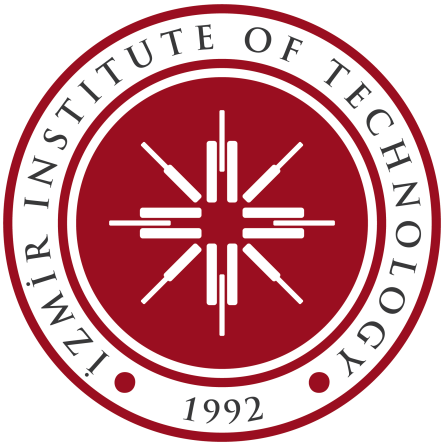
CENG318 Human Computer Interaction
Project Progress Report
Spring 2023

Project Title: Herbify

May 2, 2023



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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 want to learn about and then they can access lots of useful information, such as plant care. 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.

1 Introduction

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.

2 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.

2.1 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.

2.2 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.

2.3 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.

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.

Table 1

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 hiararchy : 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 hiararchy : identified.	Yes	Camera
plant.id	Web	No login or register needed for identification. Health assessment feature.	No	Upload/Camera
iNaturalist Seek	Android/iOS	Uses location to filter neaby species. Achievements can be earned by completing challanges. Observations can be saved. Confidence hiararchy : identified.	No	Camera
LeafSnap	Andorid/iOS	Confidence hiararchy : 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 Hiararchy : Percentage users can access species list by location. Observation Filtering.	No	Camera

Table 2

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
Candide	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

3 Methodology

3.1 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.

3.2 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.

3.3 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.

3.4 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.

3.5 Integration

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. The tool will allow users to upload by dragging and dropping to the web page an image of a plant and receive a prediction of its species within seconds. The tool will also provide users with additional information about the plant, such as its common name, habitat, and growing conditions. We will also provide users to join groups created from all over the world or they can create a group and share their experience.

3.6 Valuation

To evaluate the effectiveness of the plant identifier tool, we will conduct a user study involving a sample of individuals with varying levels of knowledge about plants. Participants will be asked to use the tool to identify a set of plant images, and their accuracy and user experience will be recorded.

3.7 Conclusion

Based on the results of the user study, we will draw conclusions about the effectiveness of the plant identifier tool and its potential for use in education, botany, horticulture, and agriculture. We will also discuss the limitations of the tool and opportunities for future research and development.

4 Preliminary Experiments & Results

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

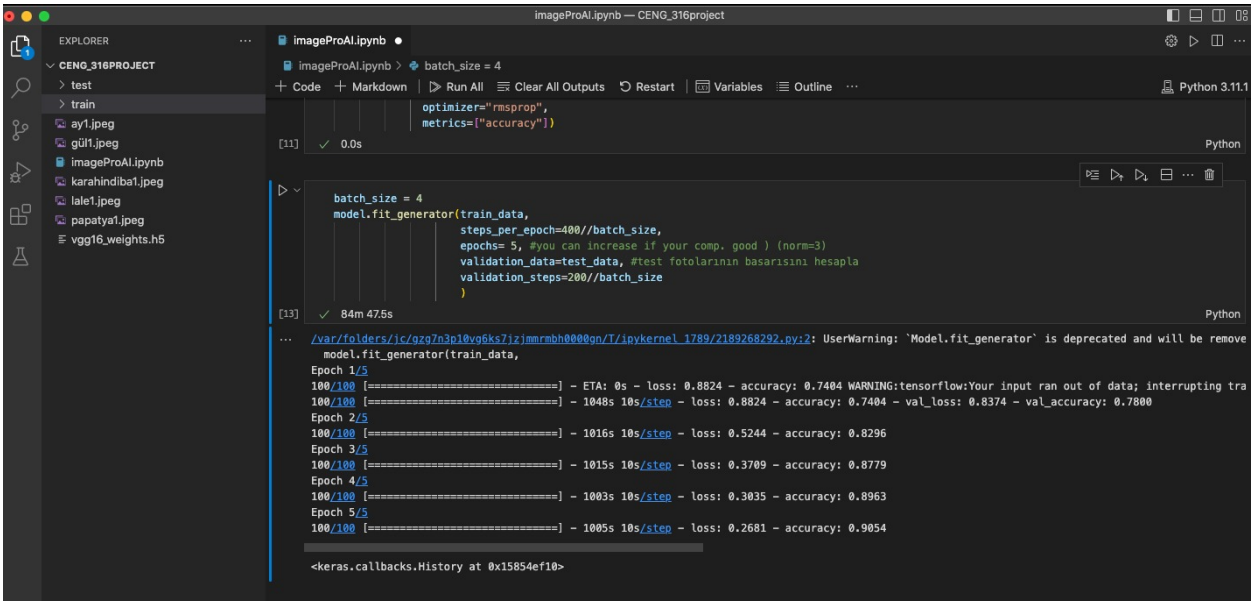

Figure 1: AI training demonstrated. In this section observed accuracy rates, loss rates, testing rate, training time, batch size and epochs trials. (approximately 4000 photos)

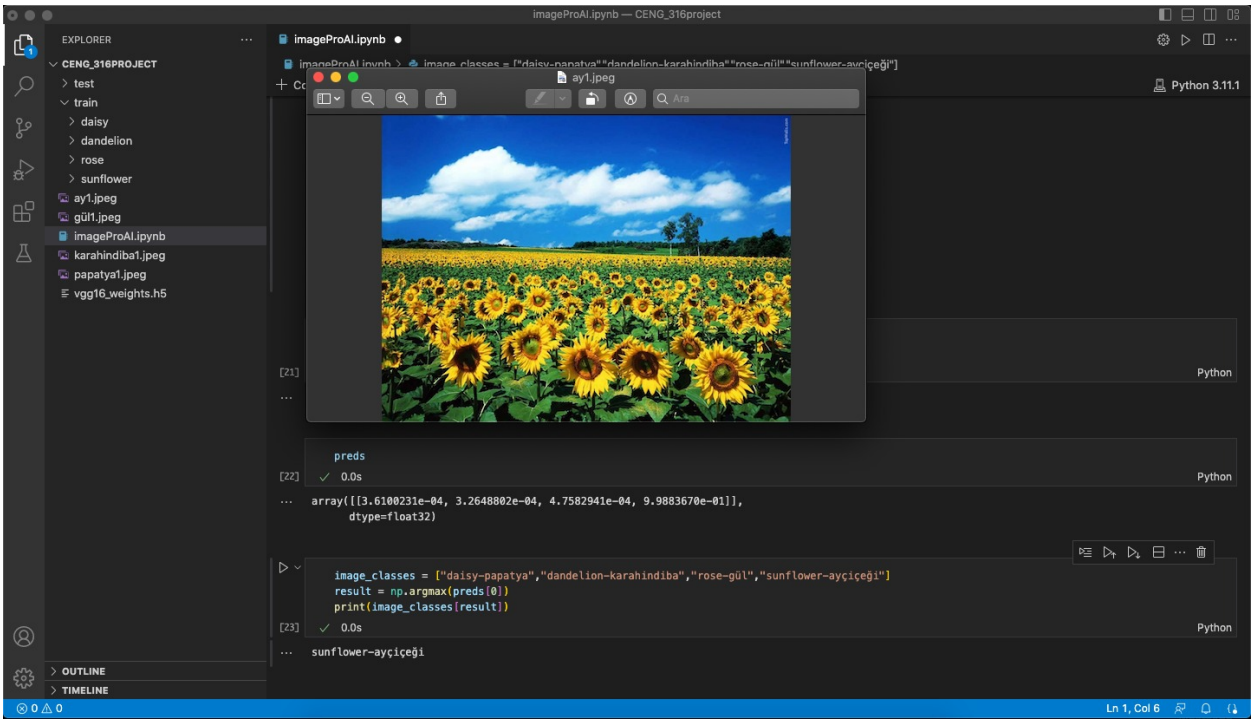

Figure 2: After the training is complete, a validation test is performed on a randomly downloaded sunflower image from the internet.

