

# GreenTech

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## **Abstract**

GreenTech is an innovative application designed to improve plant care and management for users of all experience levels. With the growing interest in urban gardening and indoor plants, it has become essential to provide effective tools for monitoring plant health. GreenTech utilizes advanced technologies to monitor key factors such as soil moisture, temperature, and humidity in real time, along with providing personalized notifications to help users maintain optimal conditions for their plants.

The application was developed based on user feedback, which contributed to improving its interface and features. GreenTech also includes comprehensive booklets on various plant and insect species, making it easier for users to make informed decisions about plant care. Results indicate that the application significantly enhances users' ability to care for their plants, fostering a healthy environment for growth and improving their overall gardening experience.

# Chapter 1

## 1.1 INTRODUCCION

Plants are one of the vital elements that contribute to improving the quality of our lives, as they stand out their importance in our daily environment by providing oxygen, purifying the air, and giving beauty to the spaces around us. Home farming has also become a growing passion for many individuals, due to its multiple benefits that include promoting mental health, relieving stress, and improving quality of life. However, many plant lovers face challenges related to caring for them, due to lack of knowledge of scientific methods to care for them, or lack of time for this. Plants require accurate care that suits their

own needs, and these challenges emerge more in the concerns of daily life, which leads to neglecting them or reducing the chances of success of their cultivation. In this context, modern technologies offer innovative solutions that contribute to facilitating the process of caring for plants and enhancing their productivity, enabling individuals to enjoy the benefits of home farming without the need for extra time or effort. To enhance the

effectiveness of the “GreenTech” system in meeting the needs of users, we conducted a comprehensive survey of a variety of individuals interested in home farming, whether they are beginners or experienced. The results emerged from the basic challenges and needs that the system seeks to meet, and these are the most prominent results:

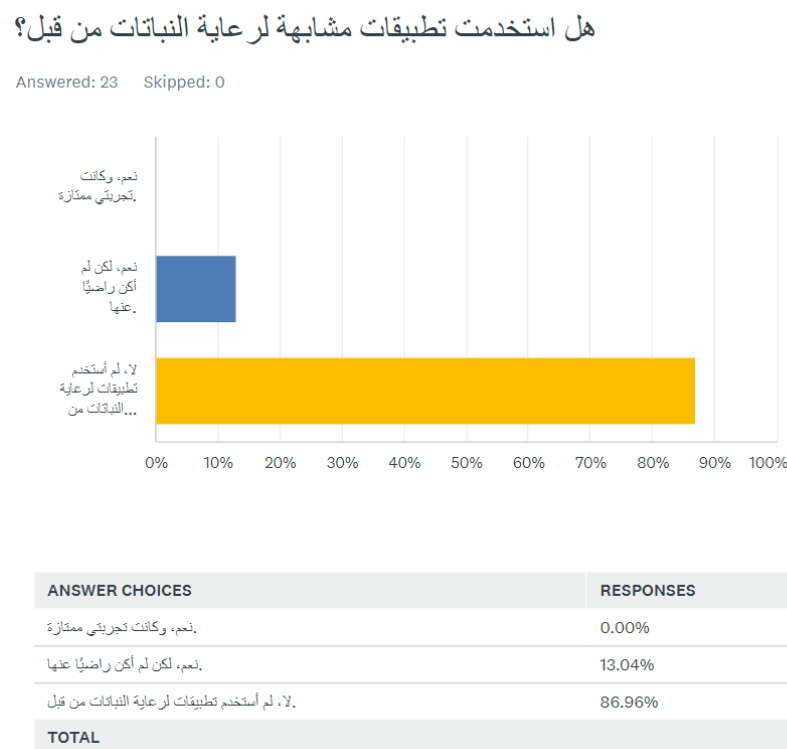


Figure 1: The user need to smart application

The survey showed that a large percentage of participants did not use any smart applications for plant care, as 86% of them did not use any previous technological solutions to monitor the health of their plants.

### ما أكثر مشكلة تواجهها عند العناية بالنباتات؟ يمكنك اختيار أكثر من إجابة

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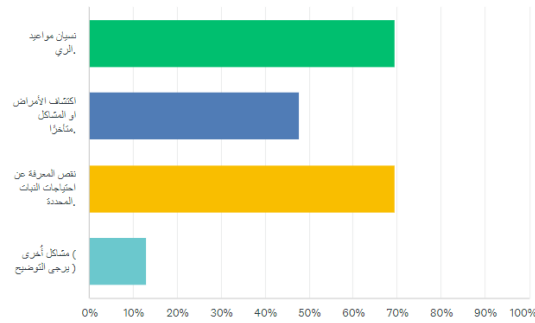


Figure 2: The most common problems facing farmers

The results of the survey showed a range of important insights into the challenges farmers face in caring for their plants. 69% of participants indicated that they have difficulty identifying optimal plant needs, such as water level and forgetting about the irrigation process.

