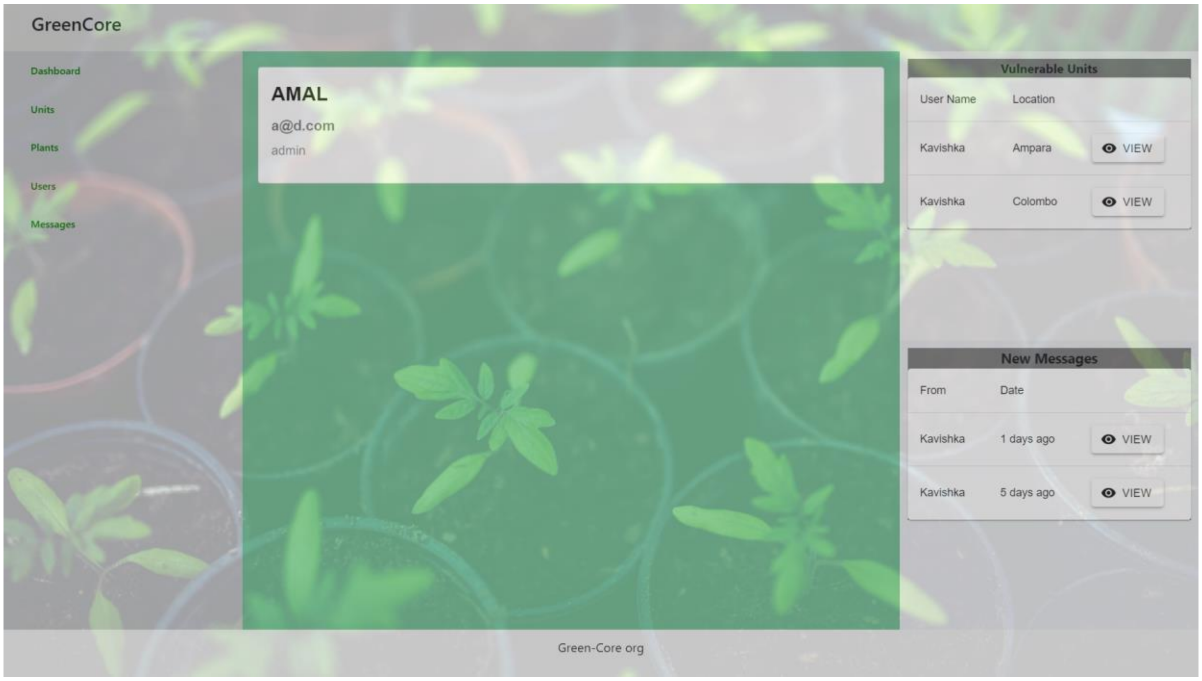
- N/A

6.1.7.6 Negative Paths

- N/A

6.1.9 View Single User (FR27)

Upon clicking the view button on the view all users page, the user can see the detail view of the specific user.



AMAL

a@d.com

admin

Vulnerable Units

User Name	Location	
Kavishka	Ampara	VIEW
Kavishka	Colombo	VIEW

New Messages

From	Date	
Kavishka	1 days ago	VIEW
Kavishka	5 days ago	VIEW

Image 6.1.9:1 User interface of View Single User' details

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			
Full Name	First and last name of the user.	Text heading .	
User name	To display the user name of the user next to the full name.	Text, non-editable	
User Role	Display the user role	Text non-editable	
Email	email of the user	Text, not editable	
Phone Number	Contact number of the user.	Text field.	
Address	Address of the user	text field.	

Table 6.1.9:1: Input Field Validations for View Single User

6.1.9.1 Basic Flow of events

- The use case starts when the user clicks on the View in the view all users page.
- The use case gets the end.

6.1.5.2 Alternative Paths

- N/A

6.1.5.3 Validations

- Refer the field validations in the table for validations (Refer Table 6.1.9:1).

6.1.5.4 Actions

- N/A

6.1.5.5 System integrations

- N/A

6.1.5.6 Negative Paths

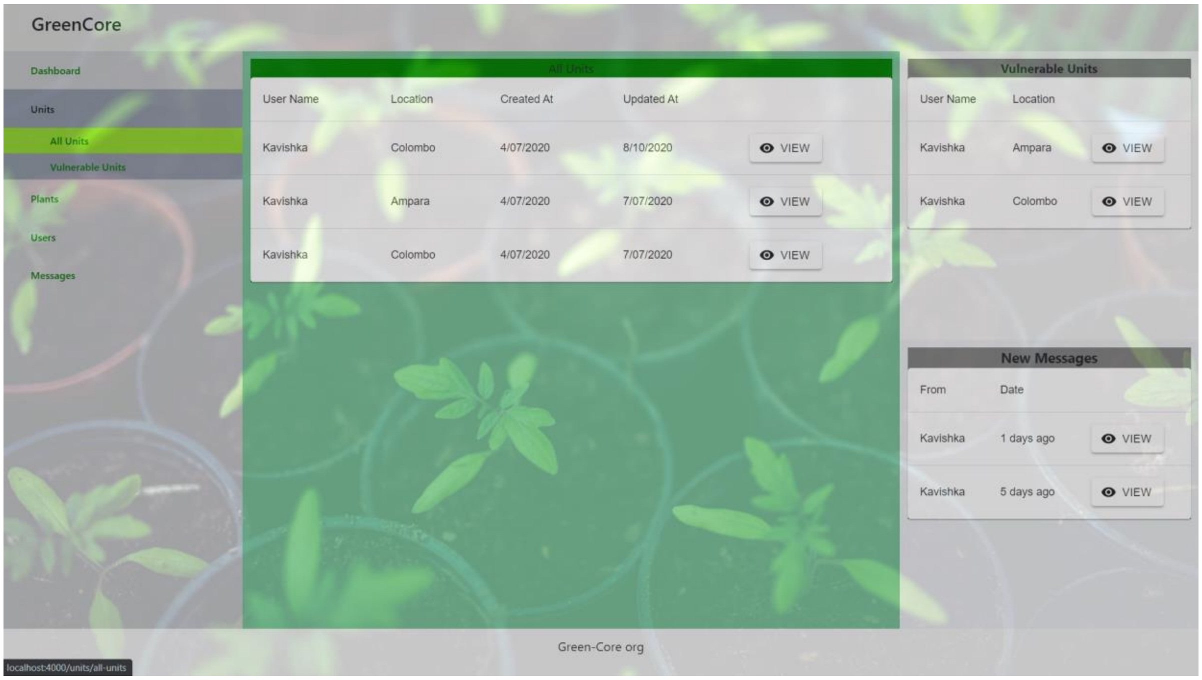
- N/A

6.2 Manage Units

- Admin should have permission to access the 'Manage Units' function.
- Through this function unit details can be viewed (Existing units of registered users in the system), from the system.

6.2.1 View All Units (FR29)

- Upon a click on the 'View Units' function, the list of existing units in the system should be displayed.



All Units

User Name	Location	Created At	Updated At	
Kavishka	Colombo	4/07/2020	8/10/2020	VIEW
Kavishka	Ampara	4/07/2020	7/07/2020	VIEW
Kavishka	Colombo	4/07/2020	7/07/2020	VIEW

Vulnerable Units

User Name	Location	
Kavishka	Ampara	VIEW
Kavishka	Colombo	VIEW

New Messages

From	Date	
Kavishka	1 days ago	VIEW
Kavishka	5 days ago	VIEW

Image 6.2.1:1 User interface of View All units' details

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Table			
Unit results	This table should display a list of all units details that are already registered in the system.	Field Type – Table Length – Should have pagination and 20 records per page Order by – Unit ID (Default) Non-editable	The unit should be able to view the following details on the table; User name of the user, location, created at and updated at.
Columns			
User name	User name of the user who own the unit	Non-editable Display only	
Location	To display units' locations	Non-editable Display only	
Created at	To display unit's created date and time	Non-editable Display only	

Updated at	To display unit's updated date and time	Non-editable Display only	
Buttons			
View	To view the detail view of the unit	Field Type – Button	Upon click, the unit should be redirected to the detail view of the unit profile.

Table 6.2.2:1: Input Field Validations for View All Units

6.2.2.1 Basic Flow of events

- The use case starts when the user clicks on the 'View units' function.
- The user views the results on the table.
- The use case gets the end.

6.2.2.2 Alternative Paths

- N/A

6.2.2.3 Validations

- Refer the input field validations in the table for validations (Refer Table 6.2.2:1).
- As the page loads, the table should be filled with existing units in the system.

6.2.2.4 Actions

- Refer the input field validations in the table for button actions (Refer Table 6.2.2:1).

6.2.2.5 System integrations

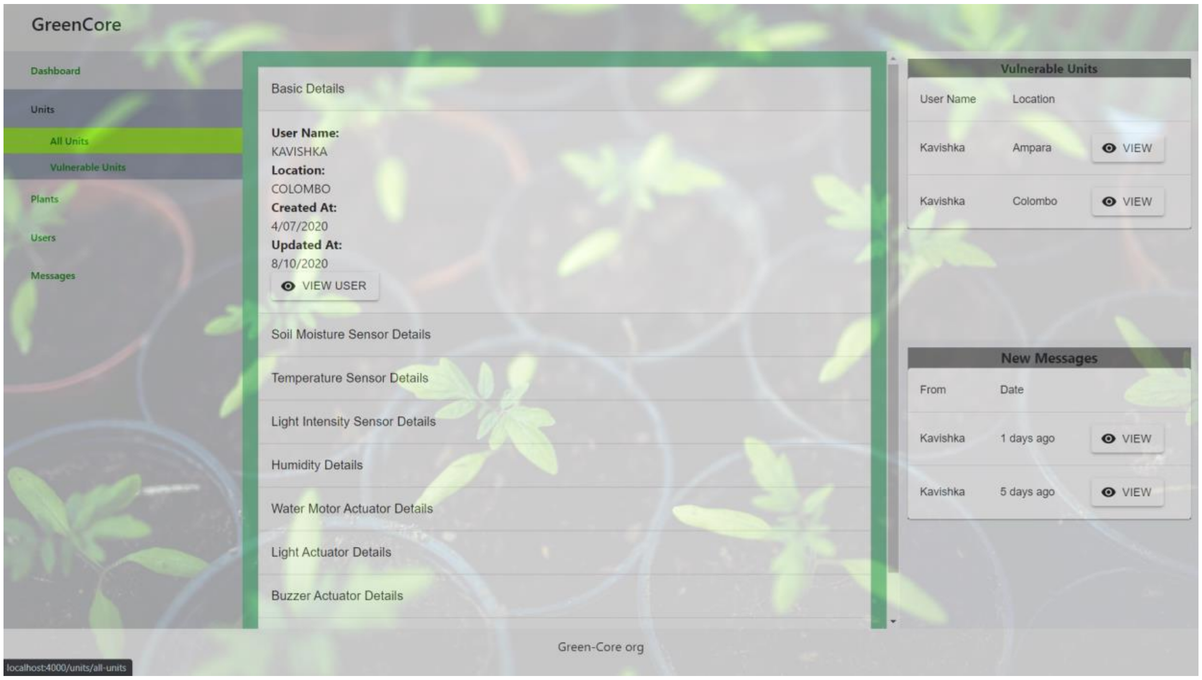
- N/A

6.2.2.6 Negative Paths

- N/A

6.2.2 View Single Unit (FR30)

- Upon a press on the 'View' button, it should be navigated into a page which consists of more details about the particular unit.



Basic Details

User Name:
KAVISHKA
Location:
COLOMBO
Created At:
4/07/2020
Updated At:
8/10/2020

Vulnerable Units

User Name	Location	
Kavishka	Ampara	VIEW
Kavishka	Colombo	VIEW

New Messages

From	Date	
Kavishka	1 days ago	VIEW
Kavishka	5 days ago	VIEW

Image 6.2.2:1 User interface of View unit's details

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Cards			
Sensor readings over time	Change of sensor readings over time	N/A	Users can view values related to soil moisture sensor, humidity sensor etc.
Fields			
Title	Title of the sensor reading	N/A	The title should clearly describe the sensor type
Time duration	The time gap between the first and the last reading	Should dynamically change according to time	The starting time should be 5 horse before the current time
Graph	To show the sensor readings over time	N/A	Readings should evenly be distributed over time

Table 6.2.3:1: Fields related to view a single unit

6.2.3.1 Basic Flow of events

- When the page loads all the graphs should be populated with the values fetched from the server according to units .

