

CENG318 Human Computer Interaction

Group 14 Final Project Report

Spring 2023

Project Title: Herbify

Yasir Duman
Computer Engineering
280201101

Berkan Gönülsever
Computer Engineering
270201064

Halil İbrahim Buğday
Computer Engineering
280201094

Gökay Gülsöy
Computer Engineering
270201072

Kerem Yavuz Şenyurt
Computer Engineering
290201100

Abstract—Many people encounter different type of plants in daily life or a flower photo in digital environment. For us people, it is a bit headache to distinguish a plant from others. Even if we know the plant's name, we probably don't know much about its features. In this project named Herbify, Users will be able to obtain fast accurate and reliable information about plants without the need to search for a long time on the Internet. In Herbify, users need to upload a photo of the plant they wish to gain knowledge about and then they can access lots of useful information, such as plant care, their origins and general knowledge. Herbify uses artificial intelligence and huge set of data related with plants to identify a plant in the photo with high accuracy. Apart from comprehensive information related with plants Herbify also provide different resources for adequate reading. Agile methodology is used to develop Herbify where every user can discover new information while they are having fun.

Index Terms—plant identification, artificial intelligence, gamification

I. INTRODUCTION

Plants existed before humanity and play crucial role in life. plants serve as the foundation of food chains and produces oxygen which is essential for the survival of all beings, including humans. Throughout history, humans have relied on plants in numerous ways. We look back to the past, humans used plants as food, medical, dressing and tool. Today, plants are still play an important role in our life, however everybody does not share the same level of interest in plants. For ordinary people, it can sometimes be difficult to recognize a plant with a similar appearance to others. To help people who want to identify a plant and who want to know more about plants, we developed web application named Herbify

Herbify is a web application that utilizes object recognition to help users identify different types of plants. With Herbify, users can easily snap a photo of any plant they come across and get instant results about its name, features, and potential uses.

However, traditional plant identification apps often lack user engagement and fail to provide additional features that users may find useful. Herbify seeks to solve this problem by incorporating gamification elements into the app, such as a points system for correct plant identifications and a social feature for users to share their findings with others.

Additionally, Herbify aims to provide users with comprehensive information about each plant, including its medicinal properties, growing conditions, and ecological significance. By combining cutting-edge technology with engaging design, Herbify strives to make plant identification both educational and entertaining for users of all ages and backgrounds.

II. LITERATURE REVIEW

Plant identification has become easier with the development of numerous plant identification websites and mobile applications. In this section, several plant identification apps/websites including PlantNet [PlantNet \(2023\)](#), PlantSnap [Pla \(2023\) Inc \(2023\)](#), Blossom Apps [\(2023\)](#), plant.id [FlowerChecker \(2023\)](#), iNaturalist Seek [iNaturalist \(2023\)](#), LeafSnap [Appixi \(2023\)](#), Google Lens [Google \(2023\)](#), Bing [Microsoft \(2023\)](#), and Flora Incognita [Ilmenau \(2023\)](#) will be reviewed in context of their plant identification sucess rates , user reviews and pricings. The apps studied are listed in Table 1. One of the apps was discarded early on because some of its features were not testable.

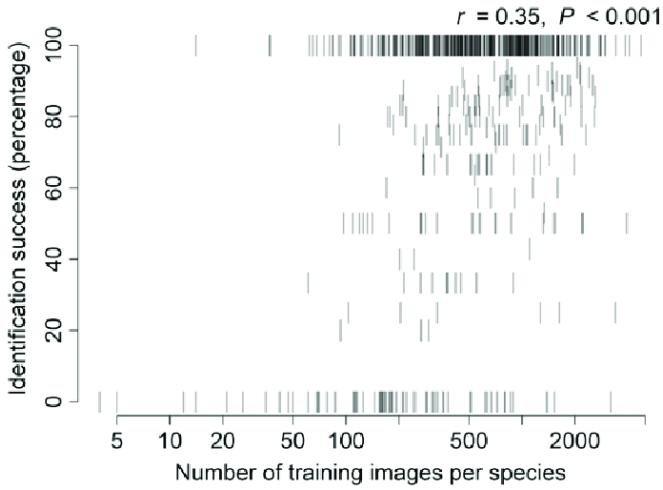
A. Plant Identification Success

Plant identification success is crucial for the efficiency and effectiveness of plant identification tools. Several studies have compared the identification success rates of different plant identification tools. One study conducted by [Jones \(2023\)](#) compared the identification accuracy different plant identification apps including PlantNet , PlantSnap , iNaturalist Seek and LeafSnap. The study found that Plant.id had the

highest identification success average score of 69.8 followed by Google Lens with 63.4, while Bing had the lowest success average score of 16.3. Average scores obtained for the first identification by each of the apps for each sub grouping of the samples whether by plant type or by plant part with the number of samples in each subset. Results can be seen in Table 2. However, the success rate of these tools may vary depending on various factors such as the quality of the image, the complexity of the plant, and the accuracy of the database.

Another research study (Author, Year) investigated the relationship between identification success of species (percentage of images identified to the species level) and the number of training images used for the Flora Incognita machine learning algorithm. The number of training images was presented on a logarithmic scale on the graph, and a log-transformation was applied prior to Pearson correlation analysis. The findings of this study revealed a positive correlation between the number of training images and the identification success rate. As the number of training images increased, the algorithm's ability to accurately identify plant species improved.

These research findings contribute to the understanding of the factors influencing plant identification success and highlight the significance of robust training data in machine learning algorithms. By incorporating a large and diverse image database, our app aims to improve the plant identification success rate and provide users with more accurate and reliable results.



B. User Reviews

User reviews provide valuable insights into the user experience of plant identification tools. The user reviews of different plant identification tools were analyzed to determine their overall user satisfaction. Users of plant identification apps have reported mixed experiences with the apps. While some users praise the apps for their accuracy and ease of use, others complain about poor performance, wrong identifications, and design issues. For example, some users have reported that PlantSnap fails to identify certain plants, and others have criticized the app's subscription model. Similarly, some users have

found the identification suggestions provided by iNaturalist Seek to be inaccurate or unhelpful, while others have praised the app's user-friendly interface. Design issues have also been noted, with some users finding the user interface of certain apps to be confusing or difficult to navigate.

C. Price

Pricing is an essential factor to consider when choosing a plant identification tool. While some plant identification apps are free to download and install on a user's device, most of them require in-app purchases or subscriptions to unlock full functionality. This means that while the basic features of the app may be available for free, users may need to pay to access additional features or content. It is important to note that several identification apps require some form of in-app purchase or subscription in order to continue using the app beyond the initial free download.

D. Conclusion

According to research and examinations about the apps and websites, it is seen that common problems with the plant identification apps are, poor user experience, relatively high prices and plant identification success. Herbify aims to solves these problems with better design, computer vision approaches and additional features integrated with gamification.

App	Platform	Comments/Key Features	Paid	Method
PlantNet	Android/iOS/Web	Can provide lists of plants in a specific area Users can participate in groups, Identified plants are sharable, 4 different images can be used to identify. API can be reached by advanced users.	Yes	Camera/Upload
PlantSnap	Android/iOS/Web	Identified Plants are sharable, Can explore nearby plants, Can search for plants, users and gardens. Confidence hierarchy : identified.	Yes	Camera
Blossom	Android/iOS	Can ask questions to experts , Plant care features. Can create rooms for plants. Diagnosis and treatment for plants. Confidence hierarchy : identified.	Yes	Camera
plant.id	Web	No login or register needed for identification. Health assessment feature. Uses location	No	Upload/Camera
iNaturalist Seek	Android/iOS	Achievements can be earned by completing challenges. Observations can be saved. Confidence hierarchy : identified.	No	Camera
LeafSnap	Android/iOS	Confidence hierarchy : Sorting according to most possible plant. Asks part of the plant after taking image. Can diagnose plant health. Plant Care guides . Can schedule tasks.	Yes	Upload/Camera
Google Lens	Android/iOS/Web	Confidence hierarchy: Related results/related content/Similar images	No	Upload/Camera
Bing	Android/iOS/Web	Confidence hierarchy: Related results/related content/Similar images	No	Upload/Camera
Flora Incognita	Android/iOS	Sometimes need multiple Images, Confidence Hierarchy : Percentage users can access species list by location. Observation Filtering.	No	Camera

TABLE I

App	Flower	Fruit	Leaf	Plant	Herb	Monocot	Woody	Average
Plant.id	76 (1)	67 (4)	62 (1)	71 (1)	65 (1)	66 (2)	92 (1)	69.8
Google Lens	69 (2)	70 (3)	58 (2)	61 (3)	56 (3)	70 (1)	83 (2)	63.4
Seek	56 (5)	79 (1)	51 (3)	68 (2)	63 (2)	51 (4)	63 (4)	60.7
Flora Incognita	67 (3)	33 (6)	48 (4)	56 (4)	52 (4)	61 (3)	61 (5)	60.3
PlantNet	58 (4)	73 (2)	42 (5)	50 (5)	49 (5)	50 (5)	65 (3)	52.1
PlantSnap	42 (6)	47 (5)	31 (6)	43 (6)	38 (6)	31 (7)	53 (6)	39.7
Candid	29 (7)	1 (9)	19 (7)	29 (7)	23 (7)	37 (6)	17 (8)	24.3
Bing	17 (8)	18 (8)	8 (9)	22 (8)	19 (8)	12 (9)	12 (9)	16.3
iPlant	12 (9)	26 (7)	11 (8)	14 (9)	7 (9)	18 (8)	30 (7)	13.4
Average	47.2	46.3	36.6	46.0	41.3	43.9	53.0	44.46
No. of samples	12	3	10	13	24	24	7	38

TABLE II

III. METHODOLOGY

A. AI Development

1) *Data Collection:* The first step we did is collecting a large dataset of plant images. We did obtain these images from kaggle.com. We did ensure that the dataset includes a diverse range of plant species, including those that are commonly found in different regions.

2) *Data Preprocessing:* Before using the dataset for training the deep learning model, we did preprocess the images to ensure that they were of high quality and consistent. If there were irrelevant or noisy images we removed them then we standardized the size (224*224) and orientation of the images to fit the model we use.

3) *Model Training:* We used VGG16 convolution neural network architecture [Toğaçar et al. \(2023\)](#) to create our model. We did split the dataset into training, validation, and testing sets. We used approximately 4000 images for training, 1 image for validation, and 100 images for testing and so the model was trained to recognize the unique features of each plant species and classify them accurately.