### هل تحتاج إلى إشعارات لتنبيهك بمواعيد الري أو أي تغييرات في حالة النبات؟

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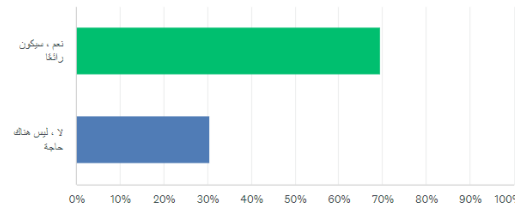


Figure 3: The user need to alert notifications

The survey also revealed that 69% of participants believe that receiving instant notifications when issues arise, such as changes in plant conditions or irrigation schedules, is essential. This highlights the need for an alert system that can assist users in taking timely actions.

هل تعتقد أن التطبيق الذي يوفر استشارات من خبير في النباتات سيكون مفيداً لك؟

Answered: 23 Skipped: 0

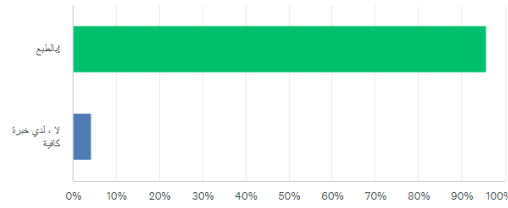


Figure 4: The user needs to communicate with expert

The results also indicated that 95% of participants need to communicate with agricultural experts to receive advice on how to deal with plant issues. This reflects the high desire of users for immediate experienced support. In response to the needs shown by the survey,

the “GreenTech” smart system was designed, which includes small numbered planting pots, each of which is linked to the application. This system allows users to accurately monitor the condition of their plants and provide appropriate care according to the type of each plant. GreenTech aims to enhance the ability of users to make informed decisions and improve plant care methods, which contributes to increasing agricultural efficiency for individuals. The application includes key features such as displaying comprehensive

information about each plant, accessing a full agricultural information booklet, and communicating with industry experts for the necessary advice. It also provides the ability to track the history of problems facing plants and available solutions, in addition to sending instant notifications. New features also include identifying harmful and beneficial insects, helping users take effective preventive measures, and better managing their gardens. All this contributes to improving farming results and reducing losses from mismanagement, making GreenTech an ideal system for plant lovers and agricultural hobbyists.

## 1.2 EXISTING APPLICATION

With the rise in interest around plant care, gardening, and environmental sustainability, plant identification applications have become popular. Among the numerous applications available, PlantSnap and GreenTech stand out for their unique approaches. PlantSnap is well known for its user-friendly design and AI-powered plant identification, In contrast, GreenTech focuses not only on identifying plants but also on special features such as plant monitoring, how to care for it, and much more.

## PlantSnap

Advantages	Disadvantages
Easily identify plants: You can photograph any plant and the application will immediately identify it using artificial intelligence.	No consultations with experts: You can't reach out to an expert for direct advice.
Large Plant Library: Contains information on more than 600,000 species of plants around the world.	Does not track the condition of the plant: The application does not directly monitor the water or moisture level in the plants.
Available globally: The application can be used anywhere, making it suitable for all users around the world.	Lacks accuracy in plant recognition: Results may appear for different types of plants when photographing the plant several times.

Table 1: Advantages and disadvantages of the PlantSnap application

After reviewing the advantages and disadvantages of PlantSnap, it turns out that it is a powerful application to recognize and share information about plants, but it lacks some important features that users need for daily care of plants and here where the role of GreenTech comes, which is have some additional features such as:

- Monitoring the state of plants directly: The application monitors the water, humidity and temperature levels of plants and displays them to the user.
- Alert notifications: Sends notifications when the plant needs irrigation or in the event of a problem such as high temperature.
- Consultations from experts: You can contact cultivation experts for tips to solve problems.
- Plant problem history: The application keeps a comprehensive record of the problems you had with the plants and the solutions was provided to you by an expert.
- Determine the needs of the plant based on its type.

## 1.3 CONCLUSION

This chapter provides a comprehensive overview of the GreenTech application, which addresses one of the important issues in plant care. Through the use of modern technology, the application contributes to improving the process of management and monitoring of plants, and proposes innovative solutions to meet the needs of users in this field.



## Chapter 2

## 2.1 INTRODUCCION

Understanding functional and non-functional requirements is a key element in the design of smart systems. In this chapter, we will review how these requirements affect the development of the GreenTech application. Functional requirements focus on determining the basic functions that the application should provide. While non-functional requirements focus on aspects such as smooth performance and security, ensuring a reliable user experience. Balancing these two types of requirements is important for developing a robust and efficient system that perfectly meets the needs of users.