6.2.3.2 Alternative Paths

- N/A

6.2.3.3 Validations

- If there is no such data present in the API response there should be a message which shows that error in the space dedicated for the graph.

6.2.3.4 Actions

- N/A

6.2.3.5 System integrations

- N/A

6.2.3.6 Negative Paths

- N/A

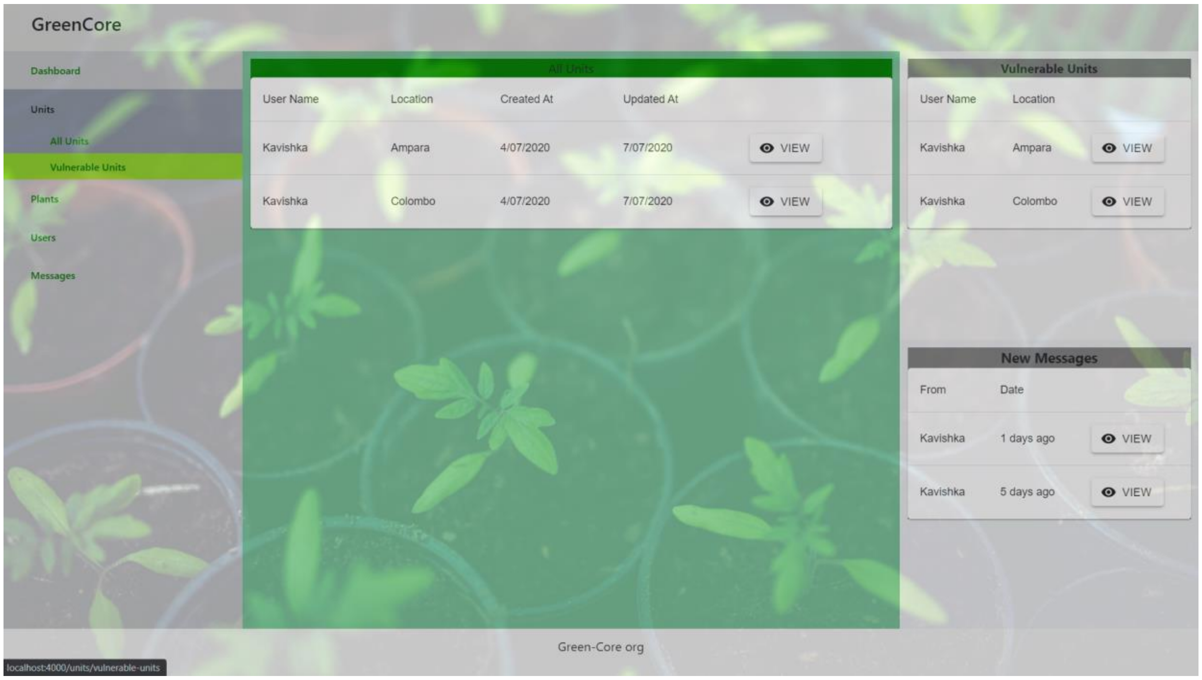
6.2.3.7 Messages

Message ID	Description	Message Type	Content
FR30-MSG1	Empty Result Set	In-line message	‘No Units’

Table 6.2.3:2: Messages for View single unit

6.2.3 View Vulnerable Units (FR31)

- Upon a click on the ‘View Vulnerable Units’ function, the list of existing vulnerable units in the system should be displayed when the button in the navigation menu is clicked.



All Units

User Name	Location	Created At	Updated At	
Kavishka	Ampara	4/07/2020	7/07/2020	VIEW
Kavishka	Colombo	4/07/2020	7/07/2020	VIEW

Vulnerable Units

User Name	Location	
Kavishka	Ampara	VIEW
Kavishka	Colombo	VIEW

New Messages

From	Date	
Kavishka	1 days ago	VIEW
Kavishka	5 days ago	VIEW

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Table			
Unit search results	This table should display a list of all vulnerable units details that are already registered in the system.	Field Type – Table Length – Should have pagination and 20 records per page Order by – Unit ID (Default) Non-editable	The unit should be able to view the following details on the table, Title, Location, Soil Moisture readings, Temperature readings, Humidity readings, Light intensity sensor readings and Water motor actuator.
Columns			
Title	Name of the plant	N/A	The name user set for the unit (Usually a plant name)
ID	Unit id	Length: 16 characters	This should be placed right under the plant name

Mini image	Image related to the selected plant type	N/A	Align with the title
Device name	Same as the title	N/A	Same as the title
Location	To display vulnerable units' locations	Non-editable Display only	
Soil Moisture readings	To display soil moisture level last reading with time and current reading with time.	Non-editable Display only	
Temperature readings	To display temperature level last readings with time and current reading with time.	Non-editable Display only	
Humidity readings	To display humidity level last readings with time and current reading with time.	Non-editable Display only	
Light intensity sensor readings	To display light intensity sensors' last readings with time and current reading with time.	Non-editable Display only	
Water motor actuator readings	To display water motor actuator activated or not activated.	Non-editable Display only	
Buttons			
View	To view the detail view of the vulnerable unit	Field Type – Button	Upon click, the unit should be redirected to the detail view of the vulnerable unit profile.
Edit	Edit details of the vulnerable unit.	Field Type – Button	Upon click, the vulnerable unit is redirected to the edit unit information screen.
Delete	Delete details of the vulnerable unit.	Field Type – Button	Upon click, a popup message is shown to

			confirm delete or cancel the action.

Table 6.2.4:1: Input Field Validations for View All Vulnerable Units

6.2.4.1 Basic Flow of events

- The use case starts when the user clicks on the ‘View units’ function.
- The user selects a search criterion from the ‘Search by’ dropdown list.
- The user clicks on the search button.
- The user views the search results on the table.
- The use case gets the end.

6.2.4.2 Alternative Paths

- N/A

6.2.4.3 Validations

- Refer the input field validations in the table for validations (Refer Table 6.2.4:1).
- As the page loads, the table should be filled with existing units in the system.

6.2.4.4 Actions

- Refer the input field validations in the table for button actions (Refer Table 6.2.4:1).

6.2.4.5 System integrations

- N/A

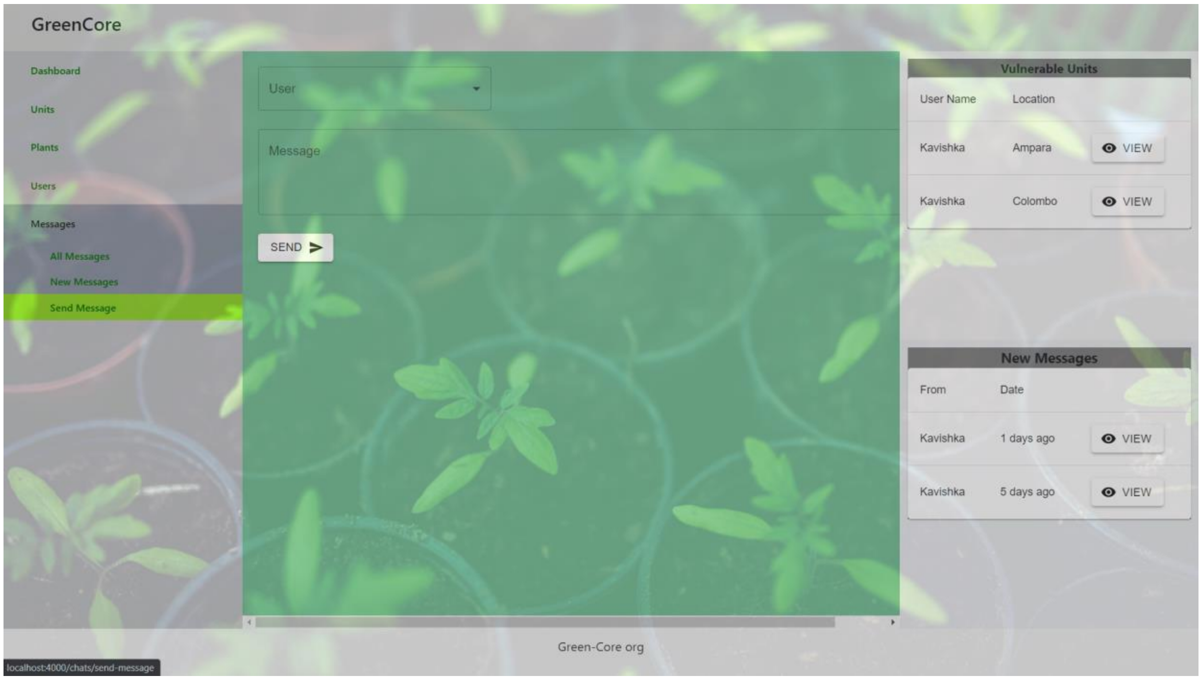
6.2.4.6 Negative Paths

- N/A

6.3 Chat Module

6.3.1 Send Message (FR32)

- Admin can send messages to users regarding their unit statuses. Upon clicking on the ‘Send Message’ button, the following mock-up should be displayed.



Vulnerable Units

User Name	Location	
Kavishka	Ampara	VIEW
Kavishka	Colombo	VIEW

New Messages

From	Date	
Kavishka	1 days ago	VIEW
Kavishka	5 days ago	VIEW

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			
Message	To enter the message	Field type - Text Box Field Length - Maximum 255 Data type - String Default Value - Null Mandatory	
Buttons			
Send	To complete the process	Field Type – Button	Upon click, the message should be successfully sent to user

Table 6.3.1:1: Input Field Validations for Send Message

6.3.1.1 Basic Flow of events

- The use case starts when the user clicks on the ‘Send Message’ button.
- User enters Message.
- User clicks on the Send button.

6.3.1.2 Alternative Paths

- User clicks on the cancel button.

6.3.1.3 Validations

- Refer the input field validation table for validations (Refer table 6.3.1:1).

6.3.1.4 Actions

- N/A

6.3.1.5 System Integration

- N/A

6.3.1.6 Negative Paths

- If the user clicks on the ‘Send’ button by leaving the Mandatory fields empty. System should display the error messages

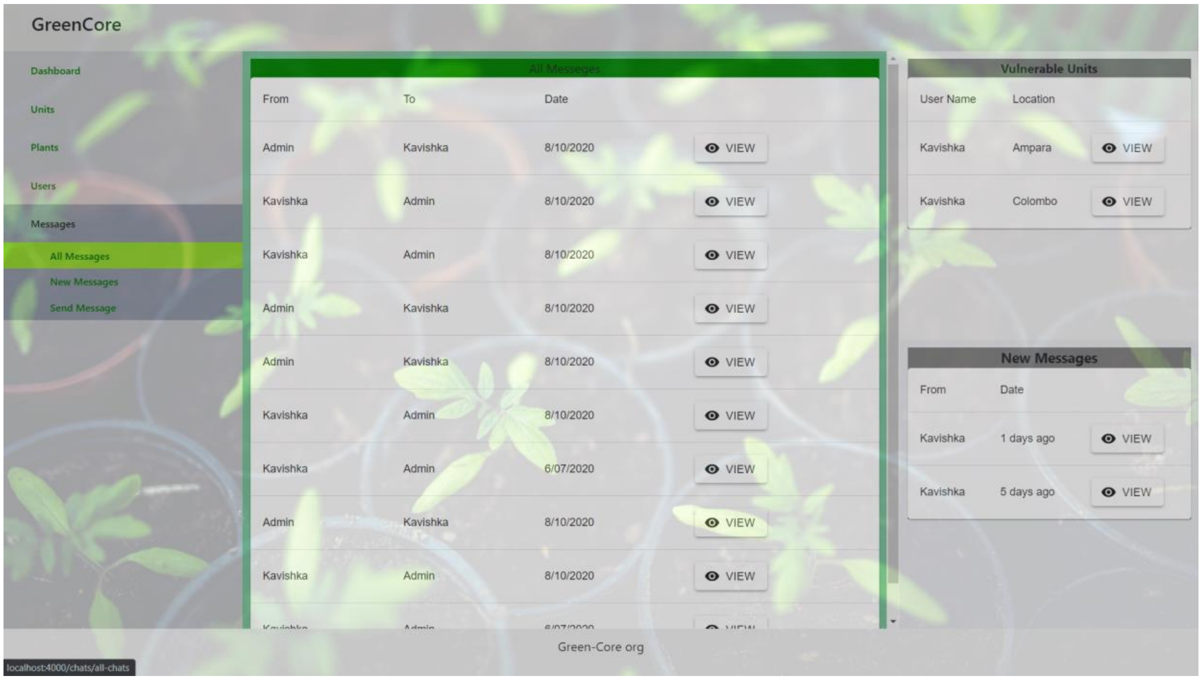
6.3.1.7 Messages

Message ID	Description	Message Type	Content
FR32-MSG1	Empty Message	In-line message	‘Value is required’
FR32-MSG2	Success Message	Message Box	‘Message sent successfully’

Table 6.3.1:2: Messages in Send Message

6.3.2 View All Messages (FR33)

- Upon clicking on the ‘View Messages’ button, the following mock-up should be displayed.