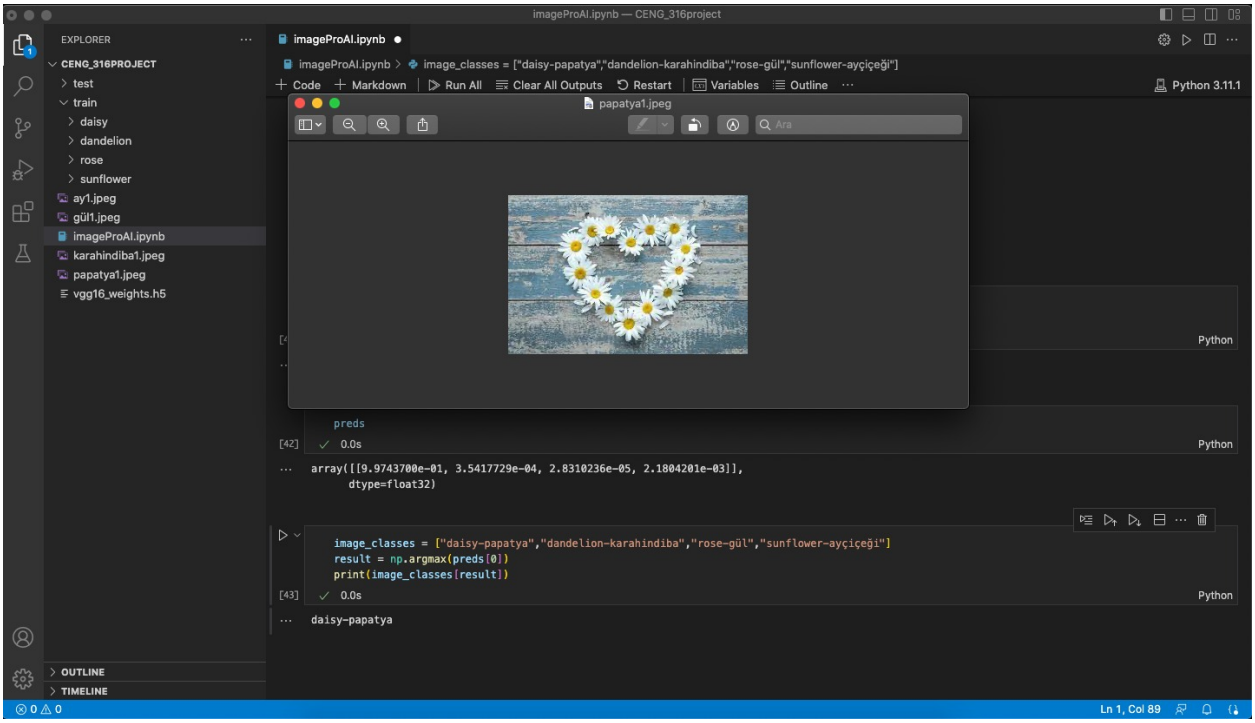

Figure 3: After the training is complete, a validation test is performed on a randomly downloaded daisy image from the internet.

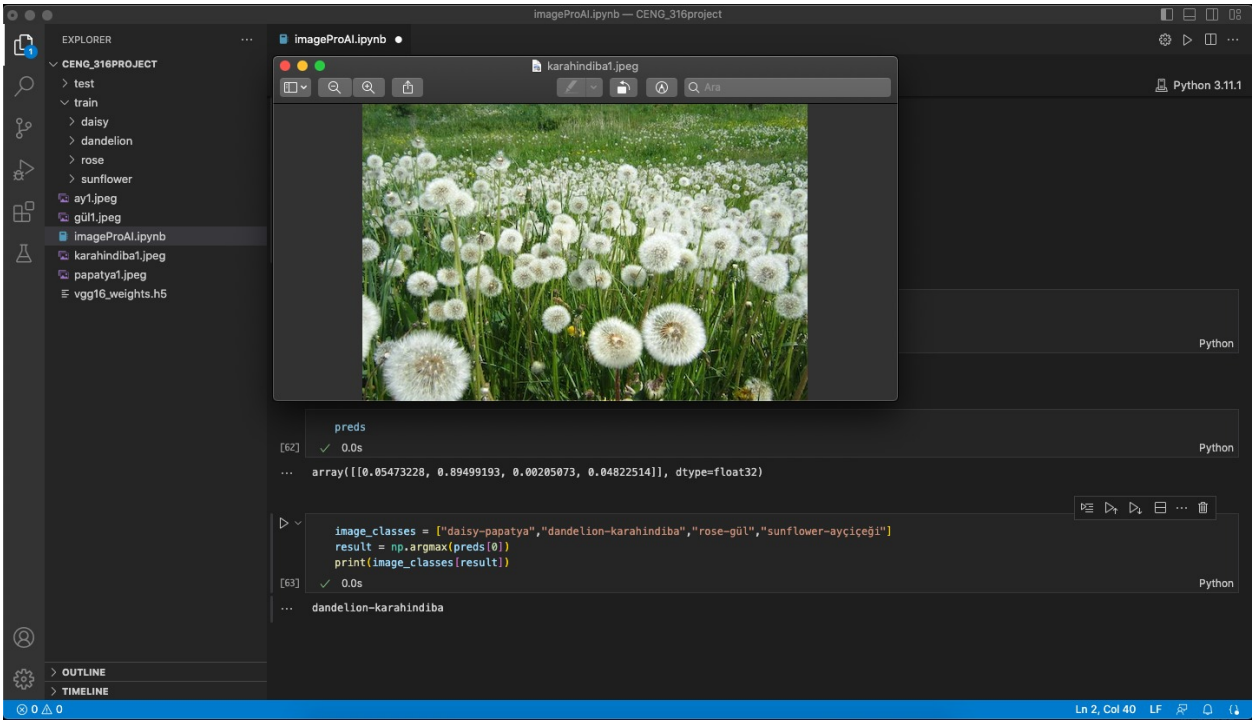

Figure 4: After the training is complete, a validation test is performed on a randomly downloaded dandelion image from the internet.

