

ELEC5619 - A1 - Project Proposal

Dex - Gamifying Ecology

01/09/2024

Daniel Chorev - 510502137

Zeeshan Ansari - 510370813

William Walker - 520659025

Nakul Reddy - 500066919

Syed Hamza Kaliyadan - 500585454

Introduction

Globally, our natural environment is ever increasingly being damaged. Our ecosystems are being harmed and more and more species of flora are becoming endangered, and difficult to track. There is a need to entice the community to get involved in protecting our environment through localised data collection of flora to better understand our endangered species, where they are and how we can better protect them. Although applications exist which allow the community to post and record their sightings, for a greater impact, we need much more data from many more people. In many real world use cases, gamification has proved to be a highly impactful methodology to increase uptake of applications and entice users to provide data and use applications. This project will develop a gamified, community based, flora sighting application to collect geo-location based data for environmental protection initiatives. The application will be inspired by pokemon, pokemon go and the pokedex, where users use their mobile phone camera to capture and record sightings of different flora in their environments. These sightings are recorded against their profile and AI is used to identify the images, provide information about the species as well as generate a make-believe ‘pokemon’ resembling the species in the image. User’s will be able to view a log of their sightings activity, see a leaderboard of their activity against others in the community, see a ‘pokedex’ view of all of their sightings and more. The gamification features of this application aims to entice and engage users to continue contributing and build a strong and accurate data backed view of their local environment.

Background

Plants play an important role in maintaining the land health, preventing erosion, providing a habitat to animals and many other benefits [1]. Of the 21000 species that occur in Australia, 1385 are listed as threatened [2]. Additionally, about 27% of plant species in Europe are classified to be at risk of extinction [3]. This has led to a great increase in conservation efforts, especially from governmental organisations, with over A\$ 7 Billion being spent by the Australian government in just the last 40 years [4].

Many of these threatened species are also classified as ‘data-deficient’, indicating a crucial lack of knowledge about their distribution [5]. Half of these data-deficient species are further predicted to be threatened by extinction. [6]

As such, the idea proposed focuses on tackling these issues directly by letting regular people contribute data to fill in the existing gaps in knowledge. Existing solutions to this problem, such as iNaturalist, have a similar model of letting people record and share their observations, however these solutions are primarily used by professionals [7].

The solution proposed here is geared towards the general populace, aiming for a broader solution that also addresses education systems neglecting plant education at both the school and university levels [8].

Furthermore, in order to make this process more engaging for the users, a ‘PokeDex’ style of application is proposed, capitalising on the growing number of studies showing the positive effects of ‘gamification’ in education [9].

Functional Requirements

Cod e	Name	Description	Importance	Difficulty	Dependencies
01	Sign up System	Self explanatory, a foundational requirement.	8	3	n/a
02	Login System	Self explanatory, a foundational requirement.	8	3	n/a
03	Edit Profile	Allow users to alter the basic information relevant to their profile. Username, password, email etc.	7	4	01, 02
04	Upload New Entry	Frontend needs to be able to transmit images to the backend for classification / registration. This then needs to be associated with the inventory of the user.	9	7	01, 02
05	Generate Pokemon data	Pokemon will have a series of standard attributes. For any species, we need the AI to generate this textual / numeric information.	10	7	04
06	Generate Real World Data	Identify the species in the image using an AI model and generate information about the plant including a description and other attributes.	10	7	04
07	View Dex	Allow users to view their collection of cards in a manner that resembles an inventory of collectible items (a bit vague admittedly but can be changed)	7	5	04
08	View Card Entry	Allow users to view an entry in a stylised / entertaining format.	8	4	04
09	Activity Log	A central UI to log / notify users of the status of their current and previous system interactions.	5	4	04, 08
10	Generate Pokemon Image	AI to take an image and generate a pokemon styled version to keep in local records.	9	7	04
11	Leaderboard of users	Allow users to view a top 10 view of the users on the application with the most points. (Can be of all time or multiple	7	7	07

		views for e.g. last week)			
12	Export location based sightings data	Allow users to download records of sightings in a particular location (a rectangular area defined by latitude and longitudes) in csv format	6	4	04, 08
13	Generate card printout	Allow the browser to print the relevant card UI element.	6	6	08
14	View other user cards	Allow users to view a different user's dex (card collection) including the total points earned and other relevant information	6	3	08, 11
15	Map view of entries	Users can view a map of their captures. While privileged users can view all captures.	6	8	08, 11
16	Friends captures map overlay	Users can see a map view of their and their friends' captures overlaid.	5	7	15

Non-functional requirements

1 Strong Login Security

The system must implement robust security measures to protect user credentials and personal data. This includes encrypting passwords, and enforcing strong password policies. Additionally, accounts should be locked after five consecutive failed login attempts to prevent brute-force attacks.