## 2.2 FUNCTIONAL REQUIREMENTS

### 2.2.1 USER REQUIREMENTS:

1. The user should log in to navigate the application.
2. The user should have the ability of adding the name of the plant that they planted according to its number in the pot, with the ability to delete and modify the name of the plant.
3. The user should have the ability to view an interface that contains information about the plant and how to care for it through its site number and the type of plant.
4. The user should have the ability to view a booklet containing comprehensive information about plants.
5. The user should have the ability to upload pictures of the insects he finds on the plant, to know whether the insect is useful or harmful based on a booklet.
6. The user should have the ability to communicate with an expert if they face a problem.
7. The user should have the ability to view a comprehensive record of all reported problems, including descriptions, resolution procedures, and dates.
8. The user should receive instant notifications.
9. The user should view the user profile.

### 2.2.2 System Requirements

#### 1. The user should log in to navigate the application.

1. The system should display two icons: “Sign up” if there is no previous account, and “Log In” if there is a previous account.
  - (1.1) The system should ask the user to enter his email, username, and password if he chooses “sign up.”
  - (1.2) The system should display if the email is entered correctly, and send a four-digit random code to verify that the email is correct.
  - (1.3) The system should check if the user-entered code matches with the system-sent code.

- (1.4) The system should display the interface after successfully signing up if the codes matched.
  - (1.5) The system should display a warning message to re-enter the code or to change the email if the codes do not match. If the email is entered incorrectly, the system should display a warning message stating that the email is incorrect until it is retyped correctly.
  - (1.6) The system should ask the user to enter his username and password if he has chosen "Log in."
  - (1.7) The system should check if the entered email and password exist in the database or not.
  - (1.8) The system should display the interface after successfully logging in if the credentials exist. If not, the system should display a warning message to re-enter the username and password or forget the password option.
  - (1.9) The system should display an icon for entering the user's email and send a new random password to that email if the email exists in the database, if the user chose the "forgot password" option.
2. The user should have the ability to add the name of the plant that they planted according to its number in the pot, with the ability to delete and modify the name of the plant.
- (2.1) The system should display an icon for the user and the numbers of sites available.
  - (2.2) The system should display the site of the numbers where the user wants to grow plants and specify names for each plant in the three pots. It is not possible to enter more than one name on the same site.
  - (2.3) The system should display a small icon at the bottom for modification, such as deleting a plant or changing the name of the plant on a site, after the user enters the names of the plants.
3. The user should have the ability to view an interface that contains information about the plant and how to care for it through its site number and the type of plant.
- (3.1) The system should save the data and show an interface containing the name and site number of each plant if the user doesn't want to edit.
  - (3.2) The system should display all information about the plant that the user entered in a specific site number.
4. The user should have the ability to view a booklet containing comprehensive information about plants.
- (4.1) The system should include a user icon called "plant booklet" , which the user can access to read information about the plants.
  - (4.2) The system should display a text box in the booklet where the user can type the name of the plant they want to search for.

- (4.3) The system should display a comprehensive set of information, including details about the plant's care, after the user writing the name of the plant , booklet should contain all the necessary details for plant care , if the plant name exists in the booklet.
- (4.4) The system should display a message informing to the user that there is no plant with this name now, If the user types a plant name that doesn't exist in the booklet. Additionally, an option should be shown to inform the system developers about adding this plant in the future or to exit.
- (4.5) The system should display a text box for the user to write the name of the plant, If the user chooses to notify the system developers. If the user chooses to exit, the system should return the user to the search interface.
- (4.6) The system should send a message that have the new plant name after writing it by the user, to the system developers to be added to the booklet with the next update. ‘
- 5. The user should have the ability to upload pictures of the insects he finds on the plant, to know whether the insect is useful or harmful based on a booklet.
  - (5.1) The system should display the results of image analysis by comparing the insect to the insect booklet available in the system.
  - (5.2) The system should determine whether the insect is beneficial or harmful based on the insect data in the booklet.
  - (5.3) The system should provide advice and guidance for dealing with harmful insects based on the results.
- 6. The user should have the ability to communicate with an expert if they face a problem.
  - (6.1) The system should have an icon in the application called “Chat” that allows communication with the agriculture expert, who will be a plant specialist. The conversation can be conducted within the same application, and the expert should be able to respond.
  - (6.2) The system should upon receiving a message from the user, forward it to the available agricultural experts at that time to be answered as soon as possible.
  - (6.3) The system should allow the user to send images in the conversation via an icon next to the text box to better clarify the problem in addition to the text conversation
  - (6.4) The system should allow saving the conversation if the user request it.
- 7. The user should have the ability to view a comprehensive record of all reported problems, including descriptions, resolution procedures, and dates.
  - (7.1) The system should create a record specific to each user containing all the problems the user has previously encountered with the expert, it will appear in the user's personal profile information as a ”History” button.
- 8. The user should receive instant notifications.