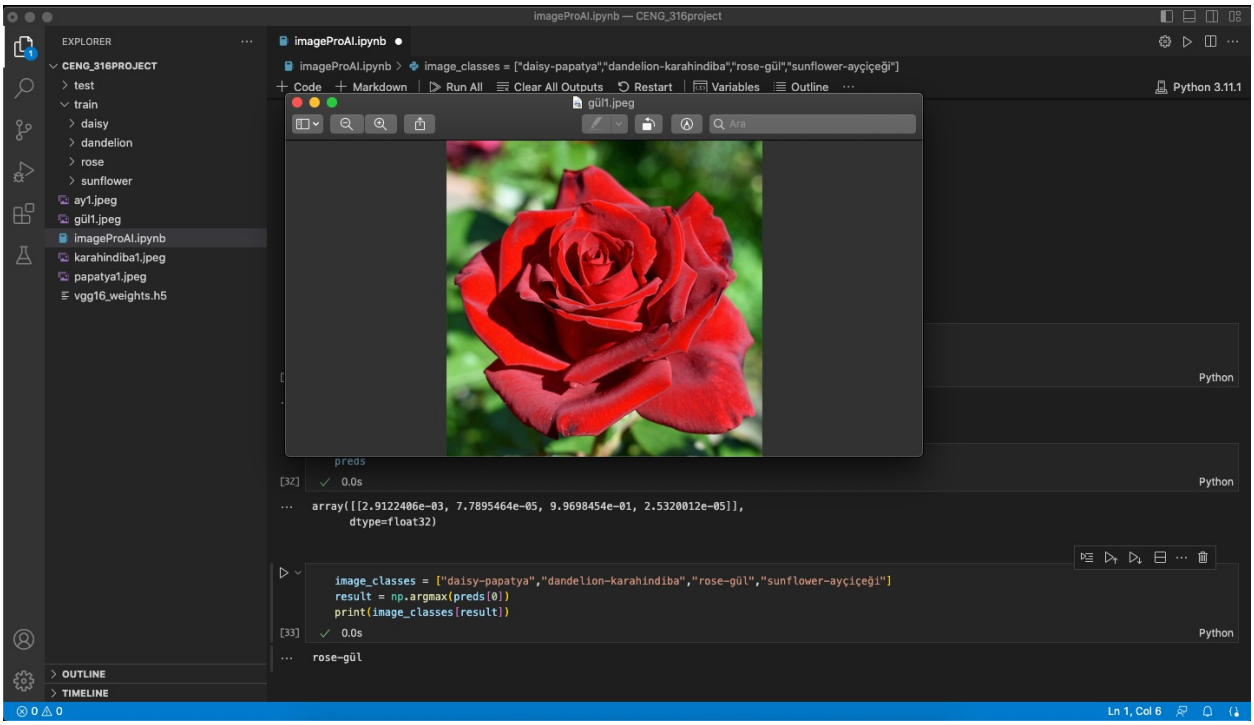

Figure 5: After the training is complete, a validation test is performed on a randomly downloaded rose image from the internet.