All Messages

From	To	Date	
Admin	Kavishka	8/10/2020	VIEW
Kavishka	Admin	8/10/2020	VIEW
Kavishka	Admin	8/10/2020	VIEW
Admin	Kavishka	8/10/2020	VIEW
Admin	Kavishka	8/10/2020	VIEW
Kavishka	Admin	8/10/2020	VIEW
Kavishka	Admin	6/07/2020	VIEW
Admin	Kavishka	8/10/2020	VIEW
Kavishka	Admin	8/10/2020	VIEW
Kavishka	Admin	6/07/2020	VIEW

Vulnerable Units

User Name	Location	
Kavishka	Ampara	VIEW
Kavishka	Colombo	VIEW

New Messages

From	Date	
Kavishka	1 days ago	VIEW
Kavishka	5 days ago	VIEW

Green-Core org

localhost:4000/chats/all-chats

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Table			
View Messages	this table should display all messages received by the admin.	Field Type – table Order by – Date Non-editable	All the admins should be able to view the following details on the table; User’s name, Date and Time, View Status, Priority
Columns			
Name	To display senders (user’s) name	Field type - table column	
Date and Time	To display date and time the message was sent	Field type – table column	
View Status	To display weather, it is viewed or not	Field type - table column	
Priority	Message Priority	Field type - table column	

Buttons			
View	To view the complete message loop	Field Type – Button	Upon click, the user should be redirected to the detail view of the message.
Delete	Delete Message.	Field Type – Button	Upon click, a popup message is shown to confirm delete or cancel the action.

Table 6.3.2.1:1: Input Field Validations for View All Messages

6.3.2.1 Basic Flow of events

- The use case starts when the user clicks on the ‘View Messages’ function.
- The user views all the messages on the table.
- The use case ends.

6.3.2.2 Alternative Paths

- The user clicks on the View button.
- The user clicks on the Delete button.

6.3.2.3 Validations

- Refer the input field validations in the table for validations (Refer Table 6.3.2:2).
- As the page loads, the table should be filled with existing Messages in the system.

6.3.2.4 Actions

- Refer the input field validations in the table for button actions (Refer Table 6.3.2:3).

6.3.2.5 System Integration

- N/A

6.3.2.6 Negative Paths

- N/A

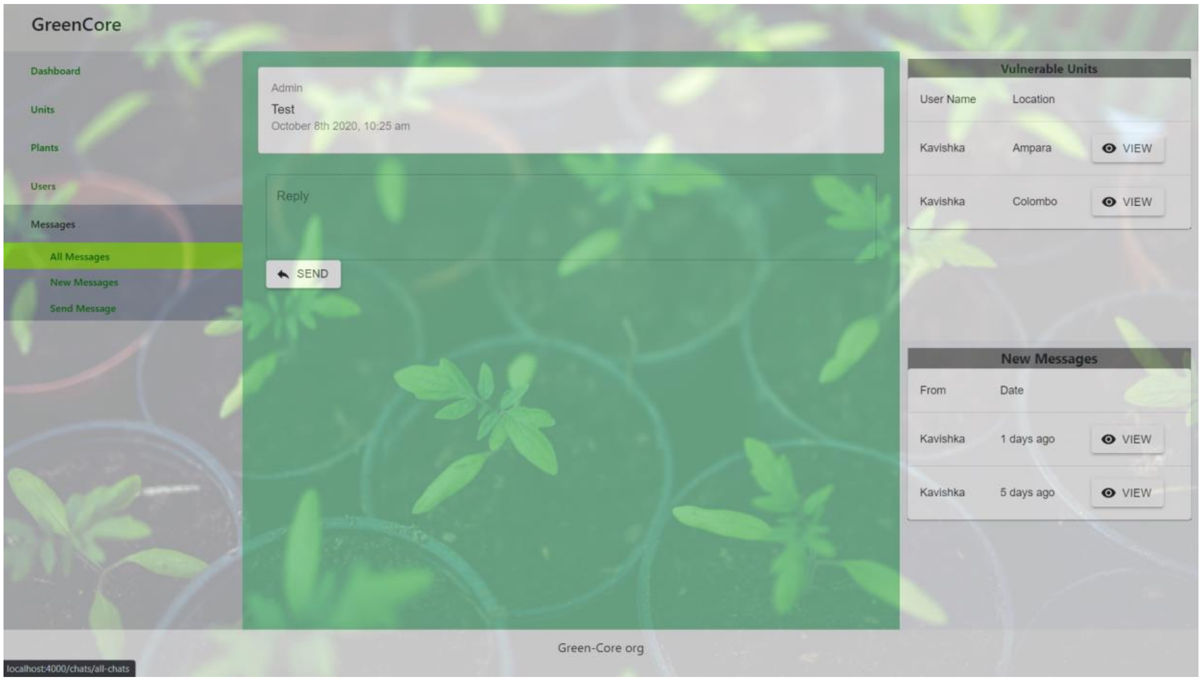
6.3.2.7 Messages

Message ID	Description	Message Type	Content
FR33-MSG1	Empty Result Set	In-line message	‘Required results are empty’

Table 6.3.2:2: Messages for View All Messages

6.3.3 View Single Message (FR34)

- Users can view a single message by clicking the view button on the relevant message in the View Messages page. Accessible for all the admins.



Admin
Test
October 8th 2020, 10:25 am

Vulnerable Units

User Name	Location	
Kavishka	Ampara	VIEW
Kavishka	Colombo	VIEW

New Messages

From	Date	
Kavishka	1 days ago	VIEW
Kavishka	5 days ago	VIEW

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
List			
Name	To display user’s name	Field type – Heading	
Message/Reply	To display the message or replies	Field type – List Item	
Date and Time	To display the message sent time		
Sent by	To display the user that sent the message or reply		
Buttons			
Back	Return to the previous page	Field Type – Button	Upon click, the user should be redirected to the previous page.

Table 6.3.3:1: Input Field Validations for View Single Message

6.3.3.1 Basic Flow of events

- The use case starts when the user clicks on the ‘View’ button.
- The user views all the replies and the message on the screen.
- The use case ends.

6.3.3.2 Alternative Paths

- N/A

6.3.3.3 Validations

- Refer the input field validations in the table for validations (Refer Table 6.3.3:2).
- As the page loads, the screen should be filled with existing replies and the message.

6.3.3.4 Actions

- Refer the input field validations in the table for button actions (Refer Table 6.3.3:3).

6.3.3.5 System Integration

- N/A

6.3.3.6 Negative Paths

- N/A

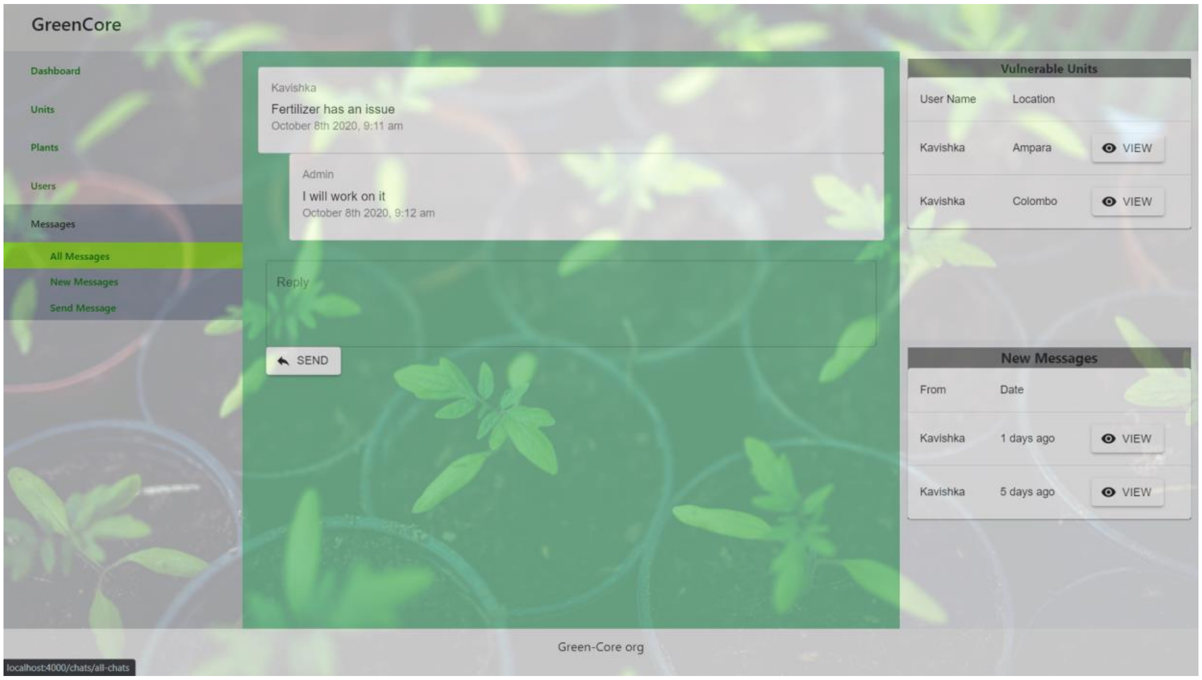
6.3.3.7 Messages

Message ID	Description	Message Type	Content
FR34-MSG1	Empty Result Set	In-line message	‘Required results are empty’

Table 6.3.3:2: Messages for View Single Messages

6.3.4 Reply Message (FR35)

- Admin can reply to received messages regarding their unit statuses. Upon clicking on the ‘View’ button in all messages screen, the following mock-up should be displayed.



Kavishka
Fertilizer has an issue
October 8th 2020, 9:11 am

Admin
I will work on it
October 8th 2020, 9:12 am

Vulnerable Units

User Name	Location	
Kavishka	Ampara	VIEW
Kavishka	Colombo	VIEW

New Messages

From	Date	
Kavishka	1 days ago	VIEW
Kavishka	5 days ago	VIEW

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			
Reply	To enter the reply	Field type - Text Box Field Length - Maximum 255 Data type - String Default Value - Null Mandatory	
Buttons			
Send	To complete the process	Field Type – Button	Upon click, the reply should be successfully sent to user

Table 6.3.4:1: Input Field Validations for Reply Message

6.3.4.1 Basic Flow of events

- The use case starts when the user clicks on the ‘View’ button.
- User enters the reply.
- User clicks on the Send button.

6.3.4.2 Alternative Paths

- N/A

6.3.4.3 Validations

- Refer the input field validation table for validations (Refer table 6.3.4:2)

6.3.4.4 Actions

- N/A

6.3.4.5 System Integration

- N/A

6.3.4.6 Negative Paths

- If the user clicks on the ‘Send’ button by leaving the Mandatory fields empty. System should display the error messages.