4) *Model Optimization:* After training the model, we did try to optimize its performance. We did evaluate the model's performance on the testing with new images.

B. Backend Development

The Backend Development phase focused on the server-side implementation and functionality of our application. This involved designing the database, developing the necessary APIs, and ensuring smooth communication between the frontend and backend components. The backend development process consisted of the following key steps:

1) *Design:* During the Design phase, we carefully planned and defined the architecture and functionality of our application. This phase played an important role in shaping the overall structure and behavior of the system. The Design phase involved the following key components:

a) *Database Design:* We designed the database architecture to store and manage relevant data efficiently. This involved identifying the necessary tables, defining their relationships, and establishing data schemas.

b) *Use Case Development:* We created detailed Use Cases to outline various scenarios and interactions between users and the application. These Use Cases provided a clear understanding of how users would interact with the system and the expected outcomes in different situations.

c) *UML Sequence Diagrams:* We prepared UML Sequence Diagrams to visually represent the flow of actions and messages between different components in the application. These diagrams helped to visualize the dynamic behavior of the system and understand the sequence of events during specific processes.

d) *Test Case Development:* We developed Test Cases to validate the functionality of the application. Test Cases covered various scenarios, ensuring that the application performed as intended and met the specified requirements.

2) *Backend Implementation:* We have implemented the necessary backend functionality to enable efficient data exchange, secure authentication, and various operations within our application. To ensure secure access to the application, we have implemented authentication mechanisms. These mechanisms involve user authentication and authorization processes, safeguarding user data and preventing unauthorized access. Our backend implementation includes functionalities for retrieving plant information from the system. In addition, we have implemented features to securely store user data within the backend system. These mechanisms ensure the safe storage and management of user information and preferences.

3) *Security Measures:* We implemented necessary security measures to protect user data and ensure the integrity of the system. This involved authentication mechanisms and data encryption.

C. UI Development

Once the model is optimized, we have started to design a user-friendly user interface template by considering the Nielsen's 10 Heuristics for our tool. We first created paper prototypes for each of our pages that will be on our website. Then we improve these paper prototypes. Then we created First we create HTML files to structure our webpages and its content then we create css files to style and layout our webpages. We use flask web framework to give our website functionalities. We choose flask framework because it provides useful tools and features that digital prototypes on the Canva website based on the paper prototypes.

D. Integration

Once the backend implementation was completed, we proceeded to integrate the developed backend functionalities with the frontend components. This integration aimed to establish seamless interaction between the user interface, backend system, and AI model. The integration process involved handling incoming requests, processing data, and sending appropriate responses back to the frontend.

E. User Evaluation

We conducted an evaluation of our system, gathering feedback from users on various aspects including user experience, system functionalities, and plant identification success. The evaluation aimed to assess the user satisfaction and system integrity.

IV. EXPERIMENTAL RESULTS

Show and explain preliminary experiments that have done so far with their corresponding setups and results.