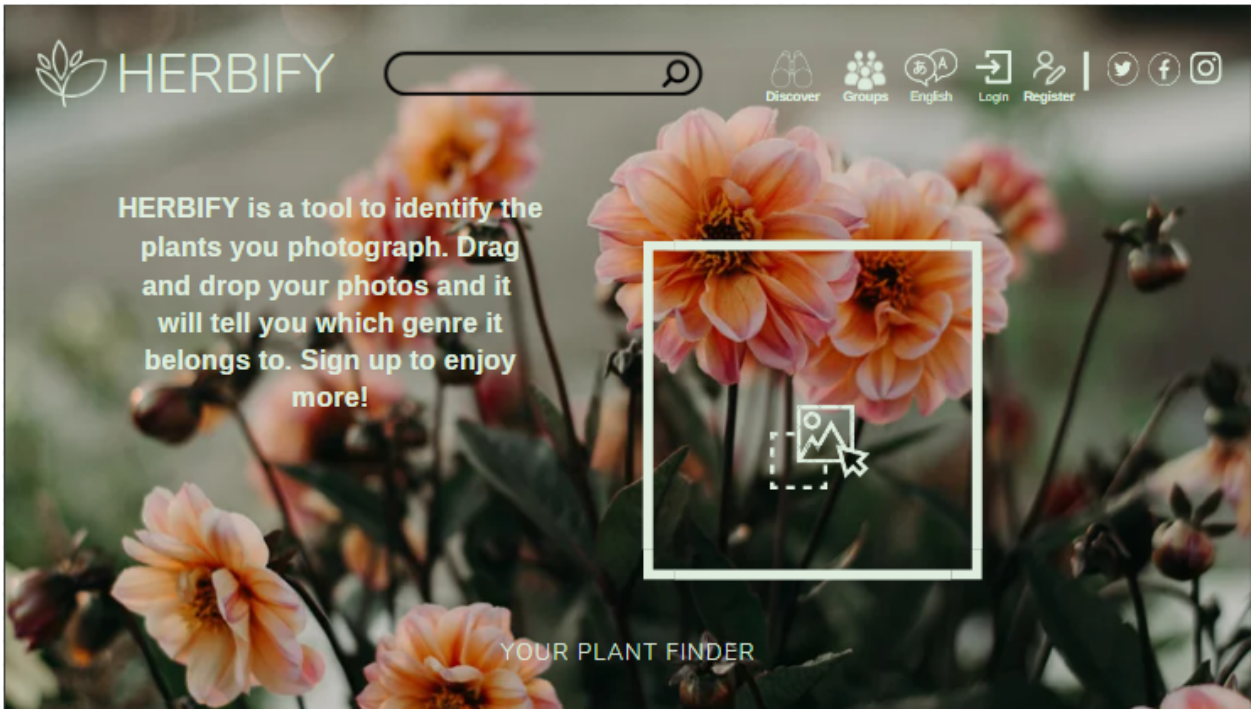

Figure 6: Main Page. Users can drag and drop a photo on this page

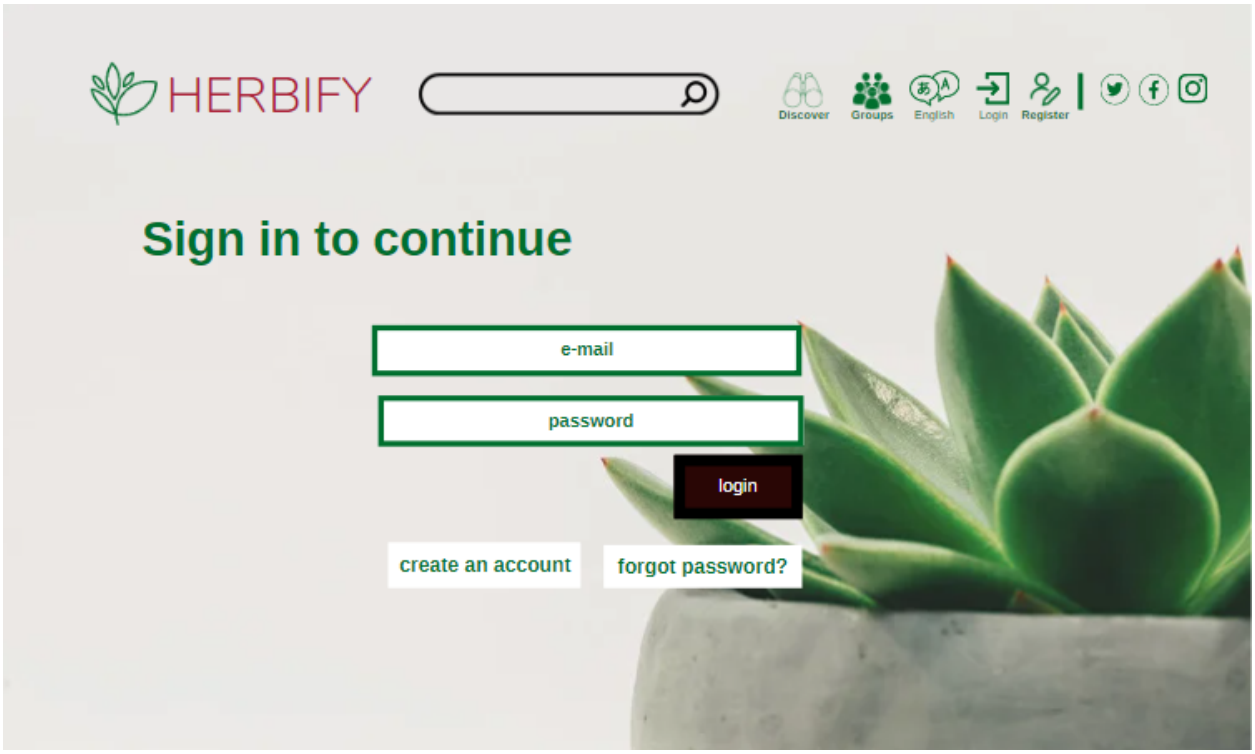

Figure 7: Sign in Page. Users sign in to the website from this page.

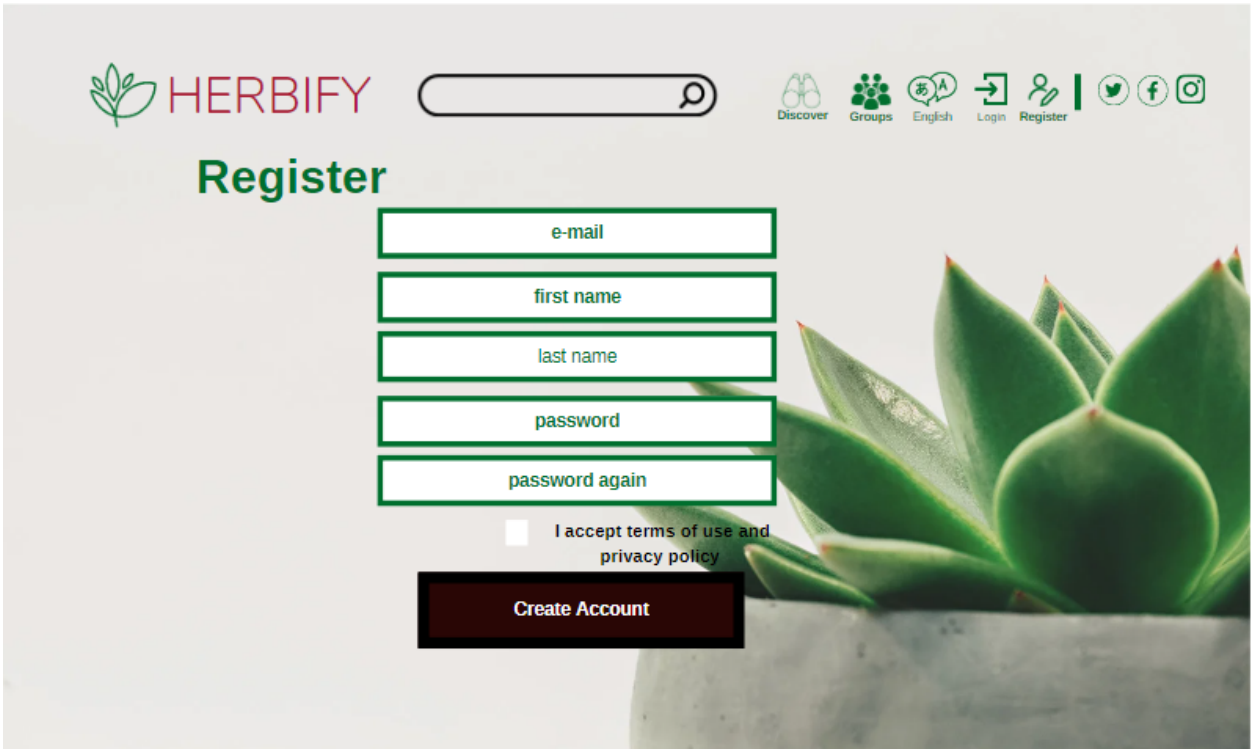

Figure 8: Register Page. Users register on the website from this page.