2 Fast Screen Performance

The application should provide a seamless user experience by ensuring that all screens load within 2 seconds under typical usage conditions. This performance standard applies to both desktop and mobile devices.

3 High Availability and Robust Uptime

The application should maintain a high level of availability, with an uptime of at least 99.8%. This ensures that the platform is reliable and accessible to users at all times.

4 Anonymous Location Data

To protect user privacy, all location data collected by the application must be anonymised. The system should store and process location data in a way that prevents the identification of individual users while still allowing for accurate ecological data collection.

5 Fast AI Data Generation

The AI component responsible for identifying species from images and generating relevant data should process requests within 15 seconds. This ensures that users receive timely feedback and maintain engagement with the application.

6 Aesthetic and Intuitive User Interface

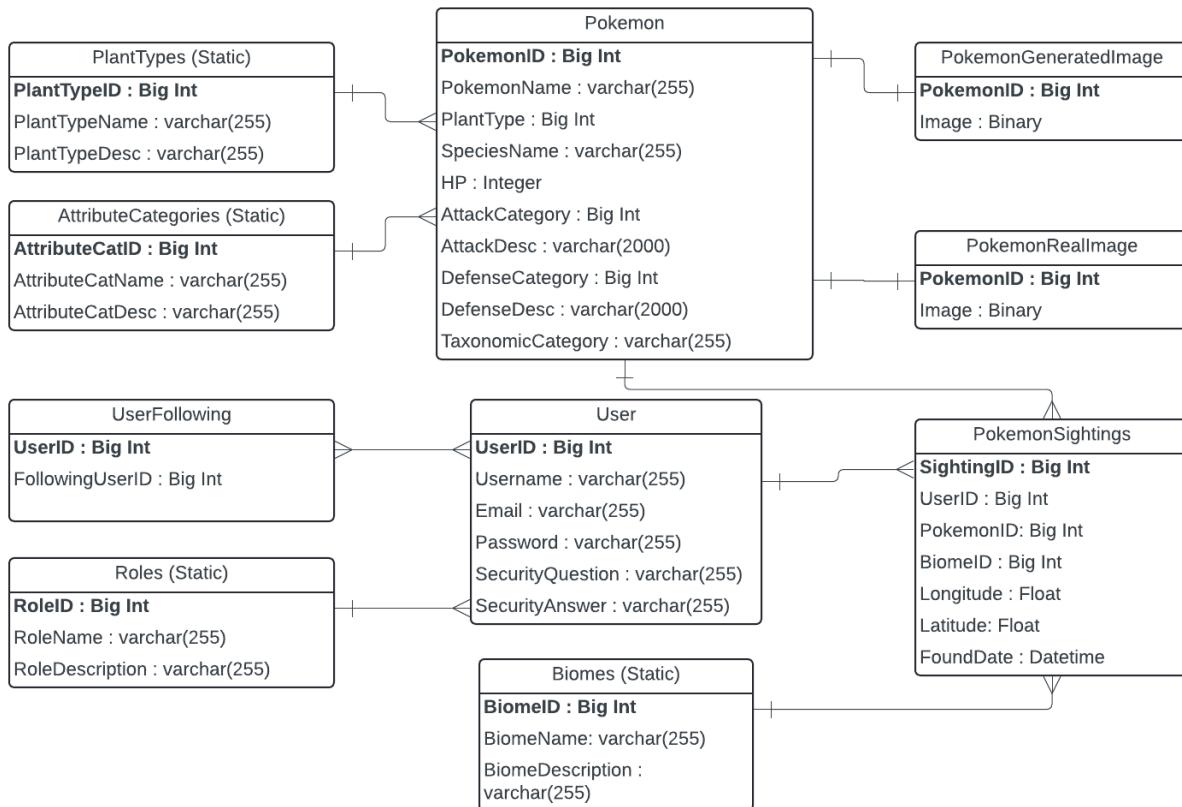
The application should feature a reasonably aesthetic design that is both visually appealing and easy to navigate. The interface should follow established UI/UX design principles to enhance user experience and make the platform accessible to users of all ages.