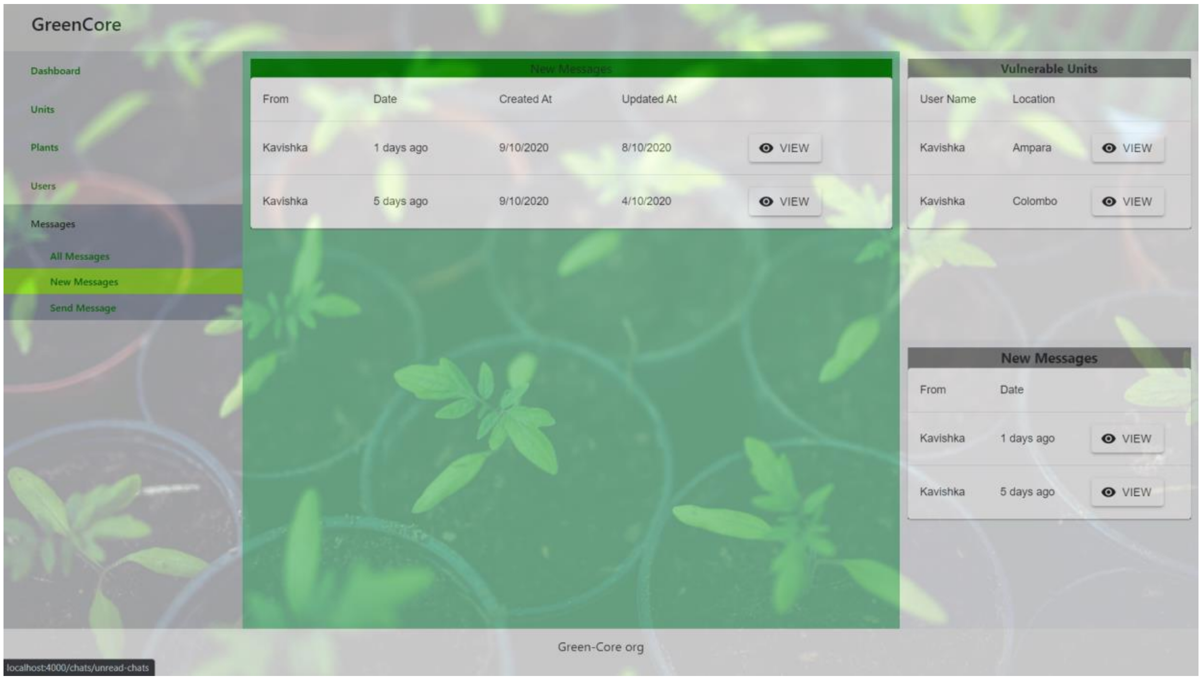
6.3.4.7 Messages

Message ID	Description	Message Type	Content
FR35-MSG1	Empty Reply	In-line message	‘Value is required’
FR35-MSG2	Success Message	Message Box	‘Reply sent successfully’

Table 6.3.4:2: Messages in Reply Message

6.3.5 View New Messages (FR36)

- Upon clicking on the ‘View New Messages’ button, the following mock-up should be displayed. Also, this should be available in the dashboard.



New Messages

From	Date	Created At	Updated At	
Kavishka	1 days ago	9/10/2020	8/10/2020	VIEW
Kavishka	5 days ago	9/10/2020	4/10/2020	VIEW

Vulnerable Units

User Name	Location	
Kavishka	Ampara	VIEW
Kavishka	Colombo	VIEW

New Messages

From	Date	
Kavishka	1 days ago	VIEW
Kavishka	5 days ago	VIEW

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Table			
View New Messages	this table should display all the new messages received by the admin which were not read.	Field Type – table Order by – Date Non-editable	All the admins should be able to view the following details on the table; User’s name, Date and Time and Priority
Columns			
Name	To display senders (user’s) name	Field type - table column	
Date and Time	To display date and time the message was sent	Field type – table column	
Priority	Message Priority	Field type - table column	This should be denoted by using colored dots, High priority: Red Medium: Yellow Low: Green

Buttons			
View	To view the complete message loop	Field Type – Button	Upon click, the user should be redirected to the detail view of the message.

Table 6.3.5:1: Input Field Validations for View All Messages

6.3.5.1 Basic Flow of events

- The use case starts when the user clicks on the ‘View New Messages’ function.
- The user views all the new (unread) messages on the table.
- The use case ends.

6.3.5.2 Alternative Paths

- The user clicks on the View button.

6.3.5.3 Validations

- Refer the input field validations in the table for validations (Refer Table 6.3.5:1).
- As the page loads, the table should be filled with existing new messages in the system.

6.3.5.4 Actions

- Refer the input field validations in the table for button actions (Refer Table 6.3.5:1).

6.3.5.5 System Integration

- N/A

6.3.5.6 Negative Paths

- N/A

6.3.5.7 Messages

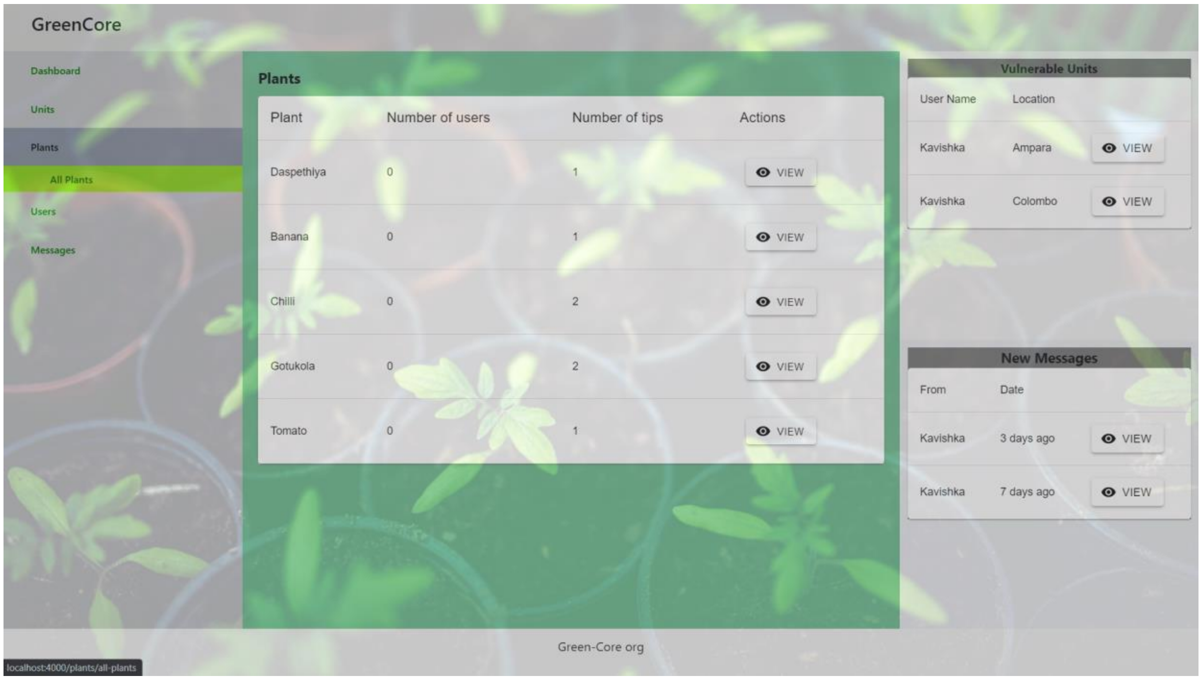
Message ID	Description	Message Type	Content
FR36-MSG1	Empty Result Set	In-line message	‘Required results are empty’

Table 6.3.5:2: Messages for View New Messages

6.4 Plant Tips

6.4.1 Planting Tips (FR37)

- Admin can add, edit , delete planting tips of a particular plant.



Plants

Plant	Number of users	Number of tips	Actions
Daspethiya	0	1	VIEW
Banana	0	1	VIEW
Chilli	0	2	VIEW
Gotukola	0	2	VIEW
Tomato	0	1	VIEW

Vulnerable Units

User Name	Location	
Kavishka	Ampara	VIEW
Kavishka	Colombo	VIEW

New Messages

From	Date	
Kavishka	3 days ago	VIEW
Kavishka	7 days ago	VIEW

Screen/Report Field	Description	Type/Value/Validations	Remarks/Special Validations
Fields			
Plant name	View planting tips	Field Type – table Order by – Name editable	
Number of users	user count of a particular plant	Field type – table column	
Number of tips	Count of tips	Field type – table column	
Buttons			
View	Viewing planting tips	Field Type – Button	Upon click, the user should be redirected to the detail view of the planting tip.

Table 6.4.1:1: Input Field Validations for Send Message

6.4.1.1 Basic Flow of events

- The use case starts when the user clicks on the ‘Plant tips’ button.

6.4.1.2 Alternative Paths

- User clicks on the cancel button.

6.4.1.3 Validations

- Refer the input field validation table for validations (Refer table 6.4.1:1).

6.4.1.4 Actions

- N/A

6.4.1.5 System Integration

- N/A

6 Non-Functional Requirements

6.1 Availability

- System will be available on both mobile and web with any internet accessible device.

6.2 Usability

- Simple and easy to use interface throughout the mobile and Web Application.

6.3 Dependability

- Backups backend database to a database in the cloud periodically

6.4 Security

- Only administrators can access the Web Application and only registered users can enter the Mobile Application.
- Assumption- Administrator is a trustworthy person.

6.5 Maintainability

- Mobile Application can be updated easily through the Play Store.
- Repairs on the IoT device can be done easily because of the modular nature of the IOT device.

6.6 Performance

- Database will update its data almost instantly when an action takes place. So, the users will always get real-time information from the database. Response time of the system is minimized

6.7 Security

- Control of access to the Admin System's resources, its data and operating system files to prevent unauthorized persons from accessing sensitive data of the system. Sensitive data is backed up frequently

6.8 Capacity

- Any number of users can login at the same time. Allocated storage space per user is unlimited.

7 System Requirements

Server for hosting.

- 4 x 1.6 GHz Processor
- 16 GB RAM
- 50 GB of Minimum HDD
- Unlimited Bandwidth
- Internet Connection