A. Paper Prototype

1) Version 0

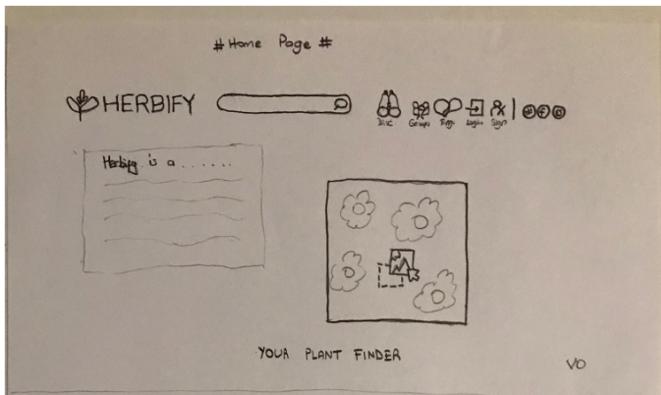


Fig. 1. Home Page Paper Prototype Version 0

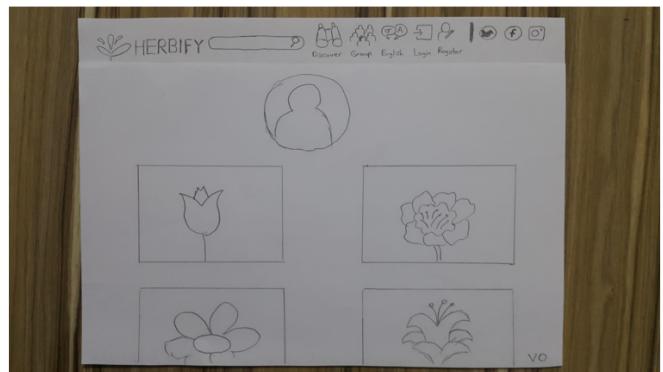


Fig. 4. Profile Page Paper Prototype Version 0

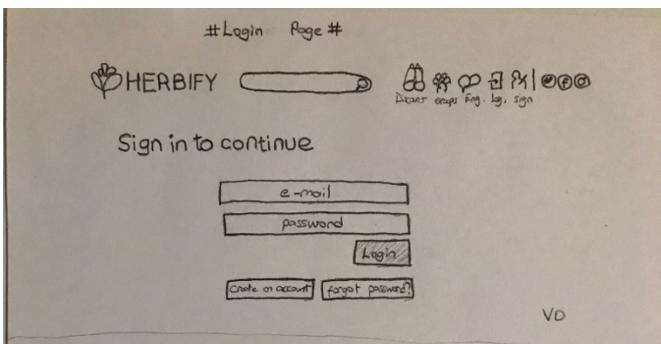


Fig. 2. Login Page Paper Prototype Version 0

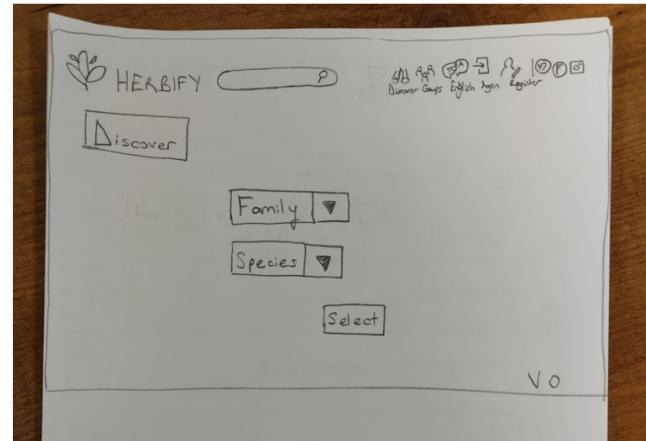


Fig. 5. Discover Page Paper Prototype Version 0

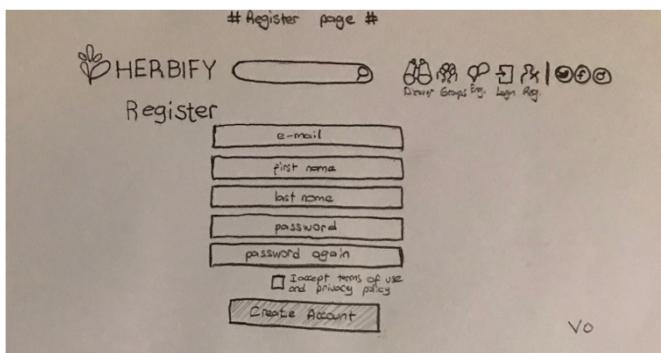


Fig. 3. Register Page Paper Prototype Version 0

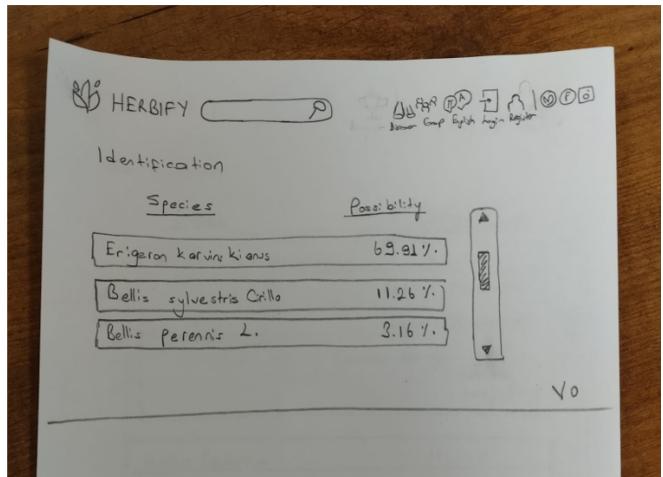


Fig. 6. Identification Paper Prototype Version 0

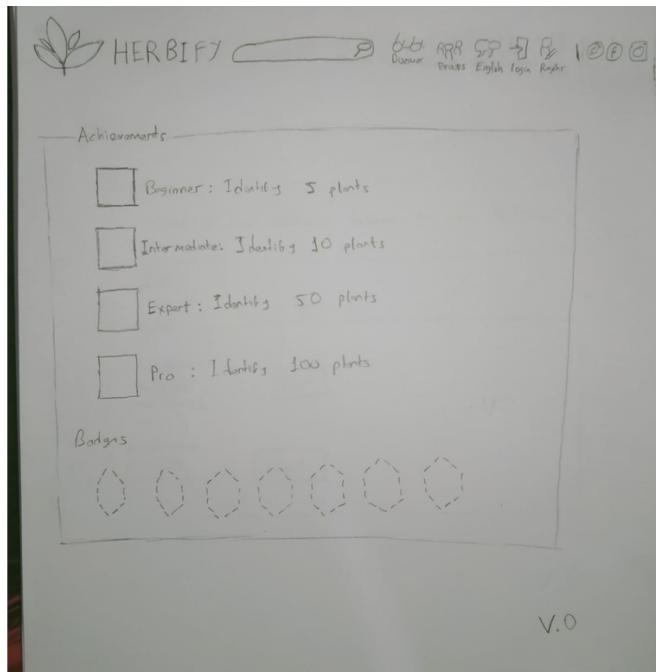


Fig. 7. Achievements Paper Prototype Version 0

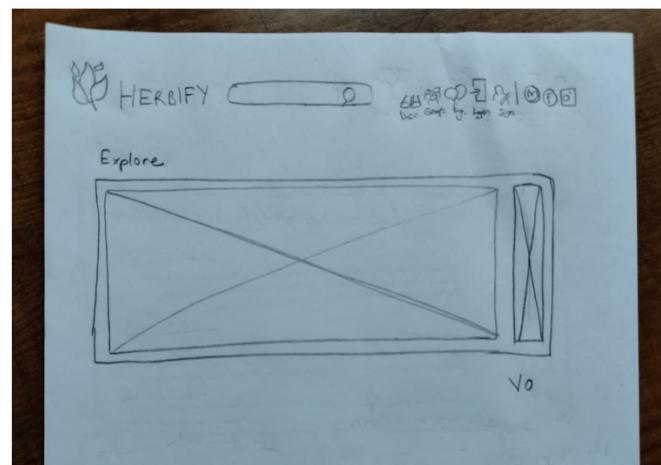


Fig. 9. Explore Paper Prototype Version 0

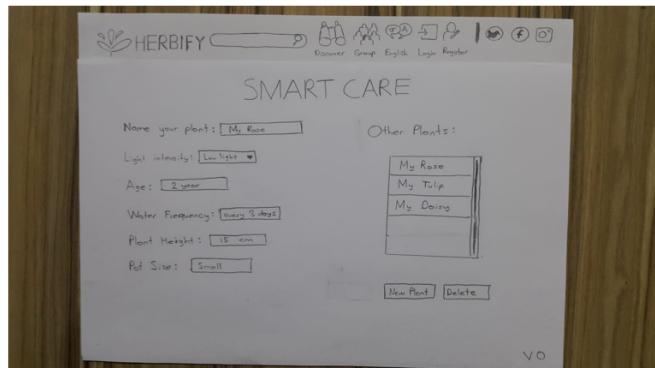


Fig. 10. Smart Care Prototype Version 0

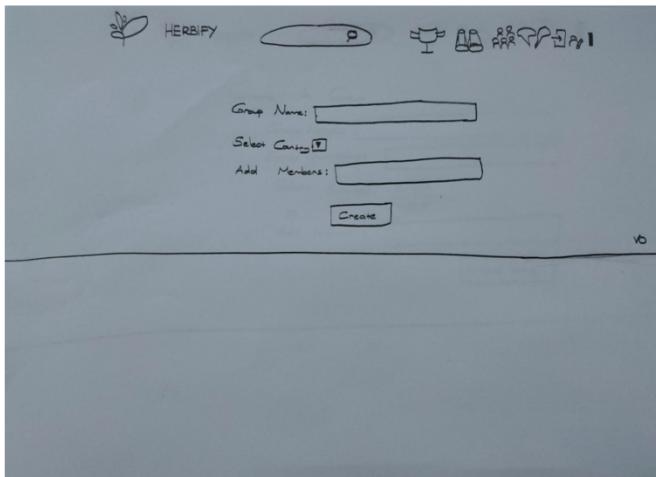


Fig. 8. Create Group Paper Prototype Version 0

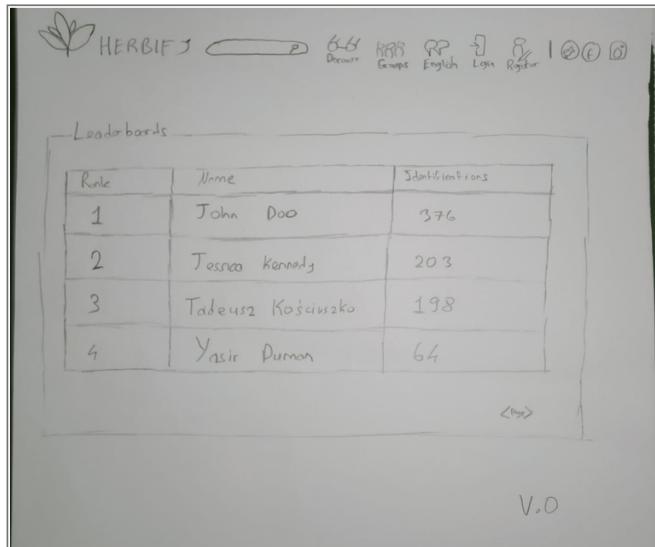


Fig. 11. Leader Prototype Version 0

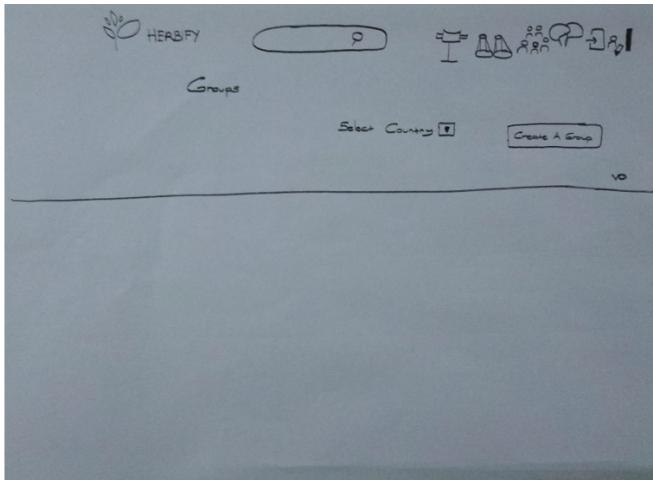


Fig. 12. Groups Prototype Version 0

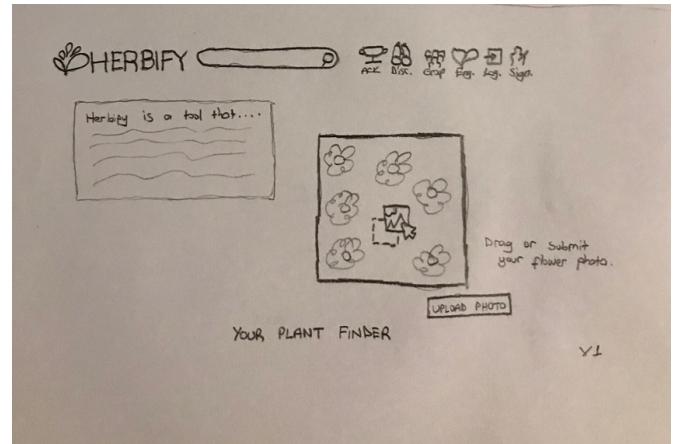


Fig. 14. Home Page Paper Prototype Version 1

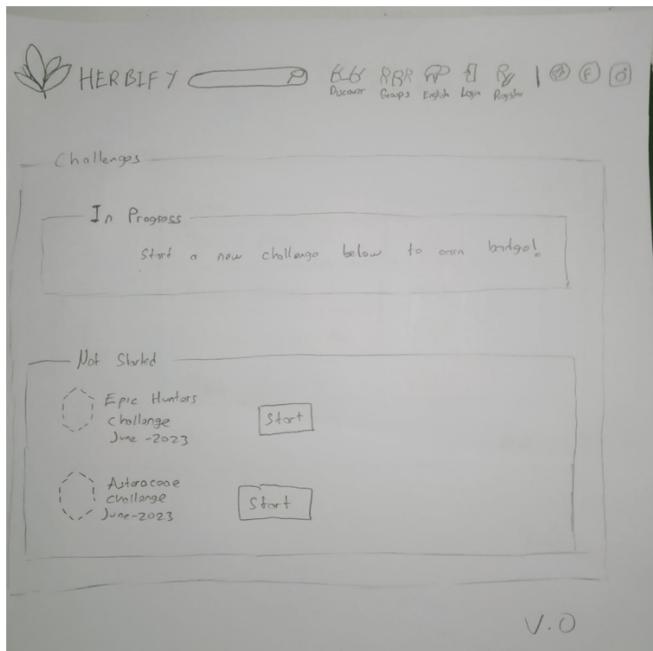


Fig. 13. Challenges Prototype Version 0

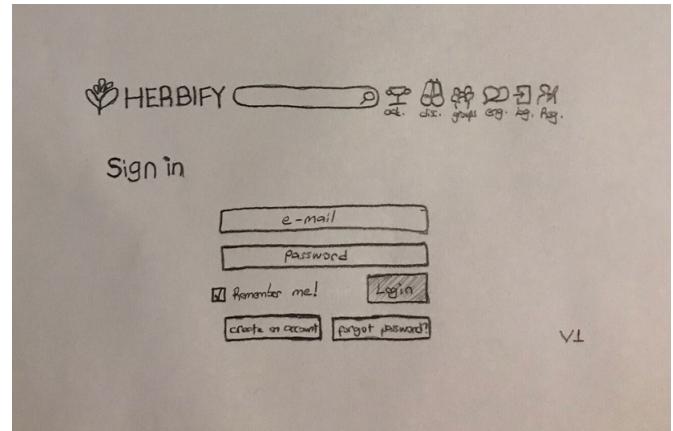


Fig. 15. Login Page Paper Prototype Version 1

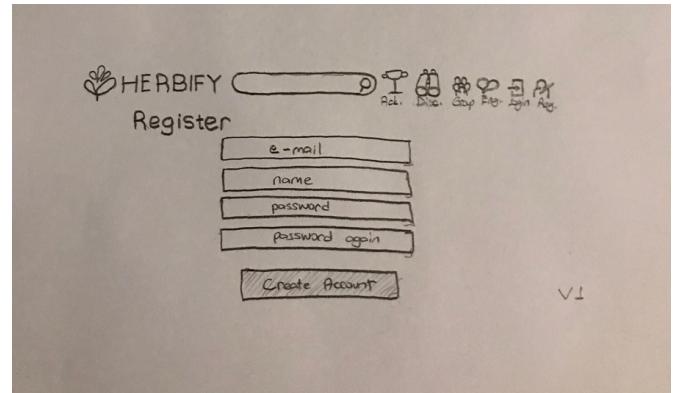


Fig. 16. Register Page Paper Prototype Version 1

2) Version 1:

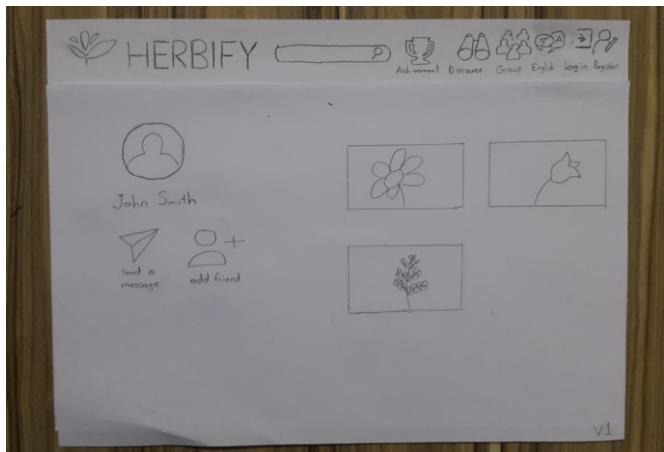


Fig. 17. Profile Page Paper Prototype Version 1

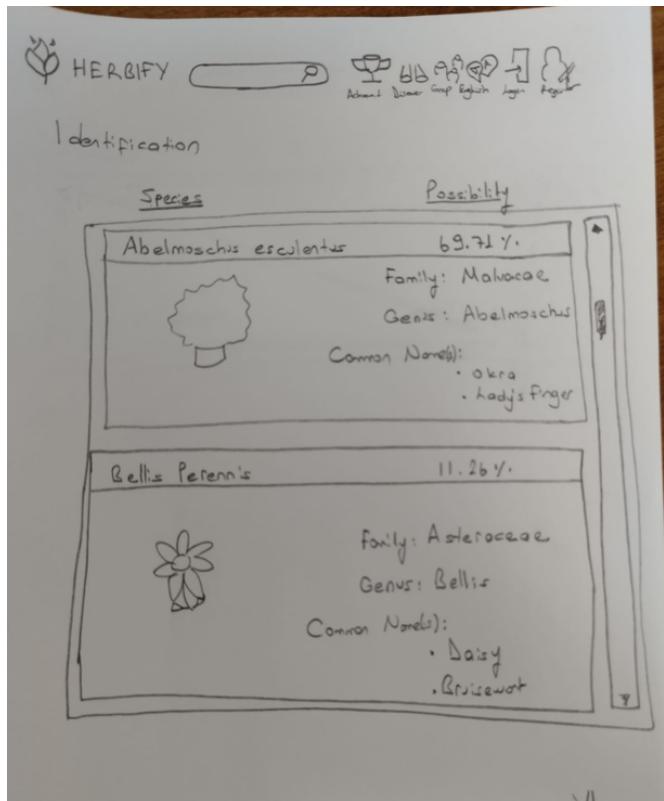


Fig. 19. Identification Page Paper Prototype Version 1

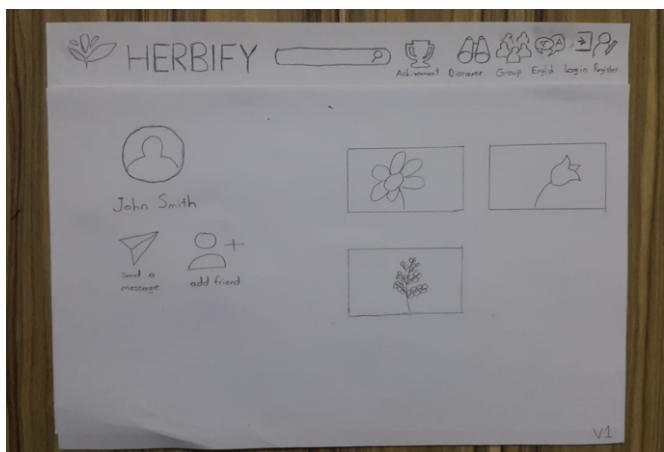


Fig. 18. Profile Page Paper Prototype Version 1

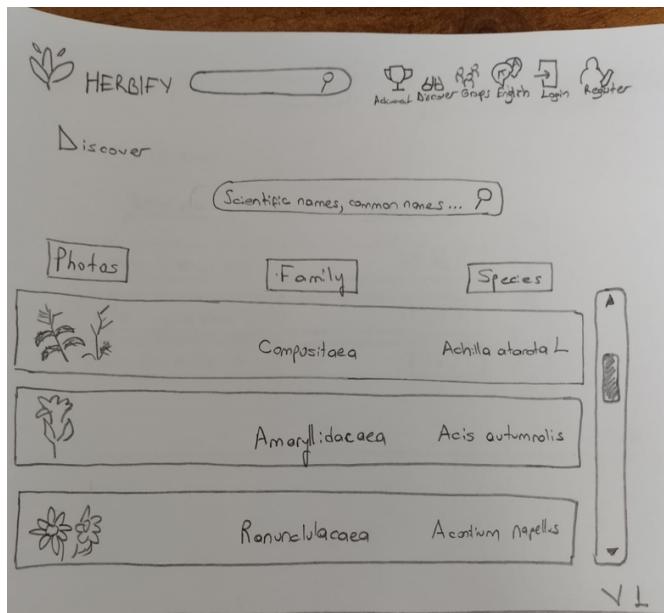


Fig. 20. Discover Page Paper Prototype Version 1

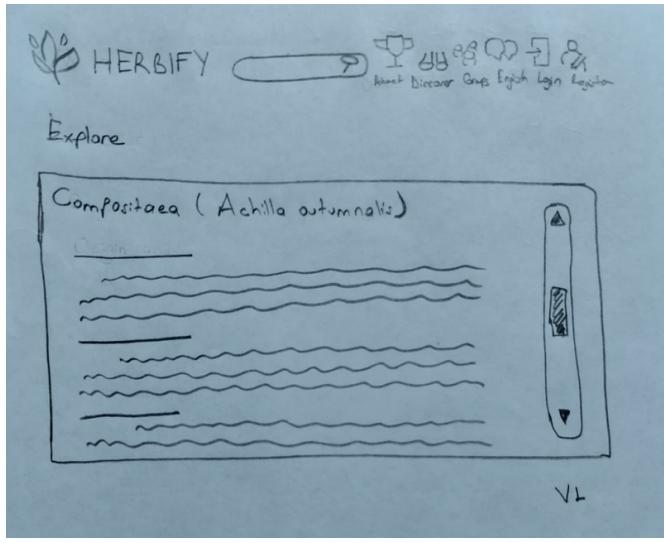


Fig. 21. Explore Paper Prototype Version 1

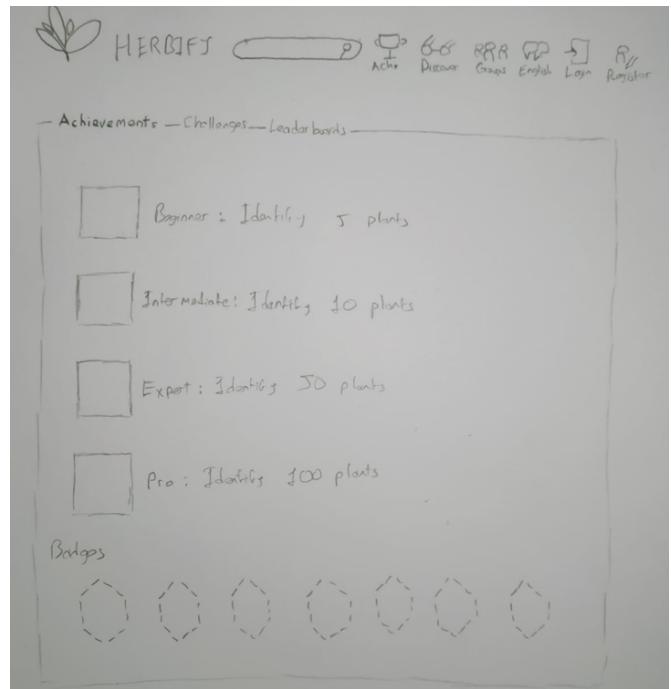


Fig. 23. Achievements Paper Prototype Version 1

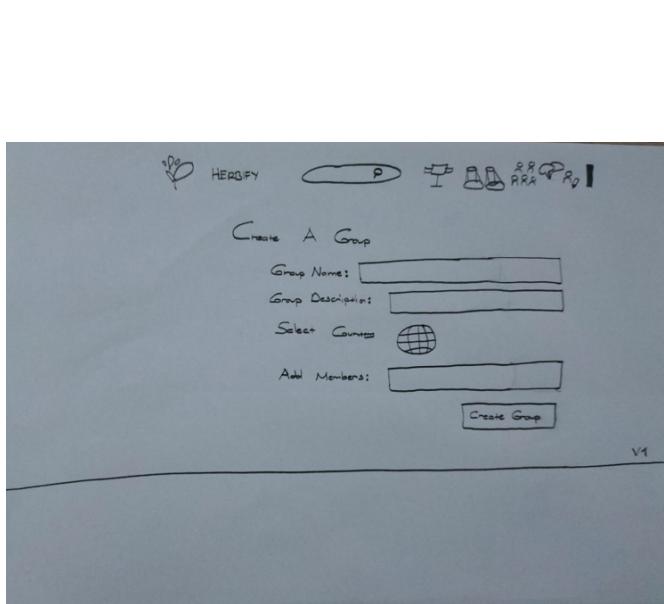


Fig. 22. Create Groups Paper Prototype Version 1

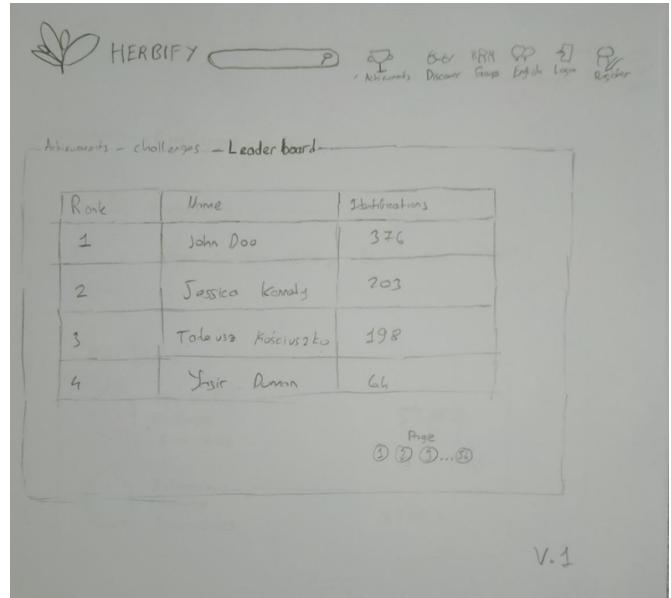


Fig. 24. Leaderboard Paper Prototype Version 1

B. Digital Design

1) Version 0

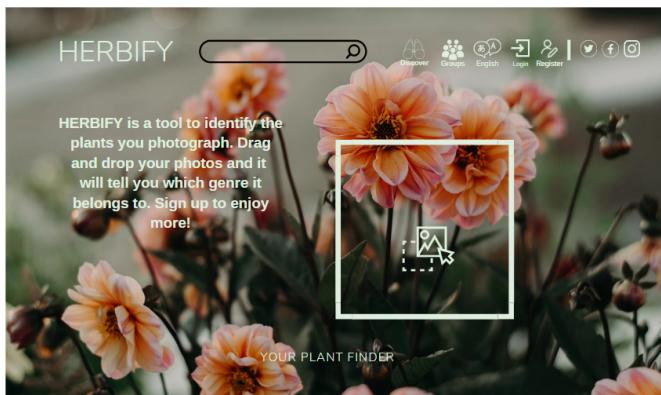


Fig. 25. Home Page Version 0

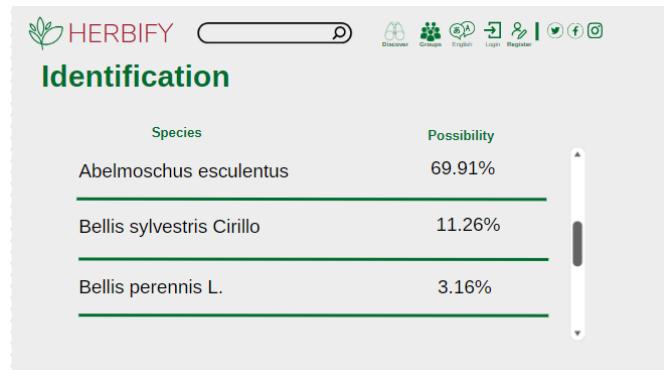


Fig. 28. Identification Page Version 0

Fig. 26. Register Page Version 0

Fig. 29. Discover Page Version 0

Fig. 27. Sign-in Page Version 0

Fig. 30. Create Group Page Version 0

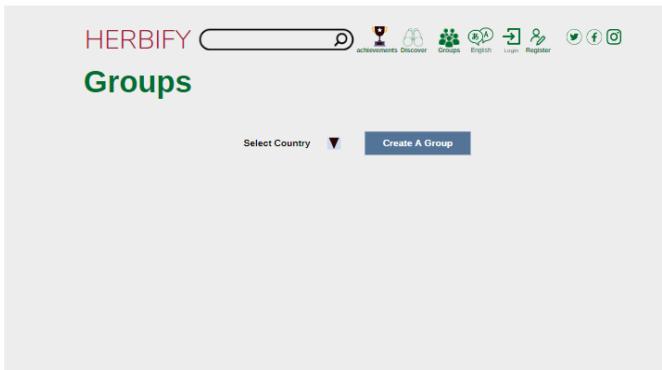


Fig. 31. Join Group Page Version 0

RANK	NAME	IDENTIFICATION
1	JOHN DOE	376
2	JESSICA KENNEDY	203
3	TADEUSZ KOSCIUSZKO	198
4	YASIR DUMAN	66

Fig. 34. Leader Board Page Version 0

Fig. 32. Achievement Page Version 0

RANK	NAME	IDENTIFICATION
1	JOHN DOE	376
2	JESSICA KENNEDY	203
3	TADEUSZ KOSCIUSZKO	198
4	YASIR DUMAN	66

Fig. 35. Leader Board Page Version 0

Fig. 33. Explore Page Version 0

Fig. 36. Profile Page Version 0

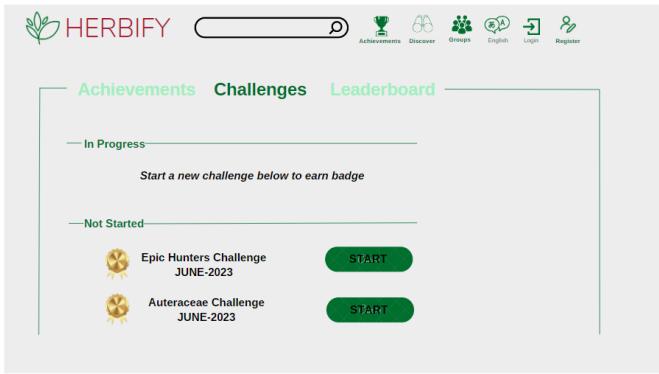


Fig. 37. Challenges Page Version 0

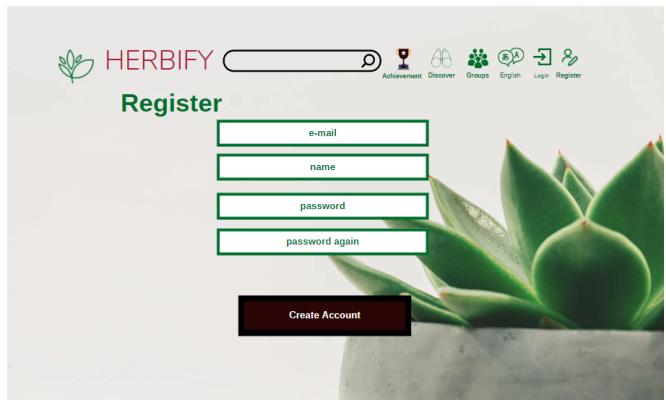


Fig. 40. Register Page Version 1

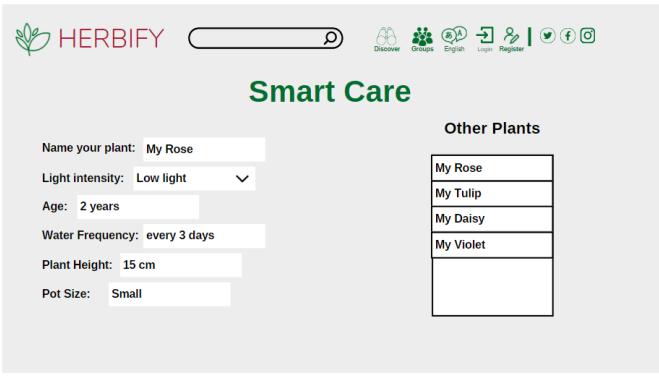


Fig. 38. Smart Care Page Version 0

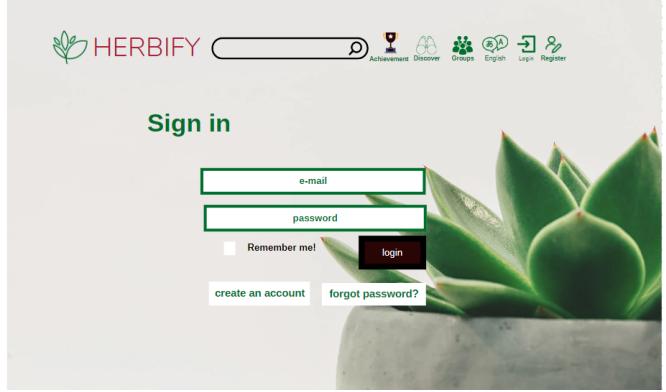


Fig. 41. Sign-in Page Version 1

2) Version 1

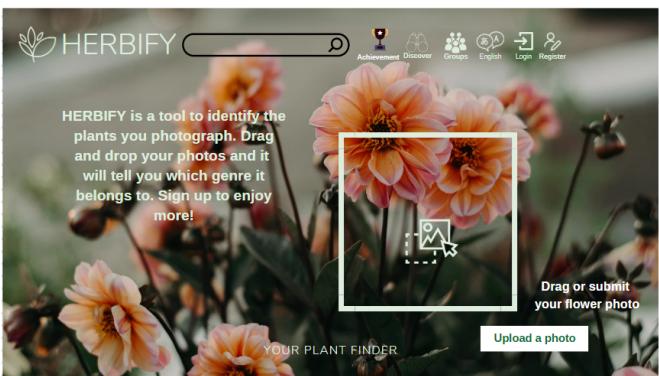


Fig. 39. Home Page Version 1

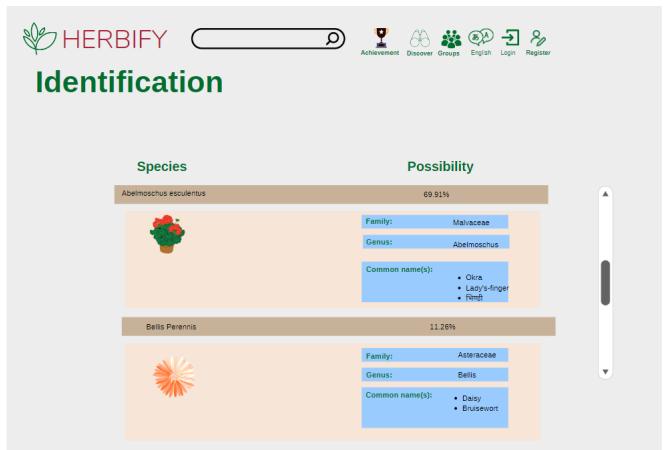


Fig. 42. Identification Page Version 1

Fig. 43. Discover Page Version 1

Fig. 46. Create Group Page Version 1

Fig. 44. Explore Page Version 1

Fig. 47. Groups Page Version 1

Fig. 45. Profile Page Version 1

RANK	NAME	IDENTIFICATION
1	JOHN DOE	376
2	JESSICA KENNEDY	203
3	TADEUSZ KOŚCIUSZKO	198
4	YASIR DUMAN	66

Fig. 48. Leaderboard Page Version 1

Achievements Challenges Leaderboard

- Beginner :** Identify 5 plants
- Intermediate :** Identify 10 plants