7 Mobile-Friendly and Responsive Design

The application must be fully responsive, providing an optimal viewing and interaction experience across a wide range of devices, from desktop monitors to smartphones. The mobile version should be particularly optimised to ensure ease of use on smaller screens, with touch-friendly controls and adaptive layouts.

Database design

The below ERD describes the planned SQL data model design for the Dex Application. It contains 10 tables with various relationships described with the ERD arrows linking the entities.



Mockups

Link to Figma Designs: <https://shorturl.at/duknW>

Screen	Assigned	Status	Considerations
Login	William	Completed	- No profile picture upload options.
Signup	William	Completed	- Needs a security question. - Username needs to be unique.
Saved entries	William	Completed	
Other Users Profile		Completed	- Largely identical to the saved entry screen. However, there needs to be a clear delineation that you're looking at another user's profile.
Leaderboard	William	Completed	
Edit profile	William	Completed	- Can change username, password and security questions. Username must be unique. - User has an "edit profile" button somewhere on their profile - Clicking on it turns the textboxes (or labels) on the pages into editable text boxes
Main Pokemon View Screen	William	Completed	- Must provide support for printouts.
Ecology Map Screen	William	Completed	- Users can search for their entries via an are search

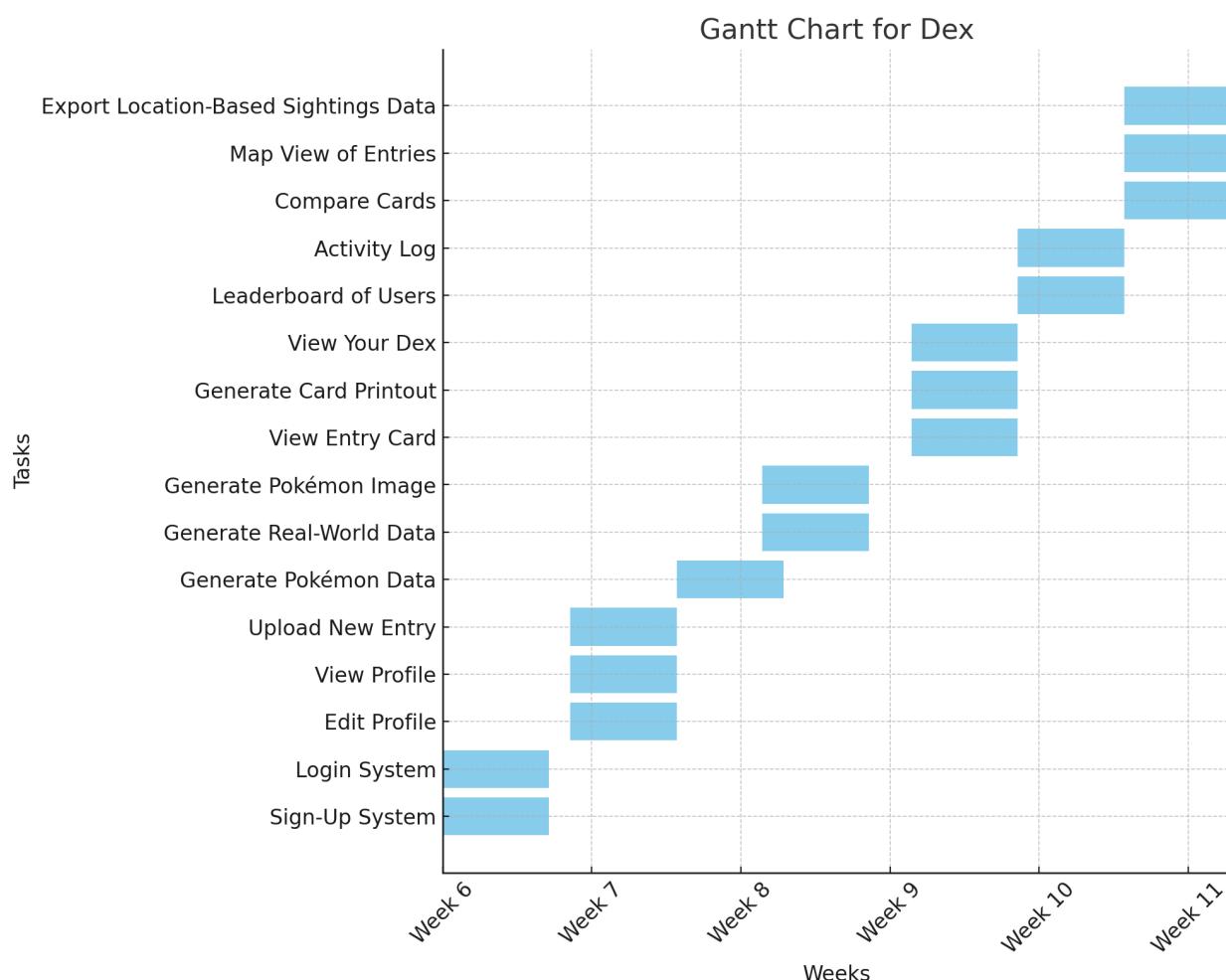
			<ul style="list-style-type: none"> - Must provide some filter mechanisms to find desired entries - Must provide some way to hide unwanted entries.
Picture Upload Options	William	Completed	<ul style="list-style-type: none"> - Options to allow users to upload an image from their desktop, or take a photo using the camera.