- (8.1) The system should display a message and a selection icon to the user when a plant species to a site is added if he wants to receive instant notification or not.
  - (8.2) The system should send notification about everything include watering times, and temperature levels, if an error occurs such as watering time passed or at high-temperature conditions, or if an expert reply to chat, and more.
9. The user should view the user profile.
- (9.1) The system should display the personal profile page, it's shows their username, email, options to change their password and a history of problems.
  - (9.2) The system should display a box for the user to enter their old password and then their new password , if the user chooses "Change password" option.
  - (9.3) The system should verify that the old password matches the one saved in the database before allowing the password change. If matched the password will change successfully , if not the system should let the user to reenter old password.
  - (9.4) The system should display all the previously occurred problems, their details, and the date of occurrence should be displayed, if the user select "history" option.
  - (9.5) The system should display a text box to change the username , if the user click on the arrow icon next to the username.
  - (9.6) The system should save and update the username with the new entered name.

## 2.3 NON- FUNCTIONAL REQUIREMENTS:

- Maintainability:  
The system should allow updates and modifications to features and issues easily, with downtime not exceeding one minute, ensuring that all information reflects the latest changes.
- Availability:  
The system should remain operational even without an internet connection, allowing users to access core functions and view data, and the latest updates appear when you reconnect.
- Reliability:  
The system should detect and resolve any malfunctions within less than three minutes, ensuring quick recovery. Regular updates should be applied every two months to maintain stability.
- Usability:  
The system should guide users to follow all application instructions to ensure the growth of healthy, complete plants.

## 2.4 CONCLUSION

At the end of this chapter, it is clear that the criteria for the GreenTech system include important functional and non-functional aspects. Non-functional criteria, such as security and ease of use, are key to improving the user experience. Functional requirements focus on ensuring effective performance to meet the needs of users.

## Chapter 3

### 3.1 INTRODUCTION

In this chapter, we will show the architecture of the GreenTech application and how it is designed to meet the needs of users in plant care. We will also discuss the use of programming languages and database tables, both of which play a vital role in ensuring system performance and reliability. In addition, we will address some of the initial interfaces of the system, explaining how they are designed to provide a smooth and efficient user experience, which enhances the interaction of users with the application and ensures easy access to the information necessary to care for plants.

### 3.2 SYSTEM ARCHITECTURE

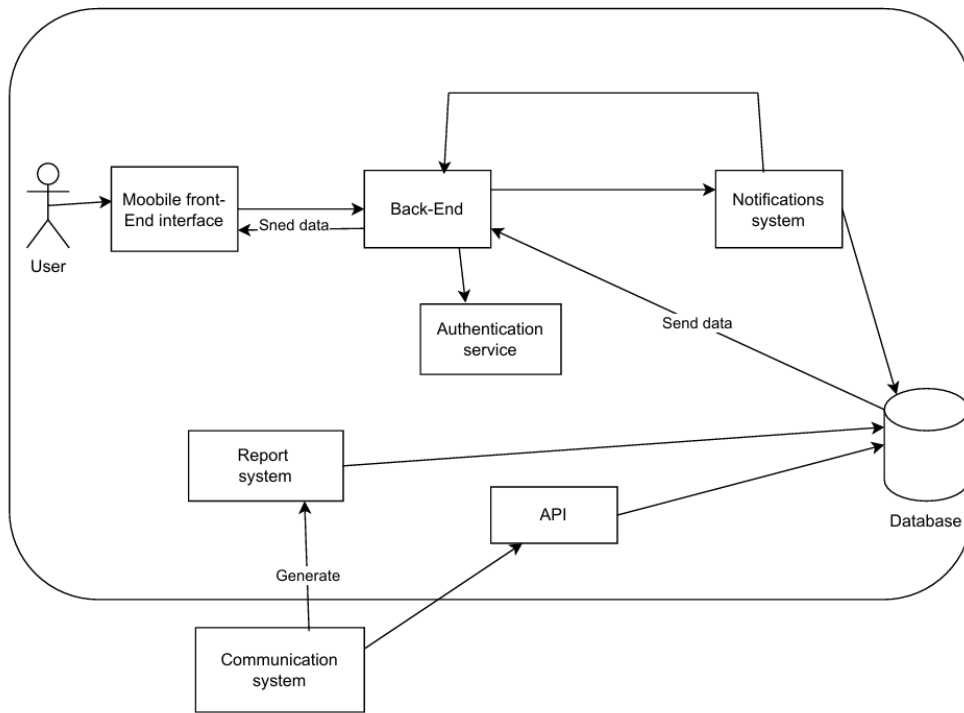


Figure 5: System Architecture For GreenTech

### 3.3 DATABASE

Databases are an essential element of any information system, as they play an important role in organizing and storing data effectively. In GreenTech application, database tables will be used to store multiple information related to users, experts, plants, insect booklet, and plant booklet. This design aims to improve data management and ensure easy access, contributing to a better user experience.