- Expert :** Identify 50 plants
- Pro :** Identify 100 plants

Badges

Fig. 49. Achievements Page Version 1

Identification

In the binomial name *Helianthus annuus* the genus name is derived from the Greek *ἥλιος* *Helios* 'Sun' and *ἄνθος* *anthos* 'flower'. The species name *annuus* means 'annual' in Latin.

The plant was first domesticated in the Americas. Sunflower seeds were brought to Europe from the Americas in the 16th century, where, along with sunflower oil, they became a widespread cooking ingredient. With time, the bulk of industrial-scale production has shifted to Eastern Europe, and (as of 2020) Russia and Ukraine together produce over half of worldwide seed production.

Description

The plant has an erect, rough-hairy stem, reaching typical heights of 3 metres (10 feet). The tallest sunflower on record achieved 9.17 m (30 ft 1 in).^[3] Sunflower leaves are broad, coarsely toothed, and mostly alternate; those near the bottom are larger and have petioles attached (petiolate), while those further up the stem are smaller and often called the "flower" of the sunflower (actually a "flower head" (*capitulum*)), 7.5–12.5 centimetres (3–5 in) wide,^[4] of numerous small individual five-petaled flowers ("florets"). The outer flowers, which resemble petals, are called *ray flowers*. Each "petal" consists of a ligule composed of fused petals of an asymmetrical ray flower. They are sexually sterile and may be yellow, red, orange, or other colors. The spirally arranged flowers in the center of the head are called *disk flowers*. These

Fig. 52. Future Identification Page Design

Challenges

In Progress

Start a new challenge below to earn badge

Not Started

	Epic Hunters Challenge JUNE-2023	START
	Asteraceae Challenge JUNE-2023	START

Fig. 50. Challenges Page Version 1

Achievements Leaderboards Badges

Luke Skywalker 51 of 60 achievements earned (82%)

	19% of users have this achievement
	Beginner Identify 5 plants 70% of users have this achievement Unlocked Sep 3, 2021
	Expert Identify 150 plants 0.21% of users have this achievement Unlocked Sep 3, 2023
	Rhinocactus Identify a Myrtillocactus geometrizans 1.21% of users have this achievement Unlocked Sep 3, 2023

Fig. 53. Future Achievements Page Design

C. Future UI Design

Home Identification Discover Achievements Groups Profile Logout

Latest observed species

Herbify helps you to identify plants with pictures. Register to explore more!