8 Stakeholders & Use Case Diagrams

8.1 Stakeholders

8.1.1 Admin

- Login
- Manage Users
- Manage Units
- Send Messages
- Reply Messages

8.1.2 Unregistered User

- Register to the system

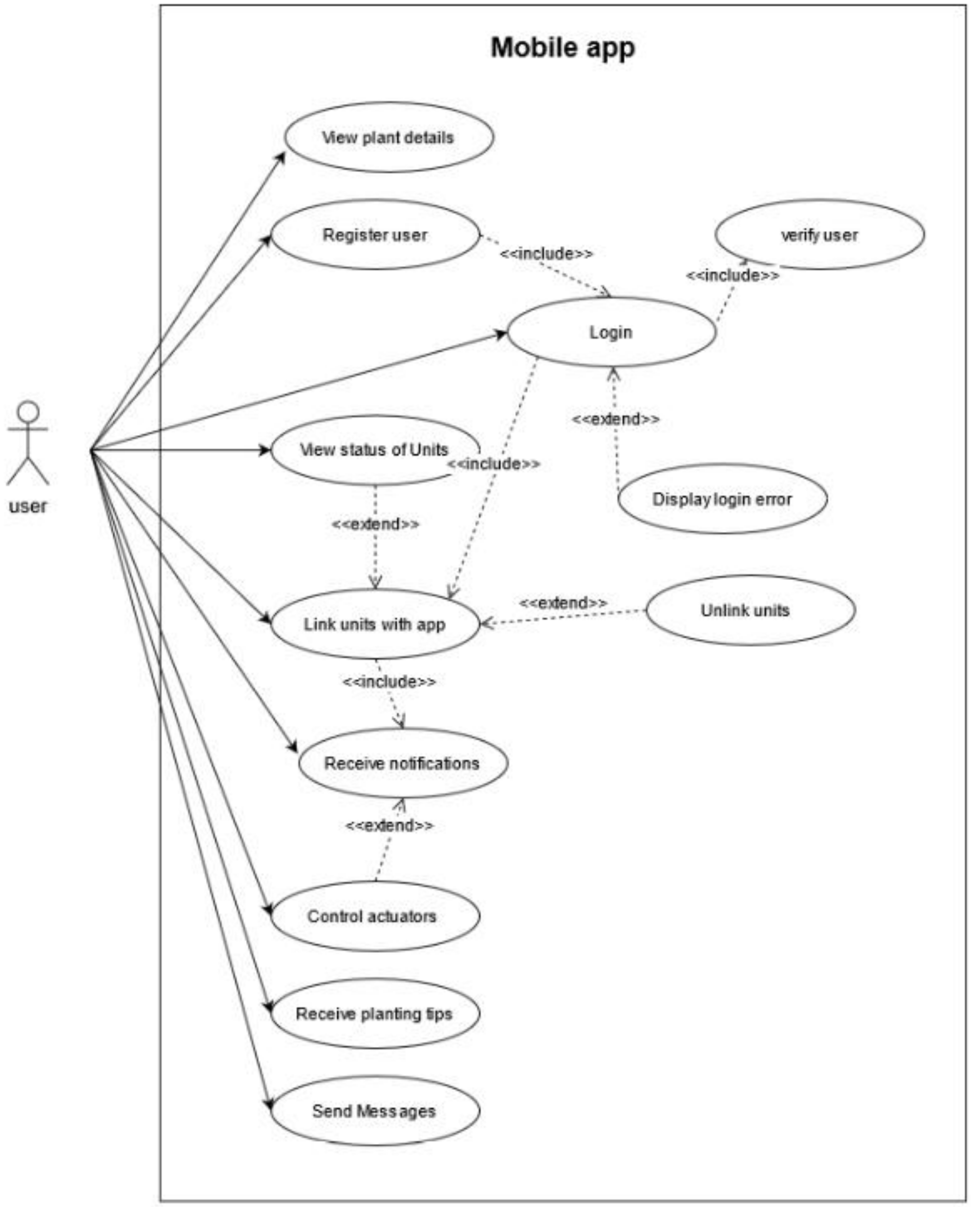
8.1.3 Registered User

- Login
- Add units
- Manage User profile
- View Units and details

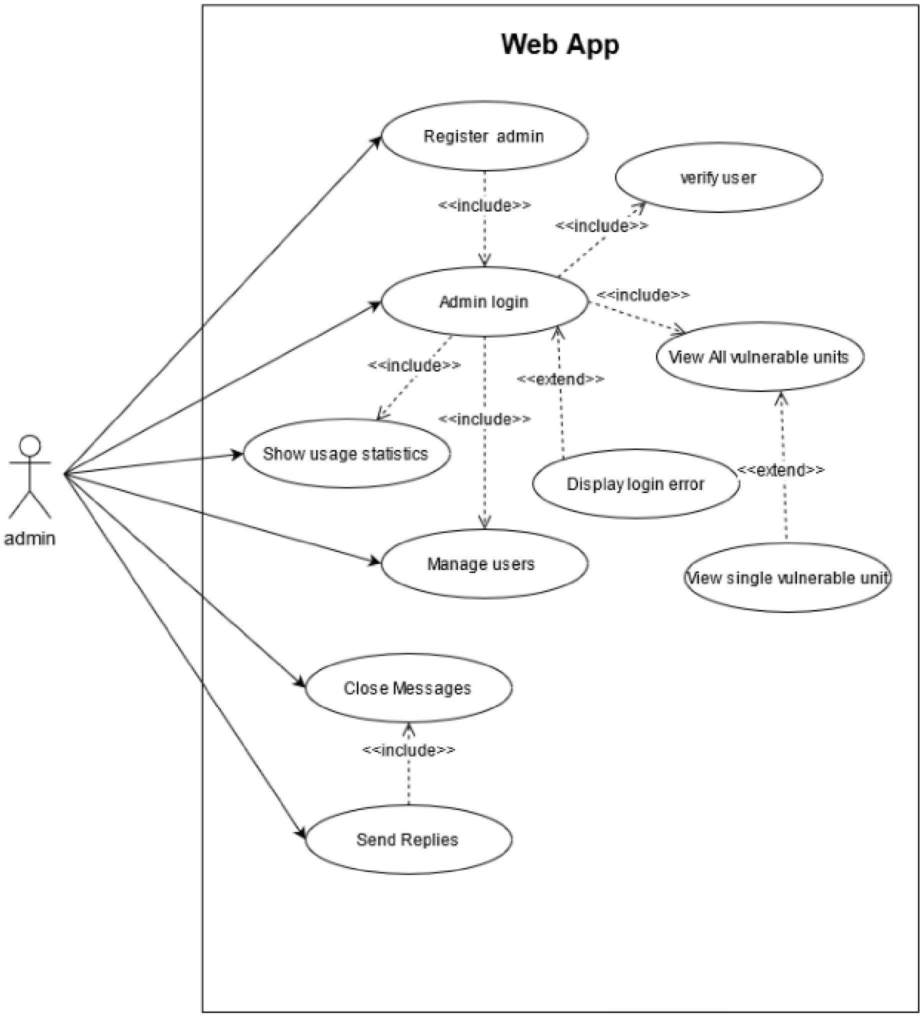
- Control actuators
- Send Messages
- Reply Messages

8.2 Use Case Diagrams

8.2.1 Users

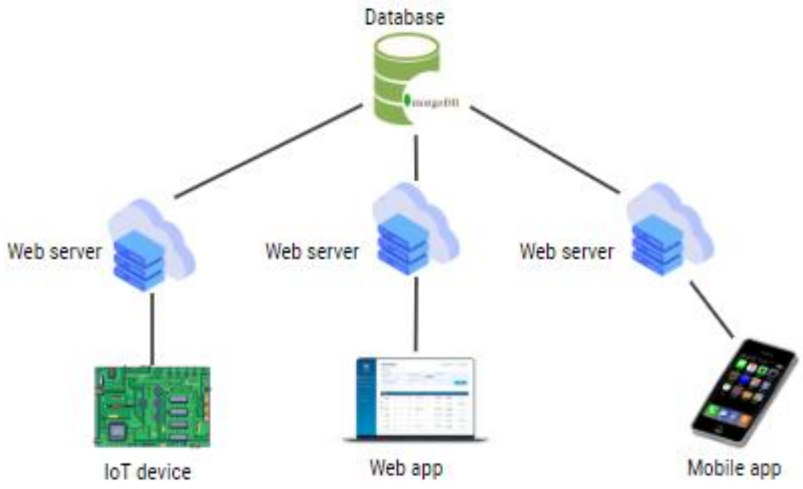


8.2.2 Admin


Web App
Register admin
<<include>>
verify user
<<include>>
Admin login
<<include>>
View All vulnerable units
<<include>>
<<extend>>
<<include>>
Show usage statistics
Display login error
<<extend>>
admin
Manage users
View single vulnerable unit
Close Messages
<<include>>
Send Replies

9 System Architecture

9.1 Architecture Diagram



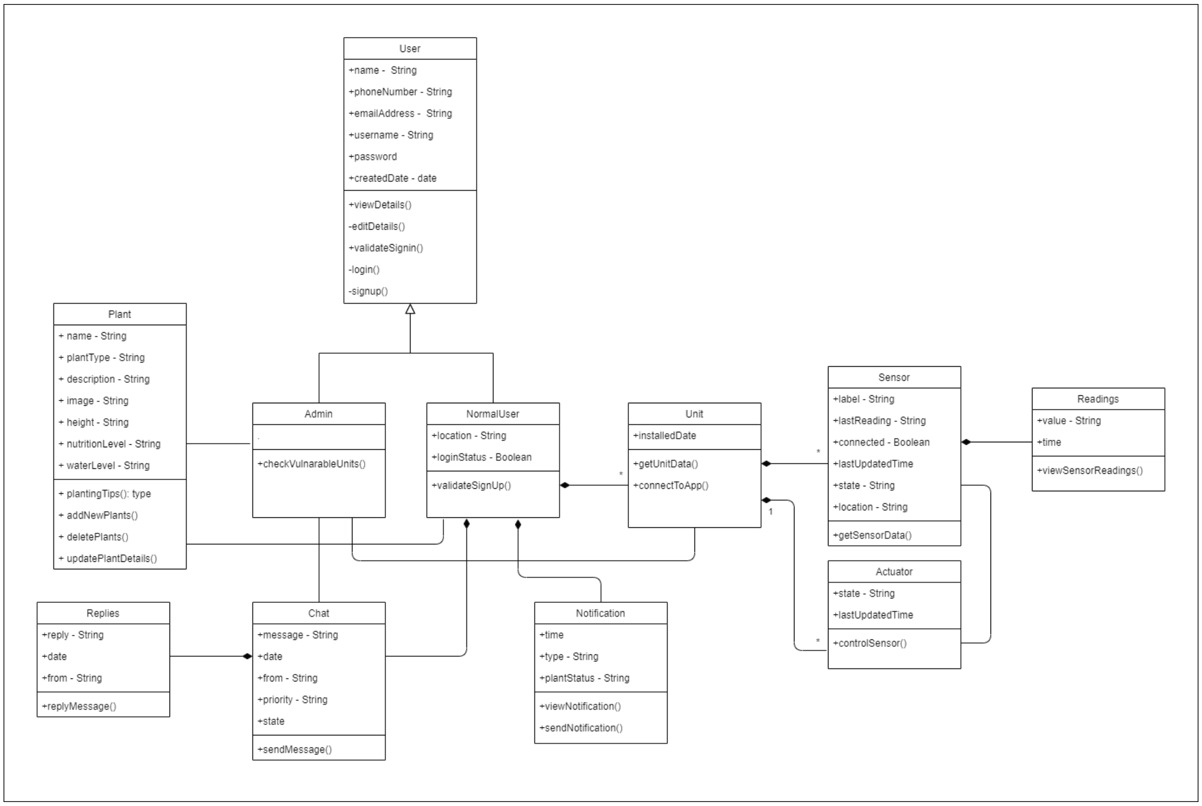
9.2 Components and their responsibilities

Components	Responsibilities
User Component	● Add User ● Edit User ● Search User ● View User ● Register User ● Login User
Units Component	● View Units ● Edit Units ● Control Actuators
Notification Component	● Notify users about garden status ● Reminders
Security Component	● Verifies users based on their credentials ● System security
Statistical Component	● Generate line charts
Admin Component	● Manage User ● Manage Units
Chat Component	● Send Message ● Reply Message ● View Messages