**Entity: User**

Have related attributes such as user\_ID represents primary key, User\_name, Email, and password.

User_ID	User_name	Email	Password
101	Ali	A23li@gamil.com	Ali350
102	Sara	Sare2@gamil.com	Sar340
103	Ahmed	AAhmed@gamil.com	ahm337
104	Lina	L2lina@gamil.com	L2in50
105	Ghadi	Gghadi@gamil.com	Gd450

Table 2: User Table

**Entity: Expert**

Have related attributes such as Ex.id which represents the primary key, Ex\_email represents unique value, Expert\_Name, and specialization .

Ex_ID	Ex_email	Expert_name	Specialization
1	hano@icloud.com	Hanay	plant pathology
2	Meme@icloud.com	Maryam	floral horticulture
3	Aman@gmail.com	Aman	organic farming
4	rery@gmail.com	Rawan	plant pathology
5	Turki@Icloud.com	Turki	Entomology

Table 3: Expert Table

**Entity: plant booklet**

Have related attributes such as Plant\_id that represents primary key , plant\_name , plant\_image , plant\_description , and care.instructions

Plant_id	Plant_name	Plant_image	Plant_description	Care_instructions
19	Rose	[image]	Roses are flowering plants with vibrant, fragrant blooms in various colors.	Requires full sun (6+ hours), well-draining soil, and regular watering.
20	Basil	[image]	Basil is an aromatic herb with green leaves, commonly used in cooking.	Needs full sun, well-drained soil, and regular watering. Pinch off flowers to encourage leaf growth.
21	Cactus	[image]	Cacti are drought-tolerant plants with thick, spiny stems that store water.	Thrives in bright light with minimal watering. Allow soil to dry completely between waterings.
22	Lily	[image]	Lilies are flowering plants with large, elegant blooms that come in many colors.	Prefers partial shade, well-draining soil, and moderate watering. Keep the soil moist, but not soggy.
23	Mint	[image]	Mint is a fast-growing herb with aromatic green leaves, used in cooking and teas.	Needs partial to full sun, moist soil, and frequent watering. It spreads quickly, so contain it in a pot if necessary.

Table 4: Plant booklet

**Entity: Notification**

Have related attributes such as Notification\_id that represent primary key , notification\_date, notification\_text , and user\_ID that works as foreign key from user's table.

Notification_ID	Notification_date	Notification_text	User_ID
12	2024/05/03	"time to water your Rose"	101
13	2024/05/22	"Basil needs more light"	102
14	2024/05/26	"cactus have a good temperature"	103
15	2024/06/12	"reminder: watering Rose after 2 hours"	104
16	2024/07/03	"too high temperature on cactus"	105

Table 5: Notification Table

### Entity: problems history

Have related attributes such as Problem\_ID that represents primary key , user\_ID works as foreign key from User's table , Ex\_id works as foreign key from Expert table , problem\_date , problem\_title , problem\_description , problem\_image that could be null , and resolution .

Problem_ID	User_ID	Ex_ID	Problem_date	Problem_ti	Problem_descrip	Problem_ir	ReSolution
1	101	1	2023-10-01	Slow growth.	Weak plant growth even though I'm following care instruction	Null	Increase watering and ensure adequate light.
2	1022		2023-10-22	Yellowing leaves.	Sudden change in leaves color	[image]	Use appropriate fertilizer and check for pests.
3	103	3	2024-01-01	Spot on leaves	There are wired big spot on my plant's leaves	[image]	Apply a fungicide to control diseases.
4	104	4	2024-04-25	Flower drop.	Almost all flower dropped off my plants	Null	Reduce watering and improve air circulation around the plant.
5	105	5	2024-09-01	Insects	I found white insects on the plant	[image]	Use natural insecticides or remove insects manually.

Table 6: Problems history

### Entity:Insects booklet

Have related attributes such as Insect\_ID that represents primary key , insect\_name , insect\_image , insect\_description , insect\_type and handling\_tips

Insect_ID	Insect_name	Insect_image	Insect_description	Insect_type	Handling_tips
1	Aphid	[image]	The small insect that sucks plant sap and causes damage to plants.	Harmful	Use natural pesticides or remove manually.
2	Spider Mite	[image]	A small insect that causes spots on leaves and weakens plant growth.	Harmful	Use soap and water or specialized pesticides for control.
3	Bee	[image]	Pollinator that helps produce fruits and vegetables.	Beneficial	Don't disturb them, plant flowers to attract more bees.
4	Whitefly	[image]	Small white insect that sucks plant sap, weakening the plant.	Harmful	Use yellow sticky traps or spray plants with water.
5	Scale Insect	[image]	Sticks to plants, causing stunted growth and black mold.	Harmful	Use alcohol to clean the plant or apply specialized insecticides.