Project Plan

Depth: Levels of dependency. I.e users can't create entries without being able to sign in, login and utilise the mechanisms which create and associate pokemon data.

Depth	Foundational System Features	Generating/Viewing Poki-data	Additional Features
1	1: Login system 2: Sign up system	1: Generate pokemon data 2: Generate pokemon image 3: Generate real world data	
2	3: Edit your profile 4: View profile (screen)	1: Upload new entry (aka specific users can generate/capture pokemon, having them associated to their profile) 2: View your dex 3: View entry card 4: Generate card printout	

3			1: Activity log 2: Leaderboard of users 3: Compare cards 4: Map view of entries
4			1: Export location-based sightings data 2: Coins system to feed animals and water plants 3: Microtransactions for bonus items



Tasks	Delegations				
	William	Zeeshan	Daniel	Nakul	Syed
Login system frontend	✓	✓			
Login system backend			✓		✓
Login system persistence			✓		✓
Sign up system frontend	✓				
Sign up system backend		✓	✓		
Sign up system persistence				✓	✓
Edit profile frontend	✓			✓	
Edit profile backend			✓		
Edit profile persistence					✓
View profile frontend	✓				✓
View profile backend			✓		
View profile persistence		✓		✓	
Prompt engineering		✓			
Pokemon generation prompt engineering	✓				
Post-image processing	✓				✓
Backend pokemon generation procedures			✓		✓
SQL database implementation	✓	✓			
Upload pokemon photo frontend	✓				
Upload pokemon photo backend			✓	✓	
Upload pokemon photo persistence				✓	✓
Upload pokemon miscellaneous frontend assets					
Error screen frontend	✓				
Error management/backend routing		✓	✓		

Data viewing frontend	✓				
Data viewing backend			✓		✓
Leaderboard frontend	✓	✓			
Leaderboard backend		✓	✓		
Leaderboard persistence mechanisms				✓	✓
Pokedex frontend	✓	✓			
Pokedex backend			✓		
Pokemon persistence mechanisms					✓
View pokemon entry frontend	✓	✓			
View pokemon entry backend			✓		
View User Profile frontend	✓		✓		
View User Profile backend			✓		✓

Conclusion

The "Dex - Gamifying Ecology" project aims to merge the power of gamification with ecological conservation, creating an engaging platform that encourages users to participate in the protection and understanding of local flora. By utilising AI to identify species and generate both real-world and fictional "Pokémon" data, the application bridges the gap between entertainment and environmental awareness.

This project not only addresses the critical issue of endangered species and the need for more extensive data collection but also leverages modern technology to make ecological data collection more accessible and enjoyable for a broad audience. The use of a responsive, mobile-friendly design ensures that users can engage with the application anywhere, anytime, contributing valuable data to conservation efforts.

"Dex - Gamifying Ecology" aspires to be more than just a project; it is a step towards fostering a community-driven approach to ecological conservation, empowering users to make a tangible impact on the environment through engaging and educational gameplay.

References

Database design: “Dex ERD : Lucidchart.”

https://lucid.app/lucidchart/8e2ee25b-bfbe-452e-97d2-133b27c98eb2/edit?viewport_loc=62%2C-753%2C2282%2C1143%2C0_0&invitationId=inv_b7a438f1-3ad3-4485-b26d-9c487df402a1

- [1] Author, “About native vegetation,” *NSW Environment and Heritage*, Jun. 14, 2022.
<https://www.environment.nsw.gov.au/topics/animals-and-plants/native-vegetation/about-native-vegetation>

[2] “Flora and fauna | Australia state of the environment 2021.”