Table 9.2.1:1: Components and their responsibility

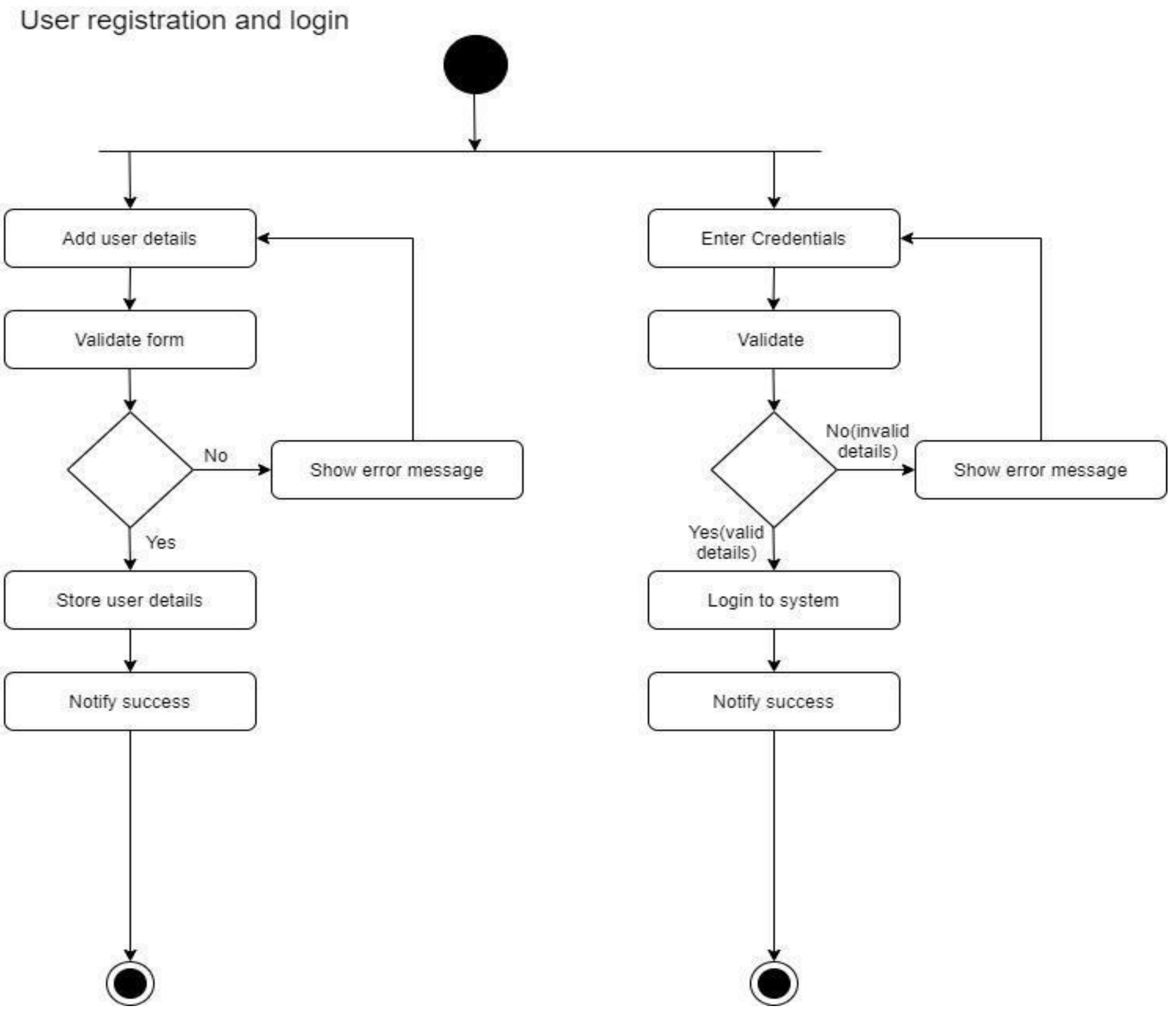
10 System Design

10.1 Class Diagram

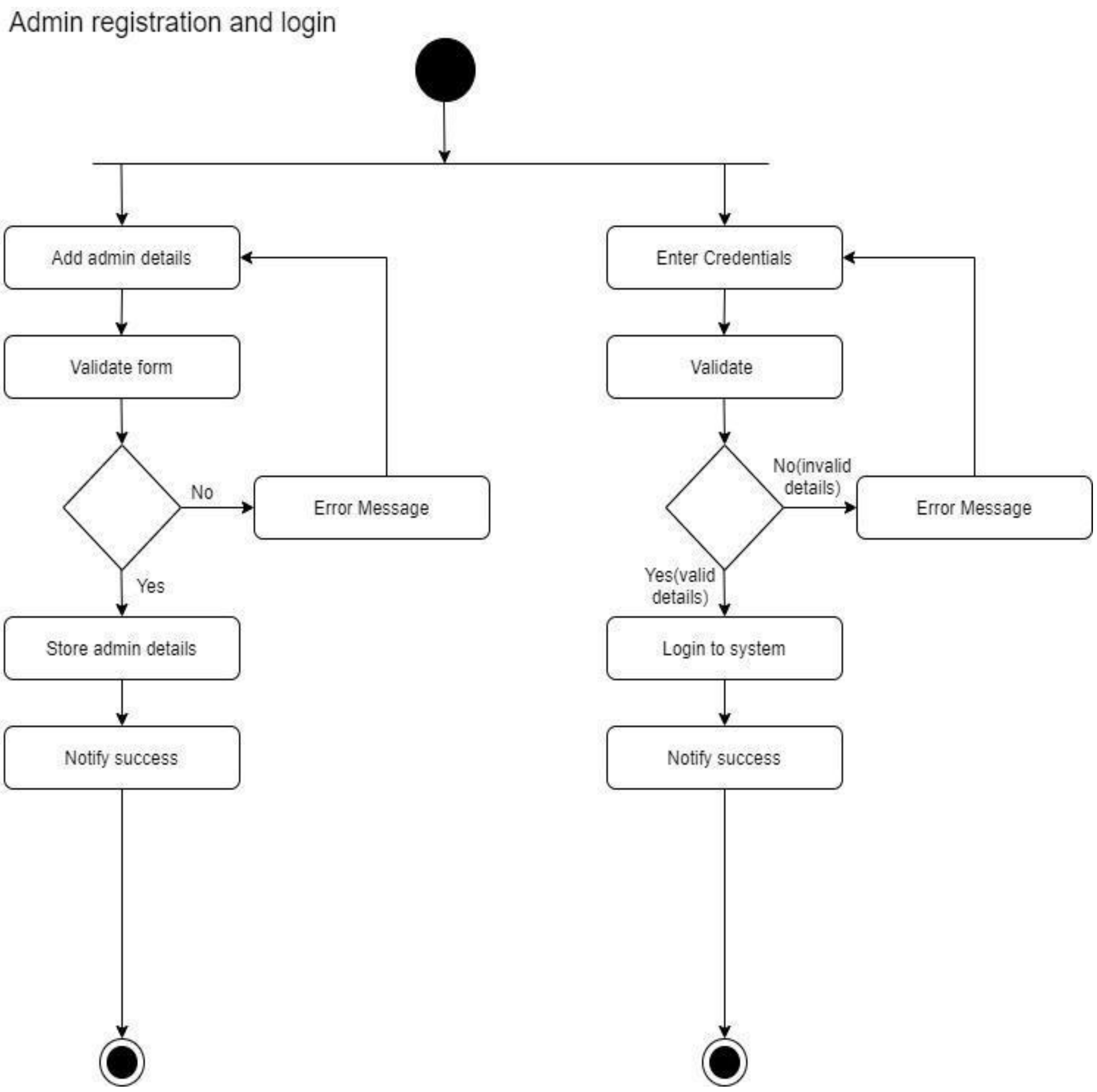


10.2 Activity Diagrams

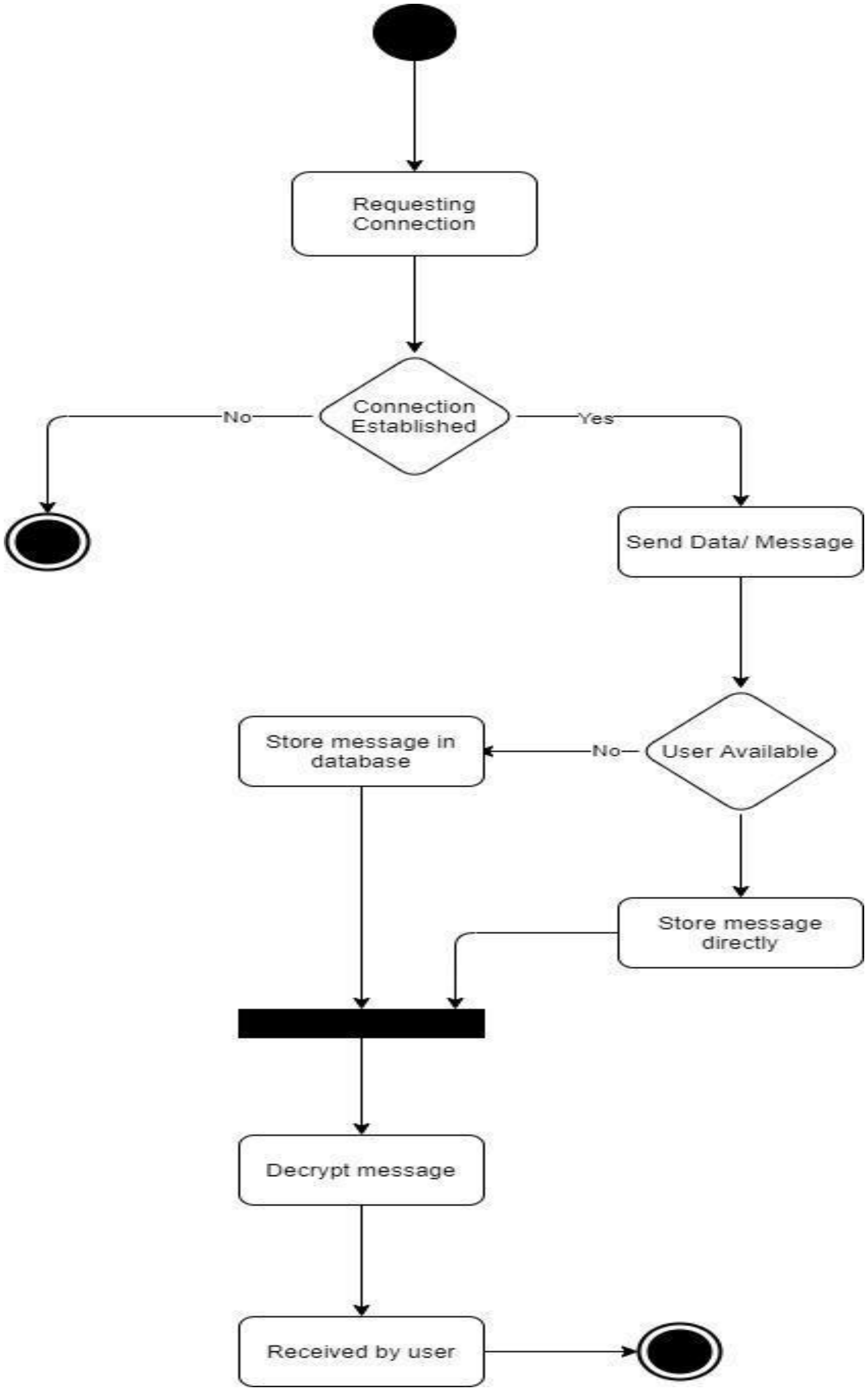
10.2.1 Login Activity Diagram-Mobile Application



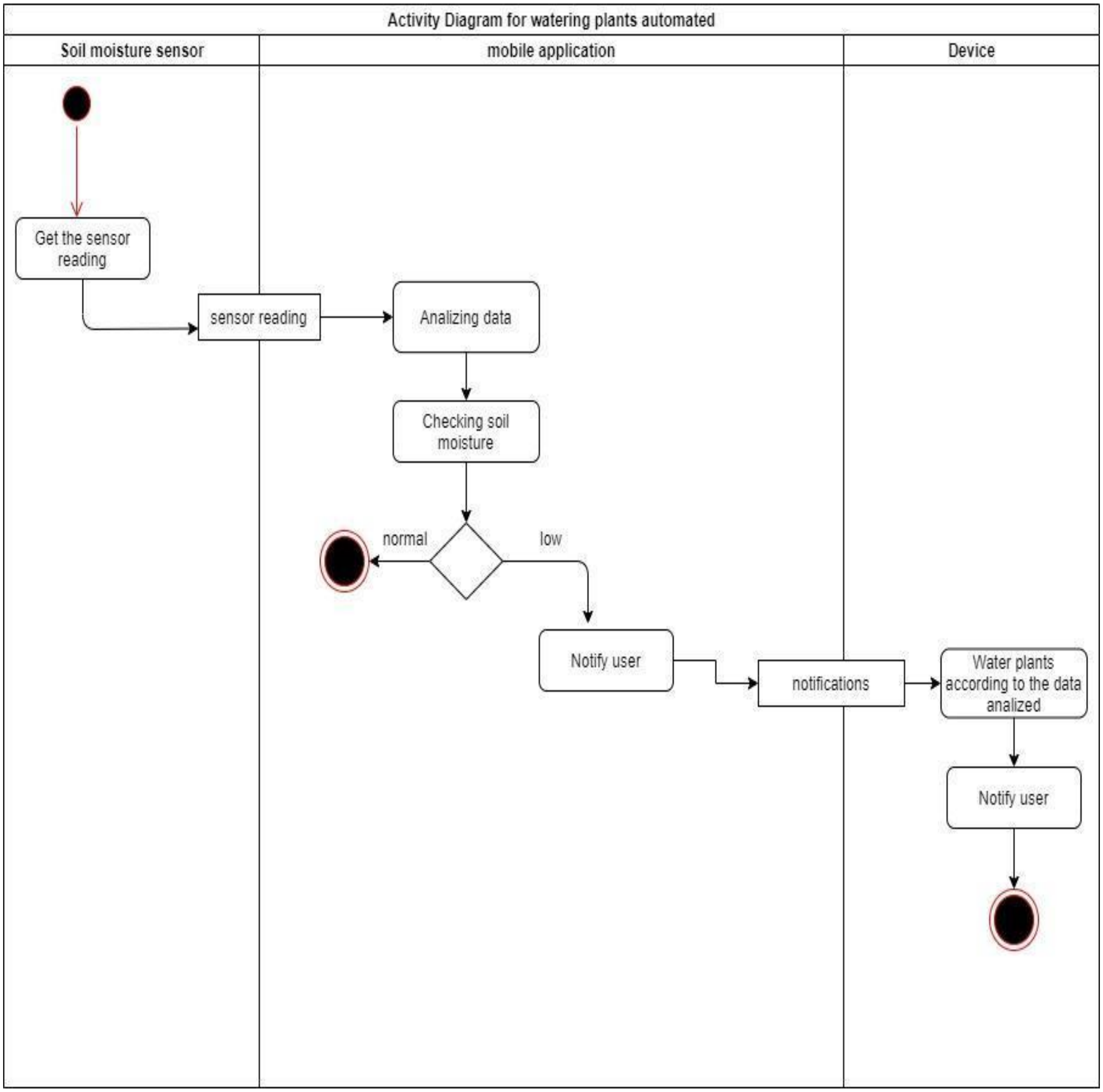
10.2.2 Login Activity Diagram-Web Application