TRY HERBIFY Add drop an image

Latest Contributions

Fig. 51. Future Home Page Design

Groups

Groups allow to pool observations of several members around taxa of common interest or a geographical area. The aims are to have a quick access to data of interest, to create a map of observations and to export this data.

Search for a Group...

Les arbres d'Afrique centrale
Le groupe de perdrix intéressé par les fleurs de la marguerite et de la famille des marguerites
2689 Public Join Group

Любители розмарина
Группа садоводов заинтересовавшихся цветами семейства розмарины
12 Public Join Group

Papaya Sevenler Topluluğu
Papaya ve papayagiller familyasındaki çiçeklerle ilgilenen bahçevanları grubu
233 Private Join Group

Fig. 54. Future Groups Page Design

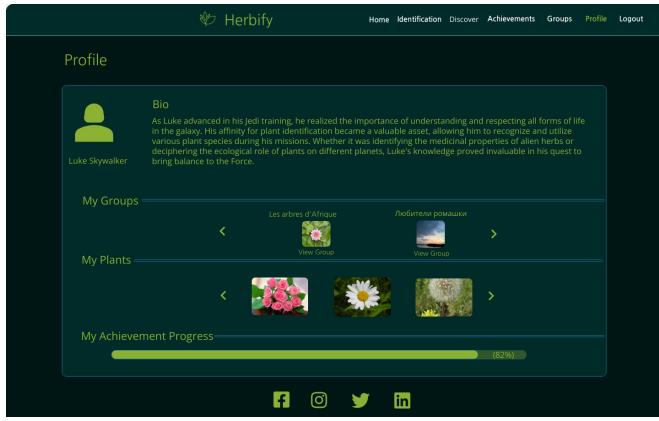


Fig. 55. Future Profile Page Design

D. Photo Recognition AI

This screenshot shows the AI training interface in a code editor. The code is defining a generator for training data and fitting it to a model. The log output shows training progress with metrics like loss and accuracy over multiple epochs and batches. The code uses Keras callbacks.

```

imageProjAI.ipynb -- CED0_2Project
...
batch_size = 4
model.fit_generator(generator=train_data,
                    steps_per_epoch=4/batch_size,
                    epochs=5, verbose=1, workers=4, max_queue_size=10,
                    validation_steps=200/batch_size)
...
Epoch 1/5
100/100 [=====] - ETA: 0s - loss: 8.8824 - accuracy: 0.7464
100/100 [=====] - ETA: 0s - loss: 0.8834 - accuracy: 0.7404 - val_loss: 0.8374 - val_accuracy: 0.7098
Epoch 2/5
100/100 [=====] - ETA: 0s - loss: 0.5244 - accuracy: 0.8236
100/100 [=====] - ETA: 0s - loss: 0.3709 - accuracy: 0.8377
100/100 [=====] - ETA: 0s - loss: 0.3035 - accuracy: 0.8463
100/100 [=====] - ETA: 0s - loss: 0.2681 - accuracy: 0.8504
Epoch 3/5
100/100 [=====] - ETA: 0s - loss: 0.2055 - accuracy: 0.8564
...
keras.callbacks.History at 0x13B544f0

```

Fig. 56. AI training demonstrated. In this section observed accuracy rates, loss rates, testing rate, training time, batch size and epochs trials. (approximately 4000 photos)

This screenshot shows a validation test for a sunflower image. The code loads the image, performs predictions, and prints the predicted classes and their probabilities. The output shows a prediction for 'sunflower' with a probability of approximately 0.99.

```

imageProjAI.ipynb -- CED0_2Project
...
preds
[0] ✓ 0.0
array([3.8103e-08, 3.204005e-04, 4.770234e-04, 9.988367e-01], dtype=float32)

> image_classes = ["daisy-papetyl", "dandelion-karinhiniba", "rose-goll", "sunflower-syc(cg)"]
print(np.argmax(preds))
print(image_classes[result])
[0] ✓ 0.0
...
sunflower-syc(cg)

```

Fig. 57. After the training is complete, a validation test is performed on a randomly downloaded sunflower image from the internet.

This screenshot shows a validation test for a daisy image. The code loads the image, performs predictions, and prints the predicted classes and their probabilities. The output shows a prediction for 'daisy-papetyl' with a probability of approximately 0.99.

```

imageProjAI.ipynb -- CED0_2Project
...
preds
[0] ✓ 0.0
array([1.031779e-04, 3.541772e-04, 2.031826e-05, 2.189409e-01], dtype=float32)

> image_classes = ["daisy-papetyl", "dandelion-karinhiniba", "rose-goll", "sunflower-syc(cg)"]
result = np.argmax(preds)
print(image_classes[result])
[0] ✓ 0.0
...
daisy-papetyl

```

Fig. 58. After the training is complete, a validation test is performed on a randomly downloaded daisy image from the internet.

This screenshot shows a validation test for a dandelion image. The code loads the image, performs predictions, and prints the predicted classes and their probabilities. The output shows a prediction for 'dandelion-karinhiniba' with a probability of approximately 0.99.

```

imageProjAI.ipynb -- CED0_2Project
...
preds
[0] ✓ 0.0
array([0.0457328, 0.0409102, 0.0020872, 0.4462324], dtype=float32)

> image_classes = ["daisy-papetyl", "dandelion-karinhiniba", "rose-goll", "sunflower-syc(cg)"]
print(np.argmax(preds))
print(image_classes[result])
[0] ✓ 0.0
...
dandelion-karinhiniba

```

Fig. 59. After the training is complete, a validation test is performed on a randomly downloaded dandelion image from the internet.

This screenshot shows a validation test for a rose image. The code loads the image, performs predictions, and prints the predicted classes and their probabilities. The output shows a prediction for 'rose-goll' with a probability of approximately 0.99.

```

imageProjAI.ipynb -- CED0_2Project
...
preds
[0] ✓ 0.0
array([12.912466e-03, 7.789546e-05, 9.993645e-01, 2.5320812e-05], dtype=float32)

> image_classes = ["daisy-papetyl", "dandelion-karinhiniba", "rose-goll", "sunflower-syc(cg)"]
result = np.argmax(preds)
print(image_classes[result])
[0] ✓ 0.0
...
rose-goll

```

Fig. 60. After the training is complete, a validation test is performed on a randomly downloaded rose image from the internet.

E. Use Cases

Use Case ID:	UUC-2
Use Case Name:	User Login
Created By:	Kerem Yavuz Şenyurt
Date Created:	21.06.2023
Last Updated By:	
Date Last Updated:	

Actor:	User
Description:	The action that a user must take to be able to login to the system
Preconditions:	The user has an account
Postconditions:	The user has logged in to the system
Normal Course of Events:	<ol style="list-style-type: none"> 1. User enters the URL of the website to their search engine of choice. 2. User enters the website 3. User clicks the login button on the main page. 4. System displays login page 5. User enters email and password 6. System allows access to the website
Alternative Courses:	<p>5a. User does not remember their password</p> <ol style="list-style-type: none"> 1. User clicks the forget password button. 2. User enters their email address. 3. User clicks recover password button <p>5b. User has entered invalid password.</p> <ol style="list-style-type: none"> 1. System notifies the user about the error. 2. User has still not been able to enter valid password after 3 tries 3. System times out the user for 30 minutes.
Exceptions:	<ol style="list-style-type: none"> 1. Website is unable to respond in at most 10 seconds. -Display an error message to the user to let them know about the issue.
Includes:	None
Special Requirements:	None
Assumptions:	The user is the owner of the account that they are trying to login
Notes and Issues:	None

Fig. 61. User Login Use Case.

Use Case ID:	UUC-3
Use Case Name:	User Identify a Plant
Created By:	Kerem Yavuz Şenyurt
Date Created:	21.06.2023
Last Updated By:	
Date Last Updated:	
Actor:	User
Description:	The action that a user must take to be able to identify a plant
Preconditions:	User has logged in to the system.
Postconditions:	User can see the name of the identification result.
Normal Course of Events:	<ol style="list-style-type: none"> 1. User clicks the Classification button located in the Navigation bar. 2. User chooses the photo of the plant he/she wants to identify. 3. User clicks on the "Upload photo" button.
Alternative Courses:	<p>Exceptions:</p> <ol style="list-style-type: none"> 1. Website is unable to respond in at most 10 seconds. -Display an error message to the user to let them know about the issue.
Includes:	None
Special Requirements:	None
Assumptions:	None
Notes and Issues:	None

Fig. 63. Identification Use Case.

Use Case ID:	UUC-1
Use Case Name:	User Register
Created By:	Kerem Yavuz Şenyurt
Date Created:	21.06.2023
Last Updated By:	
Date Last Updated:	
Actor:	User
Description:	The action that a user must take to be able to register to the system
Preconditions:	The user can access to the website
Postconditions:	The user has signed-in to the system
Normal Course of Events:	<ol style="list-style-type: none"> 1. User enters the URL of the website to their search engine of choice. 2. User enters the website 3. User clicks the register button on the main page 4. System displays register page 5. User enters email ,name and password twice. 6. User clicks Create Account button
Alternative Courses:	<p>5a. Passwords does not match</p> <ol style="list-style-type: none"> 1. System informs the user and asks to enter matching passwords.
Exceptions:	None
Includes:	None
Special Requirements:	None
Assumptions:	None
Notes and Issues:	None

Fig. 62. User Register Use Case.