Table 7: Insects booklet

### 3.4 PROTOTYPE

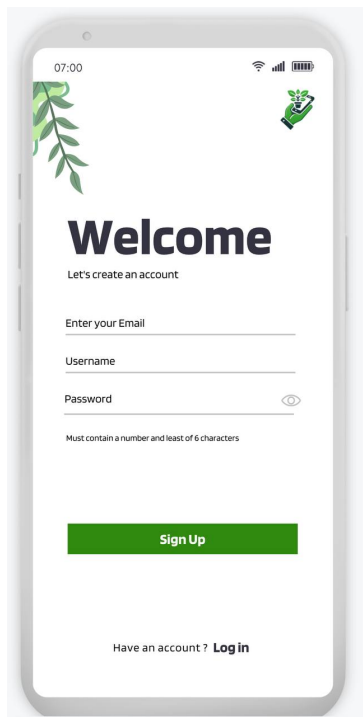


Figure 6: sign up interface

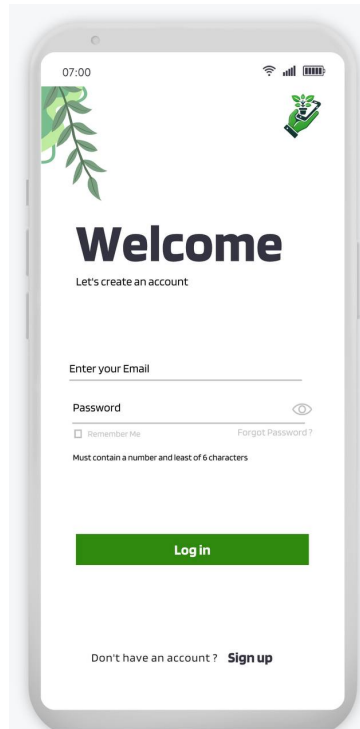


Figure 7: log in interface

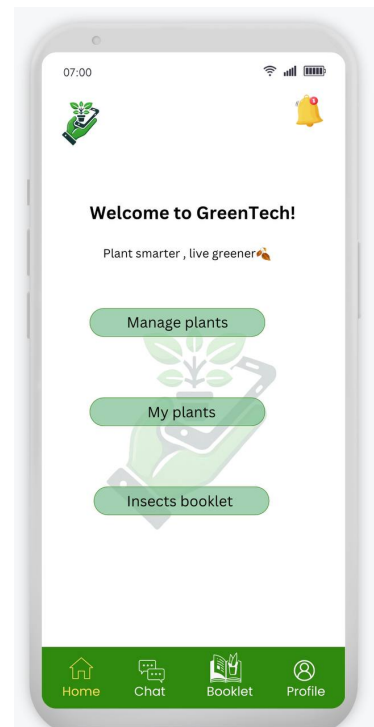


Figure 8: home interface

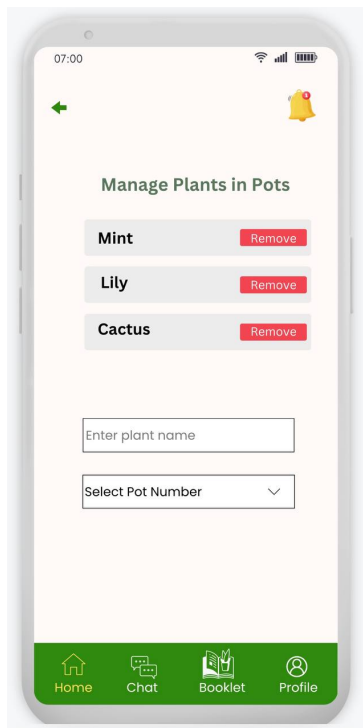


Figure 9: Manage plants interface

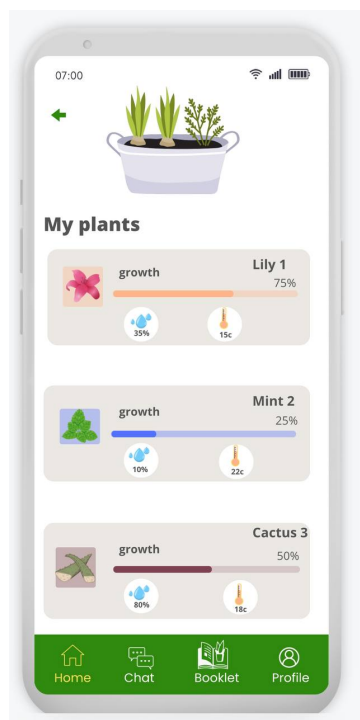


Figure 10: Monitor plants interface



Figure 11: Insects booklet interface

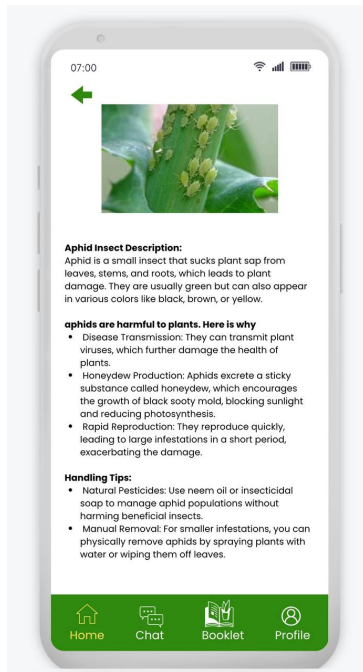


Figure 12: Insect information interface

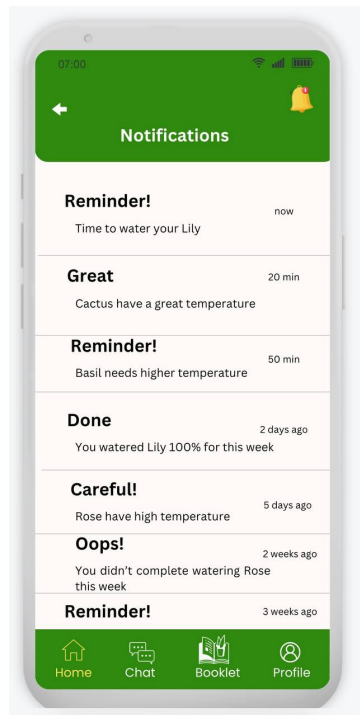


Figure 13: Inner notifications interface



Figure 14: Outer notification interface

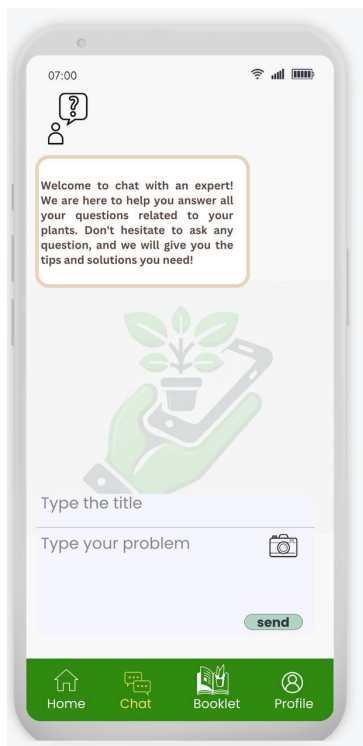


Figure 15: Chat interface

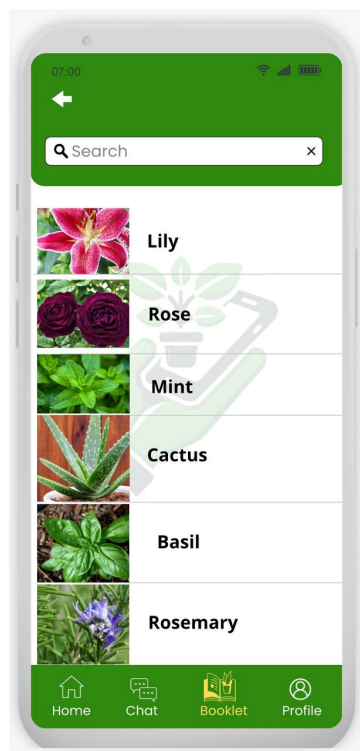


Figure 16: Plants booklet interface

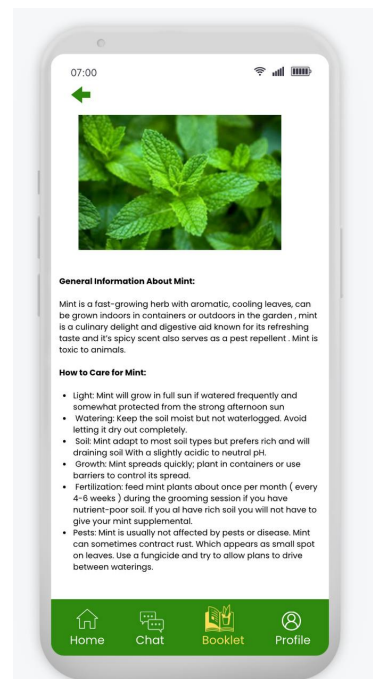


Figure 17: Plant information interface

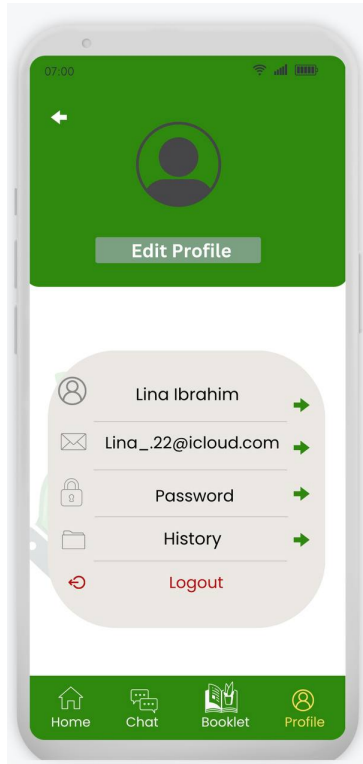


Figure 18: User profile interface

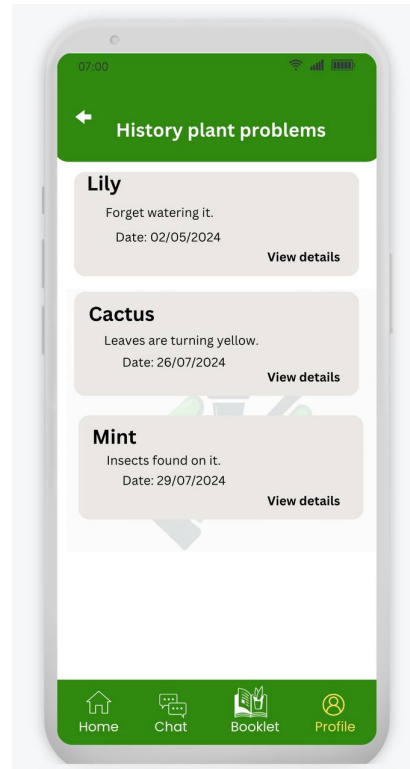


Figure 19: Plant problem history interface

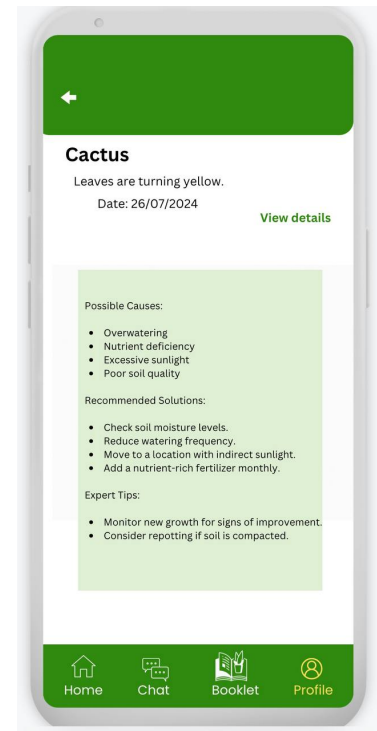


Figure 20: Plant problem history details interface