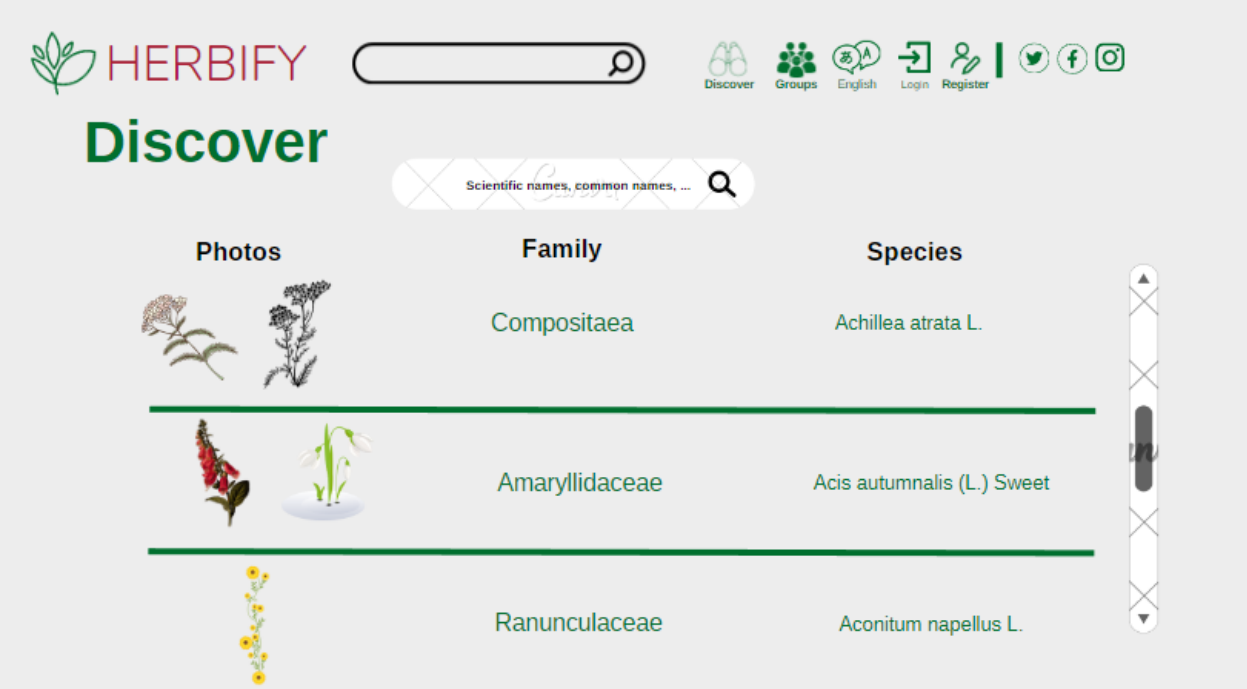

Figure 9: Discover Page. Users can search the plants they want to search by using the search bar on this page by their common names, scientific names, genus and species etc.

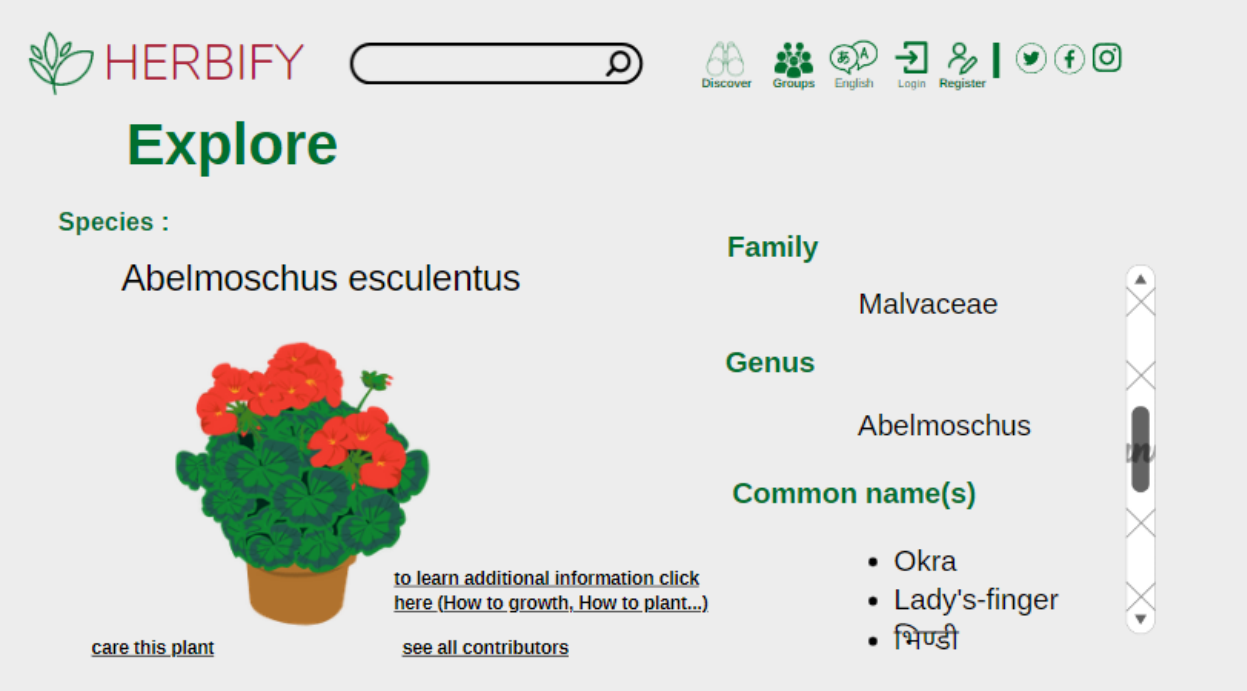

Figure 10: Explore Page. Users will be able to access a lot of information such as the family, genus, common names, and growing regions of the plant they are looking for, from this page.

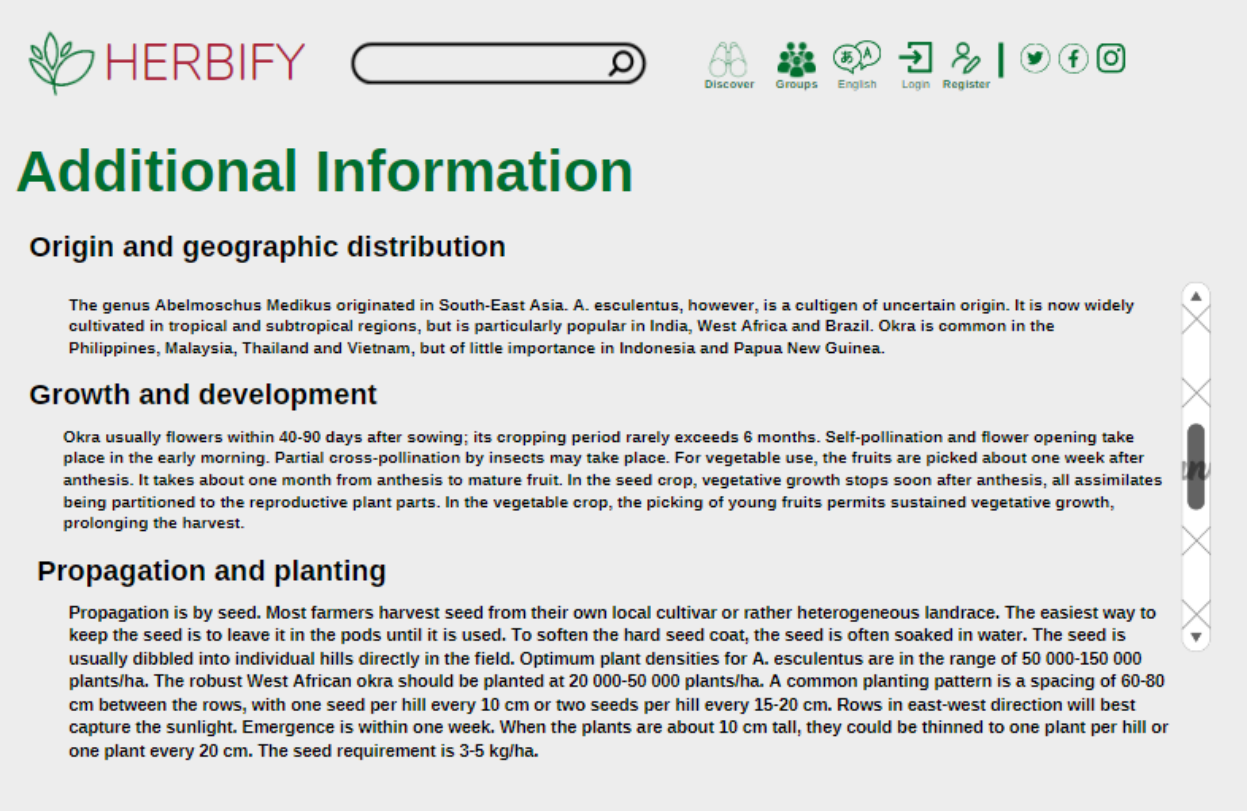

Figure 11: Additional Information Page. On this page, users will find additional reliable information that has been obtained before about the plant