<https://soe.dcceew.gov.au/biodiversity/environment/flora-and-fauna#plants>

- [3] P. Weston, “Number of species at risk of extinction doubles to 2 million, says study,” *The Guardian*, Nov. 10, 2023. [Online]. Available:
<https://www.theguardian.com/environment/2023/nov/08/species-at-risk-extinction-doubles-to-2-million-aoe>

- [4] L. Broadhurst and D. Coates, “Plant conservation in Australia: Current directions and future challenges,” *Plant Diversity*, vol. 39, no. 6, pp. 348–356, Dec. 2017, doi: 10.1016/j.pld.2017.09.005.

<https://www.sciencedirect.com/science/article/pii/S2468265917300781>

- [5] “Data-deficient species,” *NSW Environment and Heritage*, Jan. 22, 2024.

<https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/saving-our-species-program/threatened-species-conservation/data-deficient-species>

- [6] J. Borgelt, M. Dorber, M. A. Høiberg, and F. Verones, “More than half of data deficient species predicted to be threatened by extinction,” *Communications Biology*, vol. 5, no. 1, Aug. 2022, doi: 10.1038/s42003-022-03638-9. <https://www.nature.com/articles/s42003-022-03638-9>

- [7] “INaturalist,” *iNaturalist*. <https://www.inaturalist.org/>

- [8] D. Lewis, “Education system ‘neglecting the importance of plants,’” *University of Leeds*, Jul. 11, 2022.

<https://www.leeds.ac.uk/news-science/news/article/5120/education-system-neglecting-the-importance-of-plants>

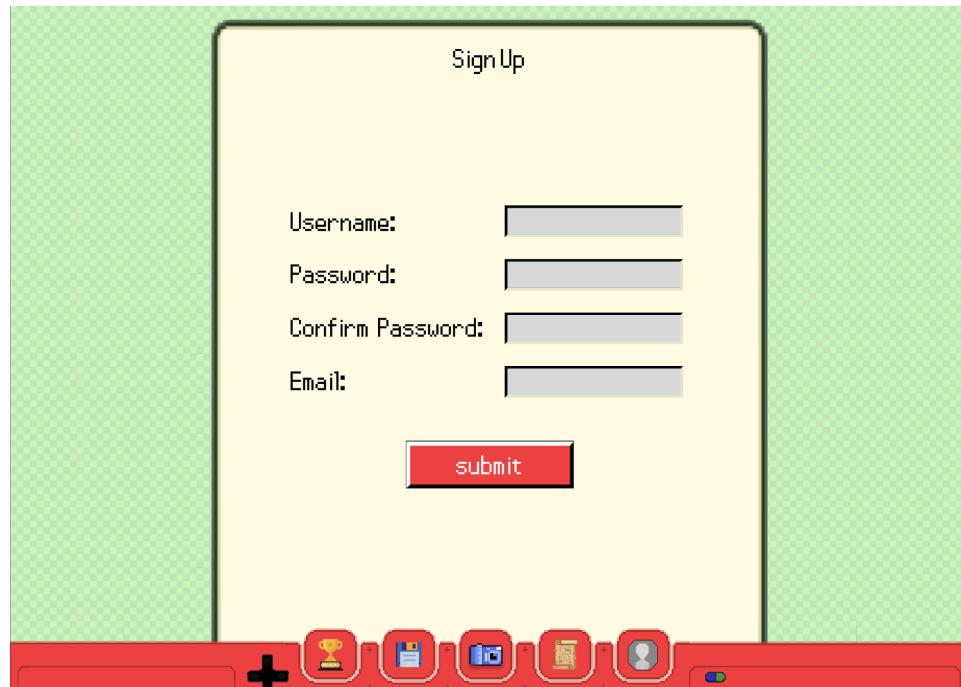
- [9] Department of Education, “Gamification,” *Department of Education*, May 02, 2022.