F. Database Model

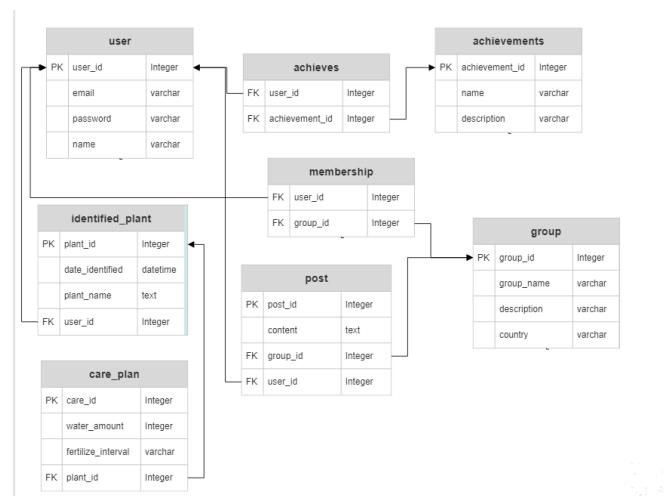


Fig. 64. Database Model Diagram

G. UML Sequence Diagram

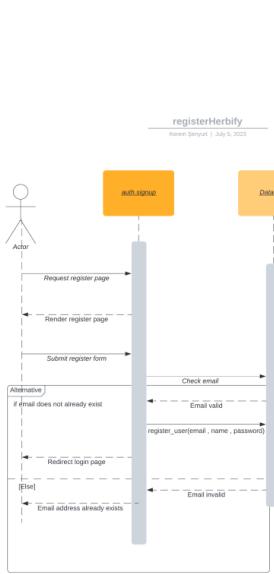


Fig. 65. Register Sequence Diagram.

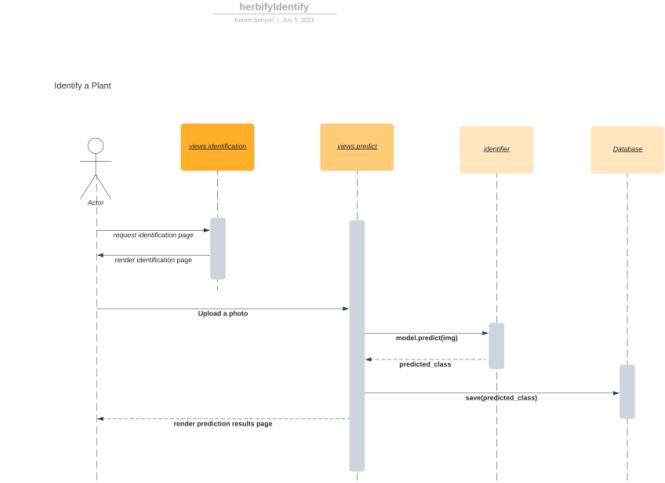


Fig. 67. Identify Sequence Diagram.

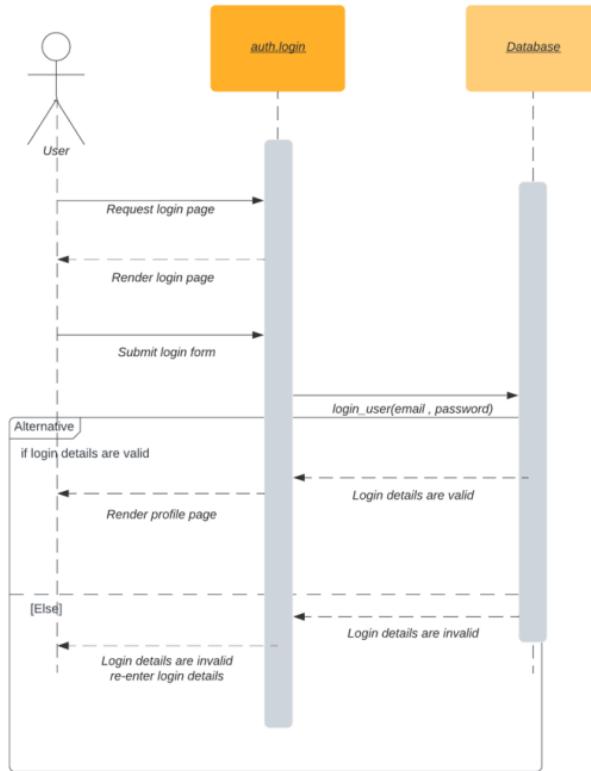


Fig. 66. Login Sequence Diagram.

H. Test Cases

Login Positive

Test Scenario ID	TC-1	Test Case ID	TC-1A
Test Case Description	User LogIn-Positive	Test Priority	High
Pre-Requisite	User has valid credentials	Post-Requisite	User have redirected to his/her profile page
Designed-by	Yasir Duman	Executed-by	Yasir Duman
Design date	04.07.2023	Execution date	04.07.2023

Test Execution Steps: The user opened the website and encountered the home page, then clicks the "login" button and be redirected to the login page and then enters valid credentials and hit the login button. He/She is redirected to his/her profile page with "Login is successful" message

S.No	Action	Inputs	Expected Output	Actual Output	Test Environment	Test Result	Test Comments
1	Launch application	http://127.0.0.1:5000/	System displays home page	System displays home page	Google Chrome version 93.0.4577.82	System displays home page successfully	Success
2	User clicks the button which refers the login page	http://127.0.0.1:5000/login	System displays the login page	System displays the login page	Google Chrome version 93.0.4577.82	System displays the login page successfully	Success
3	User enters their mail address and password correctly and click the "Login" button	Email: email@email.com; Password:*****	System redirects to him/her profile page with "Login is successful" message	System redirects to him/her profile page with "Login is successful" message	Google Chrome version 93.0.4577.82	System redirects to him/her profile page and shows the "Login is successful" message	Success

Fig. 68. Login Positive Test Case.

Login Negative

Test Scenario ID	TC-1	Test Case ID	TC-1B
Test Case Description	User Login-Negative	Test Priority	High
Pre-Requisite	User have invalid credentials	Post-Requisite	User have to be stay in the login page and the system shows the "Please check your login details and try again"
Designed-by	Yasir Duman	Executed-by	Yasir Duman
Design date	04.07.2023	Execution date	04.07.2023

Test Execution Steps: The user opened the website and encountered the home page, then clicks the "login" button and be redirected to login page and then enters invalid credentials and hit the login button. Then, the system shows "Please check your login details and try again"

S.No	Action	Inputs	Expected Output	Actual Output	Test Environment	Test Result	Test Comments
1	Launch application	http://127.0.0.1:5000/	System displays home page	System displays home page version 93.0.4577.82	Google Chrome	System displays home page successfully	Success
2	Click the button which refers the login page	http://127.0.0.1:5000/login	System displays the login page	System displays the login page version 93.0.4577.82	Google Chrome	System displays the login page successfully	Success
3	User enters their mail address and password incorrectly and click the "Login" button	Email: email@example.com Password:*****	System shows the "Please check your login details and try again"	User stays in the login page and the system shows the "Please check your login details and try again" message correctly	Google Chrome version 93.0.4577.82	System redirects to login page and shows "Account created successfully"	Success

Fig. 69. Login Negative Test Case.

User Register- Positive

Test Scenario ID	TC-2	Test Case ID	TC-2A
Test Case Description	User Register	Test Priority	High
Pre-Requisite	User have valid email address	Post-Requisite	System redirects to the login page
Designed-by	Yasir Duman	Executed-by	Yasir Duman
Design date	04.07.2023	Execution date	04.07.2023

Test Execution Steps: The user opened the website and encountered the home page, then clicks the "register" button and be redirected to register page and then enters valid credentials and hit the "Create Account" button. Then, the system redirects to login page and shows "Account created successfully"

S.No	Action	Inputs	Expected Output	Actual Output	Test Environment	Test Result	Test Comments
1	Launch application	http://127.0.0.1:5000/	System displays home page	System displays home page	Google Chrome version 93.0.4577.82	System displays home page successfully	Success
2	User clicks the "register" button	http://127.0.0.1:5000/register	System displays the register page	System displays the register page	Google Chrome version 93.0.4577.82	System displays the register page successfully	Success
3	User enters their mail address, name, password, confirm password correctly and clicks the "Create Account"	Email: example@example.com Name: example Password:***** Confirm Password:*****	System redirects to login page and shows "Account created successfully"	System redirects to login page and shows "Account created successfully"	Google Chrome version 93.0.4577.82	System redirects to login page and shows message successfully	Success

Fig. 70. User Register Positive Test Case.

User Register- Negative

Test Scenario ID	TC-2	Test Case ID	TC-2B
Test Case Description	User Register-Negative	Test Priority	Low
Pre-Requisite	User's password and confirm password don't match	Post-Requisite	System shows "Confirmation password does not match with password" message
Designed-by	Yasir Duman	Executed-by	Yasir Duman
Design date	04.07.2023	Execution date	04.07.2023

Test Execution Steps: The user opened the website and encountered the home page, then clicks the "register" button and be redirected to register page and then enters credentials but different password and confirm password values and then hit the "Create Account" button. Then, the system shows "Confirmation password does not match with password"

S.No	Action	Inputs	Expected Output	Actual Output	Test Environment	Test Result	Test Comments
1	Launch application	http://127.0.0.1:5000/	System displays home page	System displays home page	Google Chrome version 93.0.4577.82	System displays home page successfully	Success
2	User clicks the "register" button	http://127.0.0.1:5000/register	System displays the register page	System displays the register page	Google Chrome version 93.0.4577.82	System displays the register page successfully	Success
3	User enters different password value and confirm password value and clicks the "Create Account"	Email: example@example.com Name: example Password:***** Confirm Password:*****	System shows "Confirmation password does not match with password"	System shows "Confirmation password does not match with password"	Google Chrome version 93.0.4577.82	System shows message successfully	Success

Fig. 71. User Register Negative Test Case.

User Identify a Plant							
Test Scenario ID	TC-3	Test Case ID	TC-3A				
Test Case Description	User identify a plant	Test Priority	High				
Pre-Requisite	User has a plant photo	Post-Requisite	System shows the name of the plant				
Designed-by	Yasir Duman	Executed-by	Yasir Duman				
Design date	04.07.2023	Execution date	04.07.2023				

Test Execution Steps: The user opened the website and encountered the home page. The user can either reach the classification page by clicking "Try out identification" button in the home page or by clicking the "Identification" button in the navbar. Then the system redirects to "Identification" page. Then the user clicks the "Choose File" button and select a photo which includes a plant will be identified then clicks the "upload a Photo" button. The system redirects to "predict" page and shows the name of the plant

S.No	Action	Inputs	Expected Output	Actual Output	Test Environment	Test Result	Test Comments
1	Launch application	http://127.0.0.1:5000/	System displays home page	System displays home page	Google Chrome version 93.0.4577.82	System displays home page successfully	Success
2	User clicks the "Try out identification" button	http://127.0.0.1:5000/identification	System displays the identification page	System displays the identification	Google Chrome version 93.0.4577.82	System displays the identification page successfully	Success
3	User clicks the "Choose File" button and select a photo and then clicks "Upload a Photo" button	photo	System redirects to "predict" page and shows the name of the plant	System redirects to "predict" page and shows the name of the plant	Google Chrome version 93.0.4577.82	System redirects and shows the name of the plant successfully	Success

Fig. 72. Plant Identification Test Case.