## 3.5 PROTOTYPE TOOL

**Canva** is a simple and easy-to-use design tool commonly used to create user interfaces and various visual elements. Thanks to drag and drop, Canva makes it easy to design interface layouts, icons, buttons, and other UI components. It also offers a large selection of ready-made templates and elements that can be easily customized to suit your needs.

Although not as advanced as user interface design tools, Canva is an excellent choice for rapid prototyping. It is very suitable for people who want to create stylish and attractive UI designs without the need for much design experience.

## 3.6 PROGRAMMING LANGUAGES USED

### 3.6.1 koltin

Kotlin is a modern programming language that provides developers with the flexibility and scalability to create powerful applications. It has several features such as a simple structure and easy-to-use tools, and can run in parallel with Java to reuse existing codes and libraries.

Kotlin has built-in security features to protect user data, making it ideal for web and mobile application development projects. GreenTech uses Kotlin to create basic functions.

### **3.6.2 JavaScript**

JavaScript is a programming language widely used in the development of user interfaces on the web as well as mobile applications for various platforms, including iOS and Android.

In GreenTech application, JavaScript is used to create interactive elements such as buttons, making the application more dynamic and interactive. JavaScript helps improve the user experience by making the application better responsive to user interaction.

### **3.6.3 MySQL**

MySQL is a relational database management system used in the GreenTech application to store and organize user information, plants, care records, plant booklet, insect booklet, and more.

MySQL enables efficient processes such as adding, updating, and deleting data, making it easier to manage data accurately and quickly.

## **3.7 CONCLUSION**

In conclusion, GreenTech application provide an innovative and integrated solution to meet the challenges of home farming using technology. The application enables modern tools to monitor the condition of plants, such as humidity levels, temperature, and water, in addition to providing direct consultations with agriculture experts. GreenTech makes it easy for users to take care of their plants in an efficient and simple way, with an easy-to-use interface and a comprehensive guide to plant species. It also send instant notifications to help users make timely decisions. The application combines agricultural knowledge and technology to provide a better experience for users, whether they are beginners or experienced, increasing their chances of success in growing their plants in a sustainable way.

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