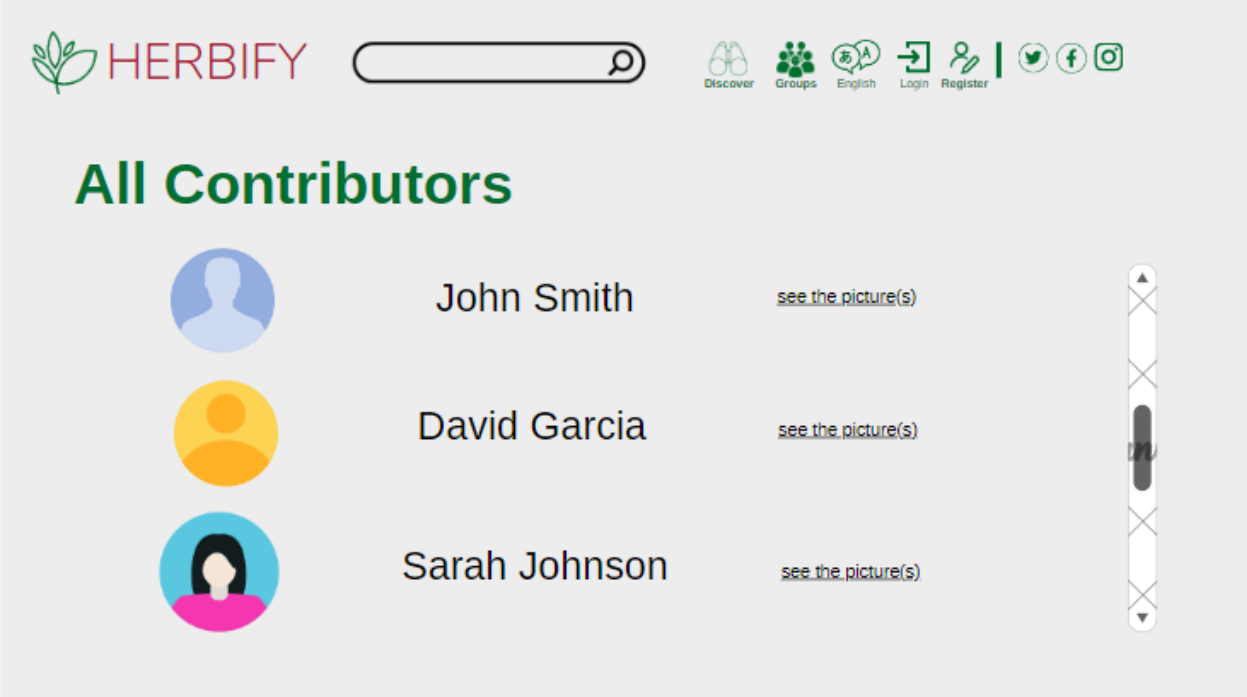

Figure 12: All Contributors Page. On this page, users will be able to see users who have uploaded photos to our system related to the plant type they are looking for.

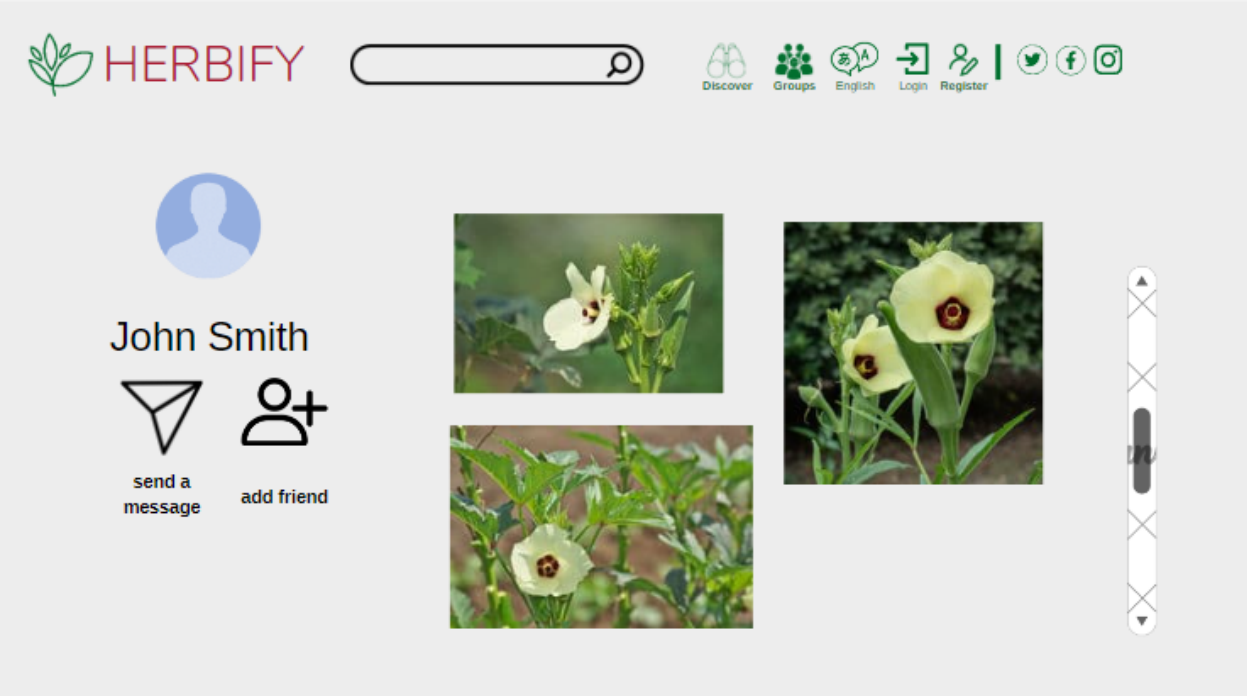

Figure 13: Profil Page. On this page, users can review the photos uploaded to our system by users who contributed to our system. They can also send a message to the user or add them as a friend.