V. CONCLUSIONS AND FUTURE WORKS

A. Conclusion

Herbify is an application that uses photo recognition technology and combines gamification elements to increase user engagement. We mentioned some plant identification apps similar to Herbify and examined them based on their identification success, user reviews, and price. We explained what processes we completed in the frontend, backend and AI side while developing Herbify. We've included some photos such as paper prototypes, digital design, database model to show the work we've done developing Herbify.

B. Importance

Nature, which is a part of our world is in crisis. As a result of global warming, pollution and destruction, the vegetation in our world is decreasing. We think that the way to slow down and stop this is to raise awareness of people and instill a love of nature in them. Our application aims to provide users with information about plants while also ensuring they have an enjoyable time. In this way, we ensure that our application is not disposable, but we make it a part of people's lives where people spend time and taking care of plants.

C. Future Works

For the future works, we will make interface designs that users can be more comfortable with and to improve existing

interfaces. Another issue we will work on is to improve the photo recognition mechanism, recognize more plants and increase the accuracy rate. In addition to recognizing plants, we are also planning to introduce the feature of recognizing plant diseases with photography.

VI. WEEKLY SCHEDULE/PROJECT PLAN

Our project schedule is explained in a Gantt Chart. The chart is in the given link with its subtasks:

<https://sharing.clickup.com/9009131277/g/h/4-90090274219-7/3aff0ce79ebf948>

Our aim as five members group is to not overwork ourselves and spread our tasks evenly over the given time span. Our group's weekly meetings are held online at unspecific times.

- Design Analysis (09.03.2023-15.03.2023):

Task Name: Problem Definition

Definition: The aim is to find a problem and focus on its solutions. We identified our problem and thought how we can solve the problem. Finally, we decided on our project.

Current status: Completed.

Responsible Person: All Team members

- Design Analysis (15.03.2023-22.03.2023):

Task Name: Literature review

Definition: Review of articles and resources on the subject, the study review process related to the problem.

Current status: Completed.

Responsible Person: Gökay Gülsöy, Yasir Duman, Berkcan Gönülseven, Kerem Yavuz Şenyurt.

Task Name: Stages

Definition: Milestones to be passed for the Project.

Current status: Completed.

Responsible Person: Gökay Gülsöy, Berkcan Gönülseven

Task Name: Determines tools

Definition: Determination of software and hardware tools to be used in the project.

Current status: Completed.

Responsible Person: Gökay Gülsöy

Task Name: Experiments result

Definition: Designing user interfaces of web pages.

Current status: Completed.

Responsible Person: Yasir Duman

- AI development (24.03.2023-28.03.2023):

Task Name: Tools research

Definition: research of the most suitable artificial intelligence software program for the project topic.

Current status: Completed.

Responsible Person: All team members

- AI development (28.03.2023-02.04.2023):

Task Name: AI model research

Definition: The most reliable and fast model search for image classification.

Current status: Completed.

Responsible Person: Halil İbrahim Buğday

- AI development (2.04.2023-07.04.2023):

Task Name: dataset collecting

Definition: Collection of 4 different flower image datasets for AI (approximately 4000 images in total).

Current status: Completed.

Responsible Person: All team members

- AI development (04.04.2023-09.04.2023):

Task Name: AI design

Definition: Building an architecture for AI software

Current status: Completed.

Responsible Person: Halil İbrahim Buğday

- AI development (10.04.2023-20.04.2023):

Task Name: AI implementation

Definition: Artificial intelligence software development

Current status: Completed.

Responsible Person: Halil İbrahim Buğday

- AI development (21.04.2023-24.04.2023):

Task Name: AI testing

Definition: Specific tests of finished software

Current status: Completed.

Responsible Person: All team members

- AI development (24.04.2023-29.04.2023):

Task Name: AI improvements

Definition: Improve software based on test results

Current status: Completed.

Responsible Person: Halil İbrahim Buğday

- Backend development (1.05.2023-04.05.2023):

Task Name: Tools research

Definition: Researching the appropriate backend software program for the project topic

Current status: Completed.

Responsible Person: All team members

- Backend development (02.05.2023-05.05.2023):

Task Name: UML design

Definition: Visual modeling language used for representing the software system

Current status: Completed.

Responsible Person: All team members

- Backend development (06.05.2023-10.05.2023):

Task Name: Database Design

Definition: Creating a structured and efficient representation of data, tables, relationships in a database system

Current status: Completed.

Responsible Person: All team members

- Backend development (05.05.2023-08.05.2023):

Task Name: Use Cases

Definition: capturing and representing interactions between actors

Current status: Completed.

Responsible Person: Gökay Gülsøy, Yasir Duman, Kerem Yavuz Şenyurt

- Backend development (09.05.2023-12.05.2023):

Task Name: Test Cases

Definition: Specific scenarios used to validate software functionality and performance

Current status: Completed.

Responsible Person: Kerem Yavuz Şenyurt, Berkcan Gönülsever, Gökay Gülsøy

- Backend development (06.05.2023-22.05.2023):

Task Name: Backend Implementation

Definition: Development of the sever-side components of the software system

Current status: Completed.

Responsible Person: Kerem Yavuz Şenyurt, Halil İbrahim Buğday, Berkcan Gönülsever

- Backend development (22.05.2023-24.05.2023):

Task Name: Backend Testing

Definition: Assessing the functionality, performance of the sever-side components of the system *

Current status: Completed.

Responsible Person: All team members

- Backend development (24.05.2023-30.05.2023):

Task Name: Backend Improvements

Definition: Enhancements made to the server-side components of the software system

- Current status: Completed.
Responsible Person: All team members
- UI Frontend Development (25.05.2023-28.05.2023):

Task Name: Tools Research
Definition: Exploring various software tools for designing user interfaces
Current status: Completed.
Responsible Person: All team members
 - UI Frontend Development (27.05.2023-29.05.2023):

Task Name: UI Design
Definition: Process of creating visually appealing interfaces for the software application
Current status: Completed.
Responsible Person: Yasir Duman
 - UI Frontend Development (30.05.2023-09.06.2023):

Task Name: Login and Register Page implementation
Definition: Designing and developing the user interface for login and register page
Current status: Completed.
Responsible Person: Gökay Gülsöy, Berkan Gönülsever, Yasir Duman, Halil İbrahim Buğday
 - UI Frontend Development (04.06.2023-12.06.2023):

Task Name: Main Page implementation
Definition: Designing and developing the user interface for Main Page
Current status: Completed.
Responsible Person: Gökay Gülsöy, Berkan Gönülsever, Halil İbrahim Buğday, Yasir Duman
 - UI Frontend Development (06.06.2023-15.06.2023):

Task Name: Other Pages Implementation
Definition: Designing and developing the user interface for other page
Current status: Completed.
Responsible Person: Gökay Gülsöy, Berkan Gönülsever, Halil İbrahim Buğday, Yasir Duman
 - UI Frontend Development (15.06.2023-19.06.2023):

Task Name: Frontend Testing
Definition: Evaluating the ui of client-side components to ensure they meet requirements
Current status: Completed.
Responsible Person: All team members
 - UI Frontend Development (17.06.2023-22.06.2023):

Task Name: Frontend Improvements
Definition: Enhancements made to the client-side components of the software system
Current status: Completed.
Responsible Person: All team members
 - Test (25.06.2023-27.06.2023):

Task Name: Class and Interface Test
Definition: Verifying the behavior and correctness of classes and interfaces in the software system
Current status: Completed.
Responsible Person: All team members
 - Test (25.06.2023-27.06.2023):

Task Name: Integration Test
Definition: Integration between modules, and components within the software system
Current status: Completed.
Responsible Person: All team members
 - Test (28.06.2023):

Task Name: Feedback
Definition: Providing constructive criticism to enhance our work
Current status: Completed.
Responsible Person: All team members
 - Test (28.06.2023- 30.06.2023):

Task Name: System Improvement
Definition: Enhancing a software system to address identified issues
Current status: Completed.
Responsible Person: All team members
 - Enhancements (30.06.2023- 03.07.2023):

Task Name: Usability
Definition: Measuring of how easy the software system to use for intended users
Current status: Completed.
Responsible Person: All team members
 - Enhancements (30.06.2023- 03.07.2023):

Task Name: Increasing Interactions
Definition: Enhancing user satisfaction with software system
Current status: Completed.
Responsible Person: All team members
 - Future Works (03.07.2023- 05.07.2023):

Task Name: Future UI Design

Definition: Updated the current UI design with better ones

Current status: Planned

Responsible Person: All team members

- Future Works (07.07.2023- 15.07.2023):

Task Name: Increase AI accuracy rate

Definition: Improving data quality and quantity for training, implementing

Current status: Planned

Responsible Person: All team members

- Future Works (16.07.2023- 18.08.2023):

Task Name: Diagnosis and treatment feature for plants

Definition: Utilizes image recognition or plant symptom identification

Current status: Planned

Responsible Person: All team members

- Future Works (10.08.2023- 21.08.2023):

Task Name: For achievements adding coupon system

Definition: Users can earn coupons as rewards

Current status: Planned

Responsible Person: All team members

REFERENCES

- (2023). Mobile app of plantsnap.
- Appixi (2023). Leafsnap plant identification app.
- Apps, C. (2023). Blossom plant identifier.
- FlowerChecker (2023). Plant.id web app.
- Google (2023). Google lens web app.
- Ilmenau, T. U. (2023). Flora incognita mobile app.
- iNaturalist (2023). inaturalist website.
- Inc, P. (2023). Plantsnap plant identification.
- Jones, H. G. (2023). Tests of automated image recognition apps for plant identification on plants from the british flora. *AoB Plants* 12(6), 1–9.
- Microsoft (2023). Bing search engine.
- PlantNet (2023). Pl@ntnet web app.
- Toğaçar, M., B. Ergen, and F. özyurt (2023). Clasification of flower images by feature selection methods in convolutional neural network models. *Fırat Üniversitesi Müh. Bil. Dergisi* 32(1), 48–56.