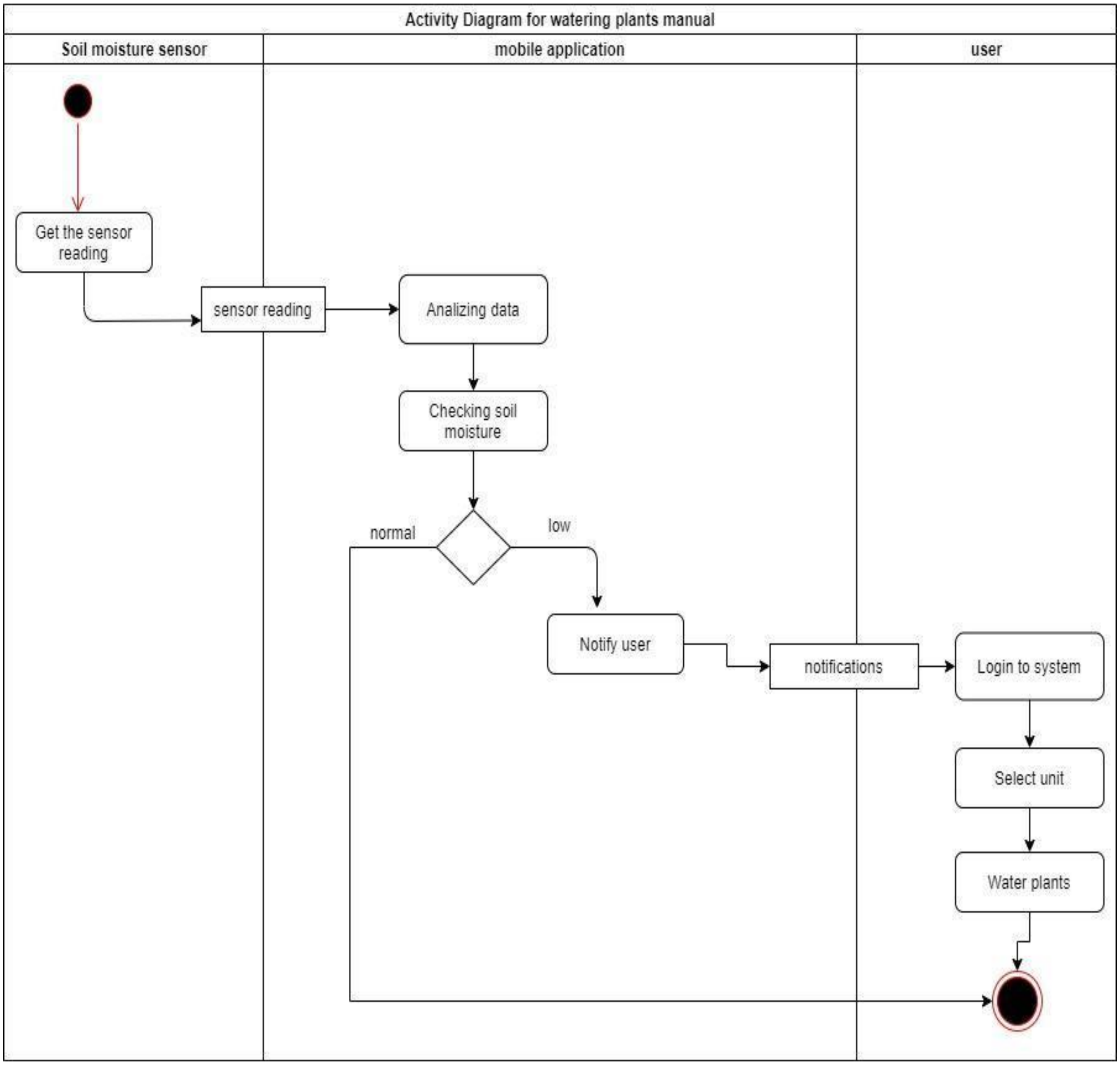
10.2.3 Chat module Activity Diagram



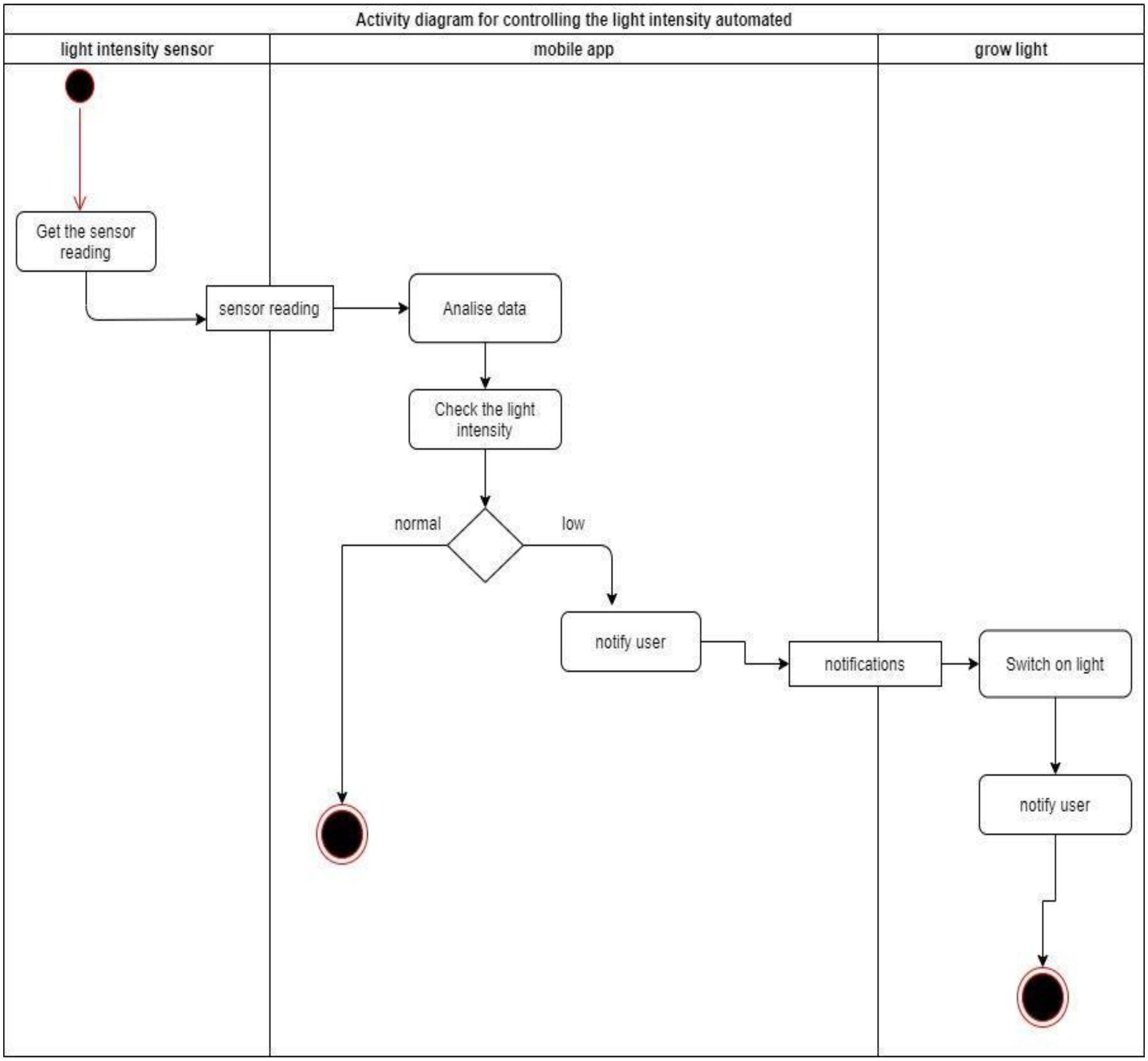
10.2.4 Automated Watering of Plants Activity Diagram



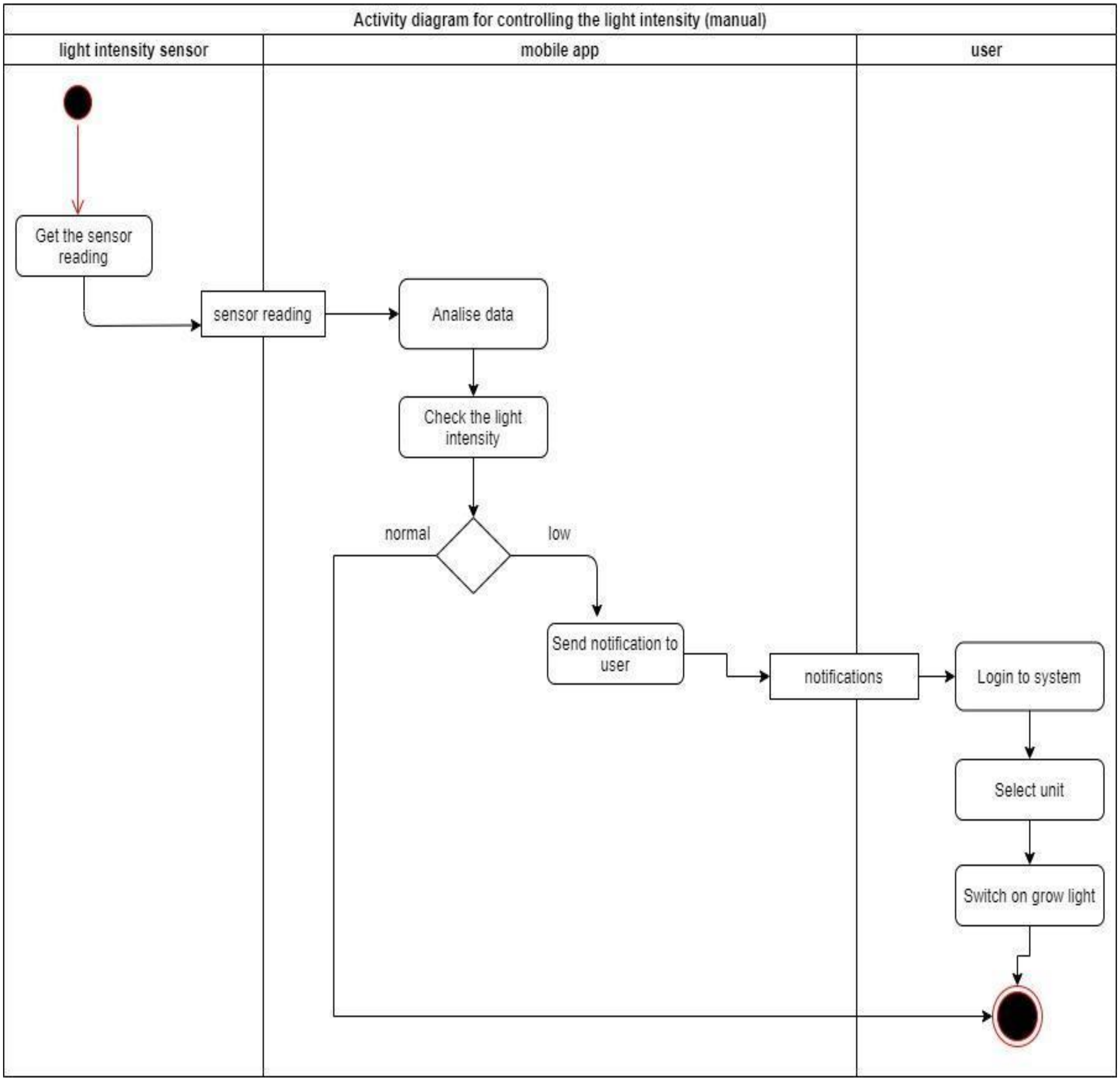
10.2.5 Manual Watering of Plants Activity Diagram