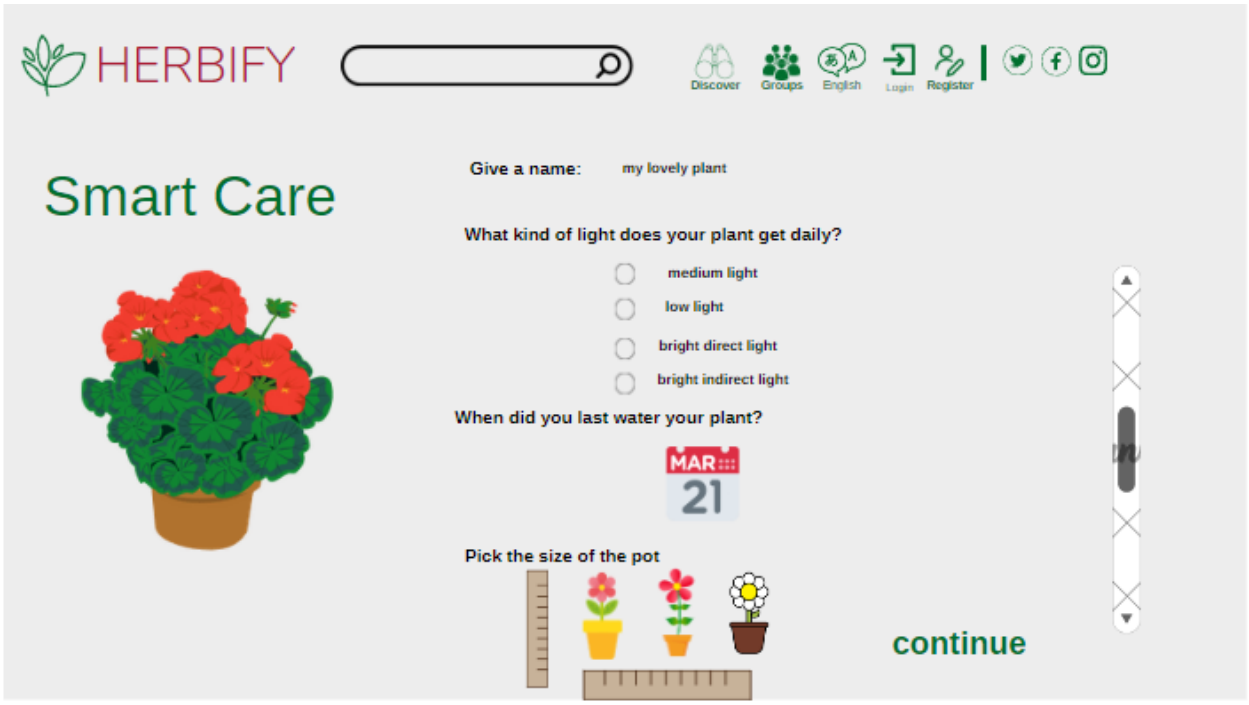

Figure 14: Smart Care Page. On this page, users can have a smart plant care assistant by entering their growing conditions into the system. The system will send an informative message to users about what to do daily to grow the plant.

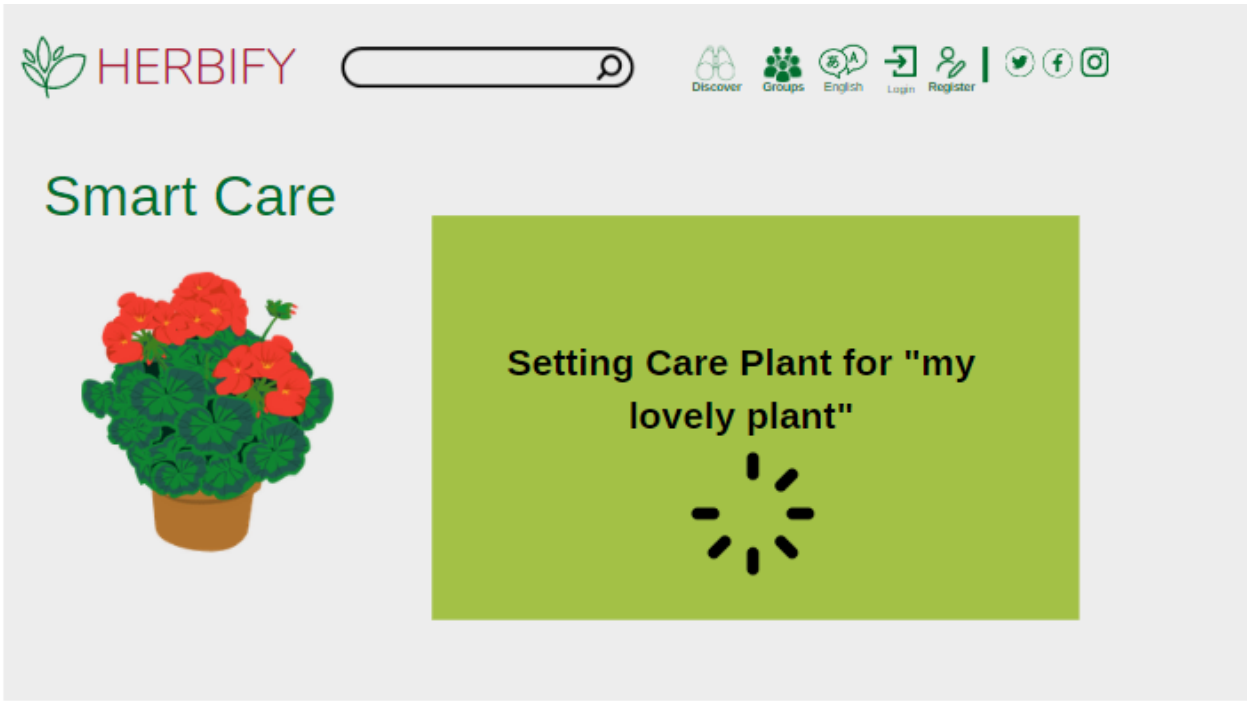

Figure 15: The system sets the appropriate growing conditions.