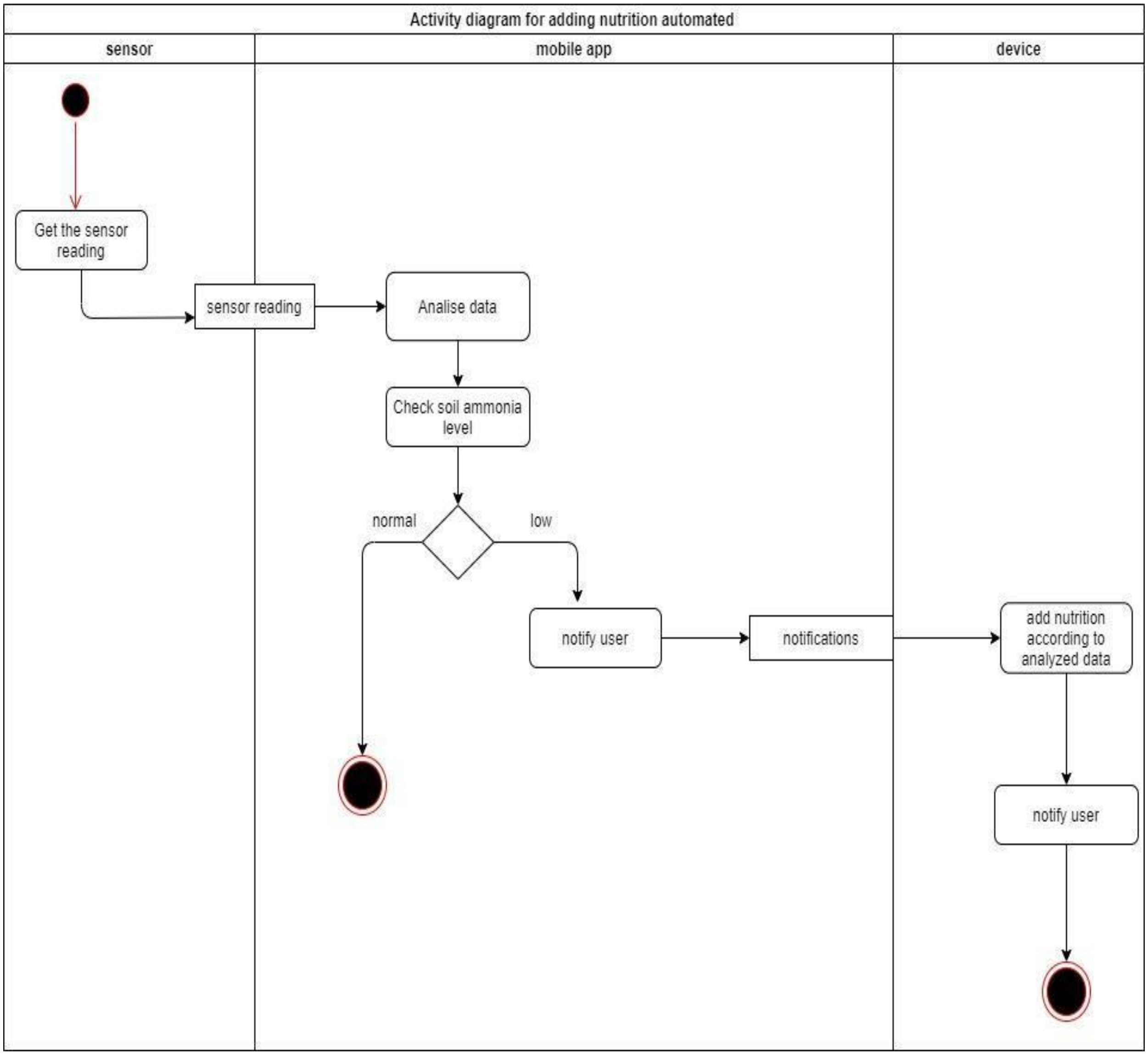
10.2.6 Controlling light intensity automated Activity Diagram



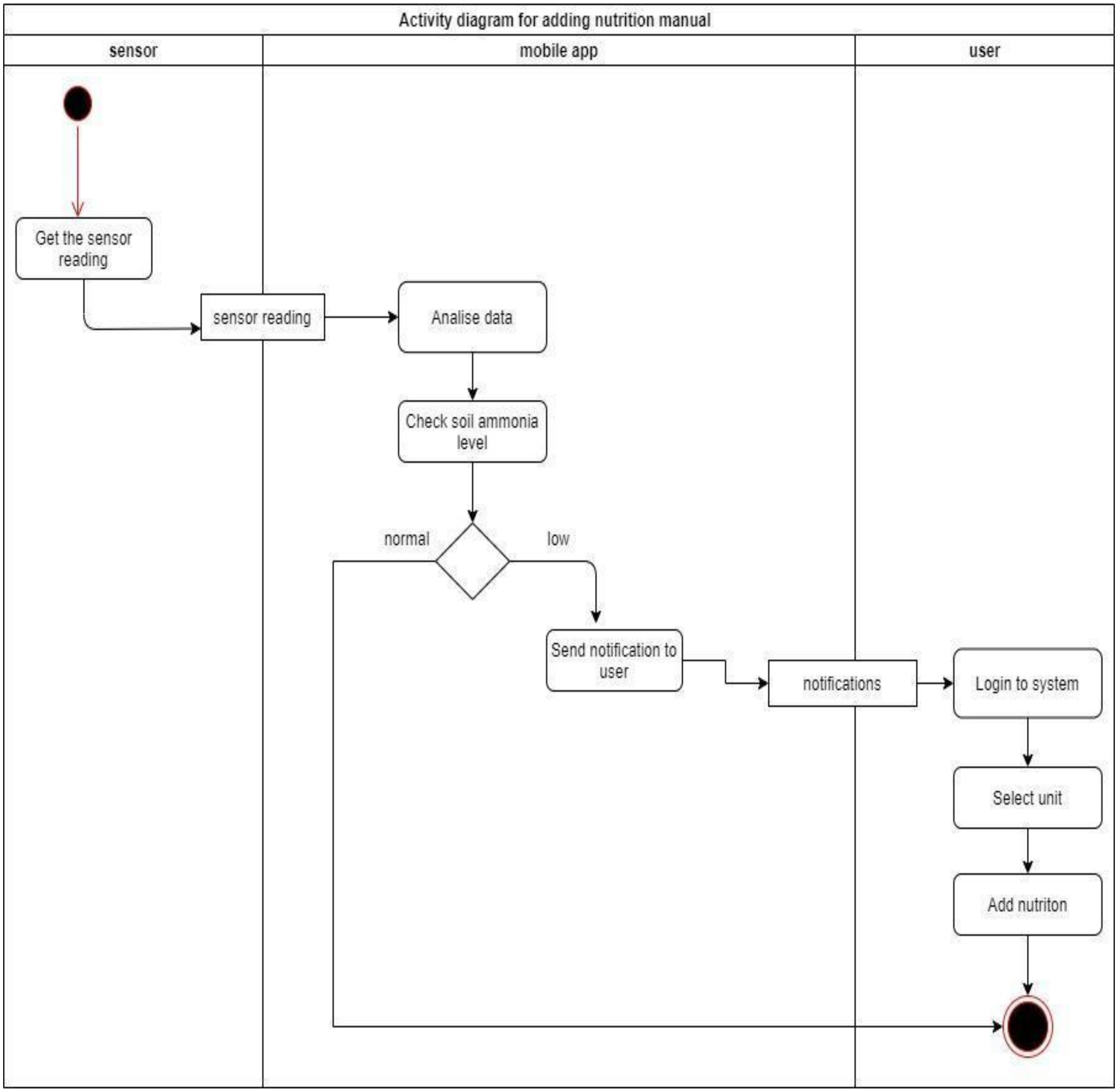
10.2.7 Controlling light intensity manual Activity Diagram



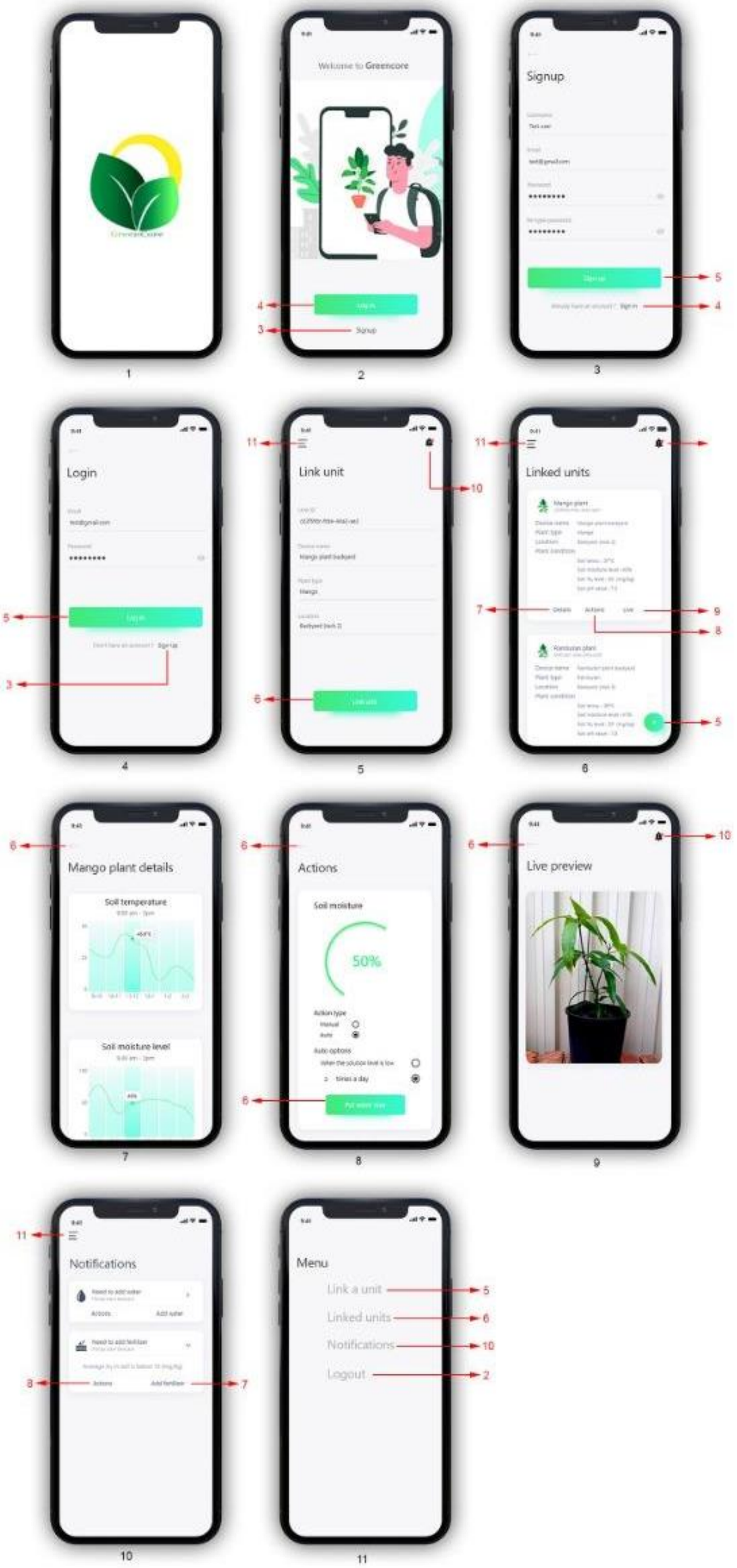
10.2.8 Adding nutrients automated Activity Diagram



10.2.9 Adding nutrition manual Activity Diagram



11 User Interface Flow Diagram



12 Approval

Stakeholder Name	Designation	Date	Signature
Dr Dinuni K Fernando			