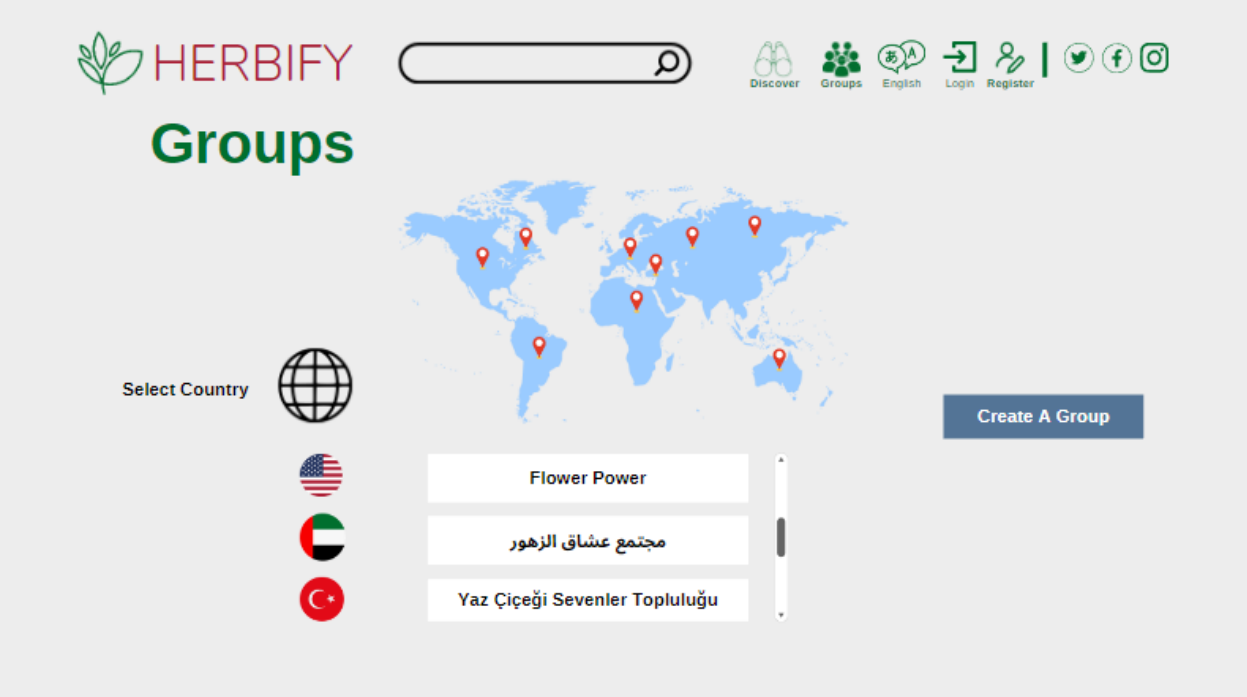

Figure 16: Group Page. Users can see and join previously opened groups here. They can further customize their search by selecting a country.

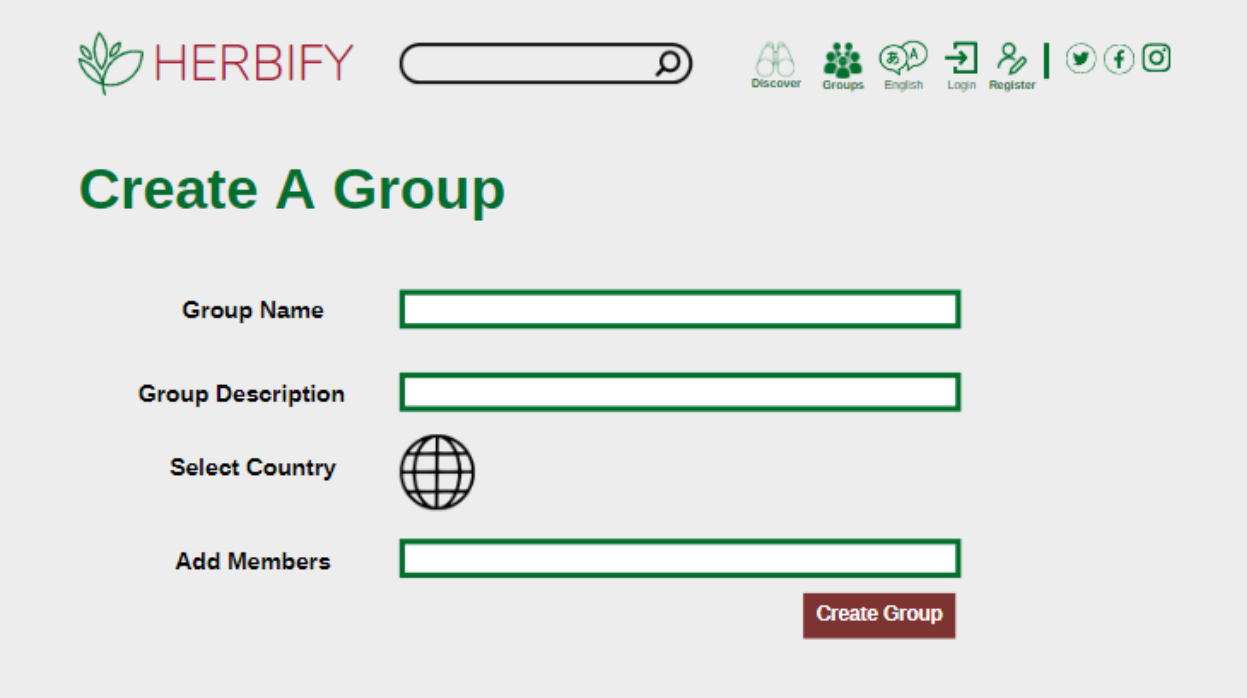

Figure 17: Create A Group. Users can create a group here

5 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.

- Week1 Design Analysis (09.03.2023-16.03.2023):

  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

- Week2 Design Analysis (16.03.2023-23.03.2023):

  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 Gülsoy, Yasir Duman, Berkan Gönülseven, Kerem Yavuz Şenyurt.

  Task Name: Stages
  Definition: Milestones to be passed for the Project.
  Current status: Completed.
  Responsible Person: Gökay Gülsoy, Berkan Gönülseven

  Task Name: Determines tools
  Definition: Determination of software and hardware tools to be used in the project.
  Current status: Completed.
  Responsible Person: Gökay Gülsoy

  Task Name: Experiments result
  Definition: Designing user interfaces of web pages.
  Current status: Completed.
  Responsible Person: Yasir Duman

- Week3 AI development (23.03.2023-30.03.2023):

  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

  Task Name: AI model research
  Definition: The most reliable and fast model search for image classification.
  Current status: In progress.
  Responsible Person: Halil İbrahim Buğday

- Week4 AI development (30.03.2023-06.04.2023):

  Task Name: AI model research
  Definition: The most reliable and fast model search for image classification.
  Current status: Completed.
  Responsible Person: Halil İbrahim Buğday

  Task Name: Dataset collecting
  Definition: Collection of 4 different flower image datasets for AI (approximately 4000 images in total)
  Current status: In progress.

Responsible Person: All team members

Task Name: AI design
Definition: Building an architecture for AI software
Current status: In progress.
Responsible Person: Halil İbrahim Buğday

- Week5 AI development (06.04.2023-13.04.2023):

  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

  Task Name: AI design
  Definition: Building an architecture for AI software
  Current status: Completed.
  Responsible Person: Halil İbrahim Buğday

  Task Name: AI implementation
  Definition: Artificial intelligence software development
  Current status: In progress.
  Responsible Person: Halil İbrahim Buğday

- Week6 AI development (13.04.2023-20.04.2023):

  Task Name: AI implementation
  Definition: Artificial intelligence software development
  Current status: Completed.
  Responsible Person: Halil İbrahim Buğday

- Week7 AI development (20.04.2023-27.04.2023):

  Task Name: AI testing
  Definition: Specific tests of finished software
  Current status: Completed.
  Responsible Person: All team members

  Task Name: AI improvements
  Definition: Improve software based on test results
  Current status: In progress.
  Responsible Person: Halil İbrahim Buğday

- Week8 AI development (27.04.2023-01.04.2023):

  Task Name: AI improvements
  Definition: Improve software based on test results
  Current status: Completed.
  Responsible Person: Halil İbrahim Buğday

- Week8 Backend development (27.04.2023-01.04.2023):

  Task Name: Tools research
  Definition: Researching the appropriate backend software program for the project topic
  Current status: In progress.
  Responsible Person: All team members

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