<https://www.education.gov.au/australian-curriculum/national-stem-education-resources-toolkit/i-want-know-about-stem-education/different-kinds-stem-education-initiatives/gamification>

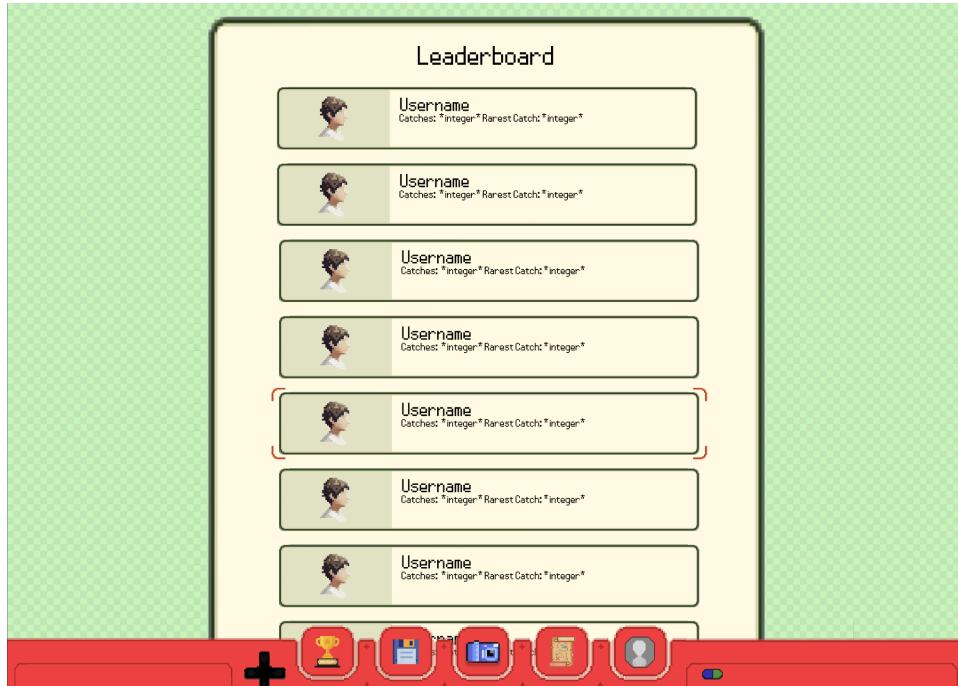
Appendix

Mockups

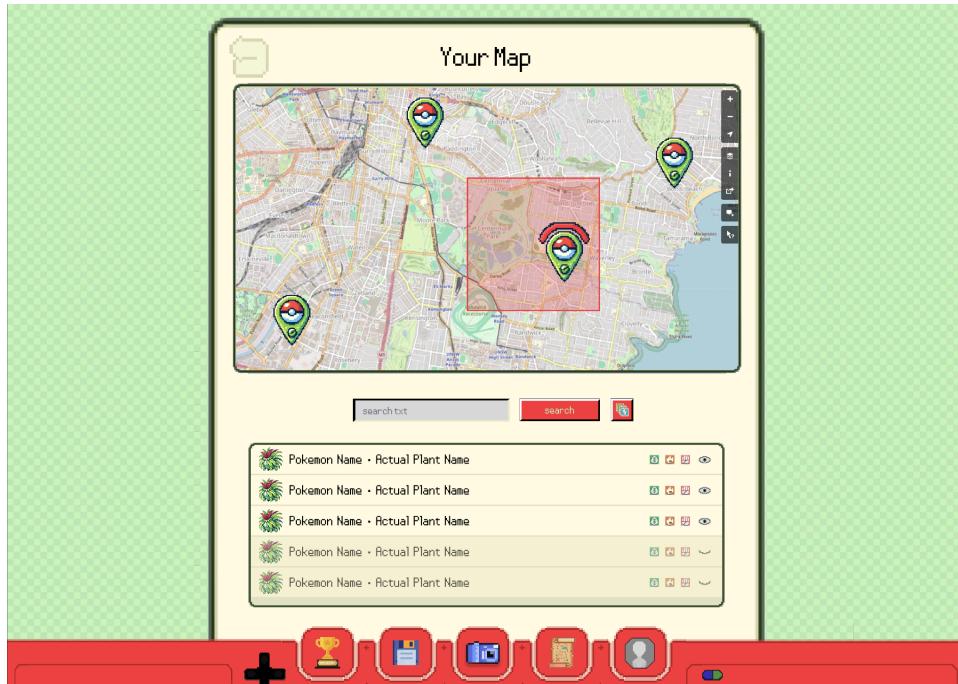
1. **Sign Up Screen** - The screen where users enter their details to sign up for the application.



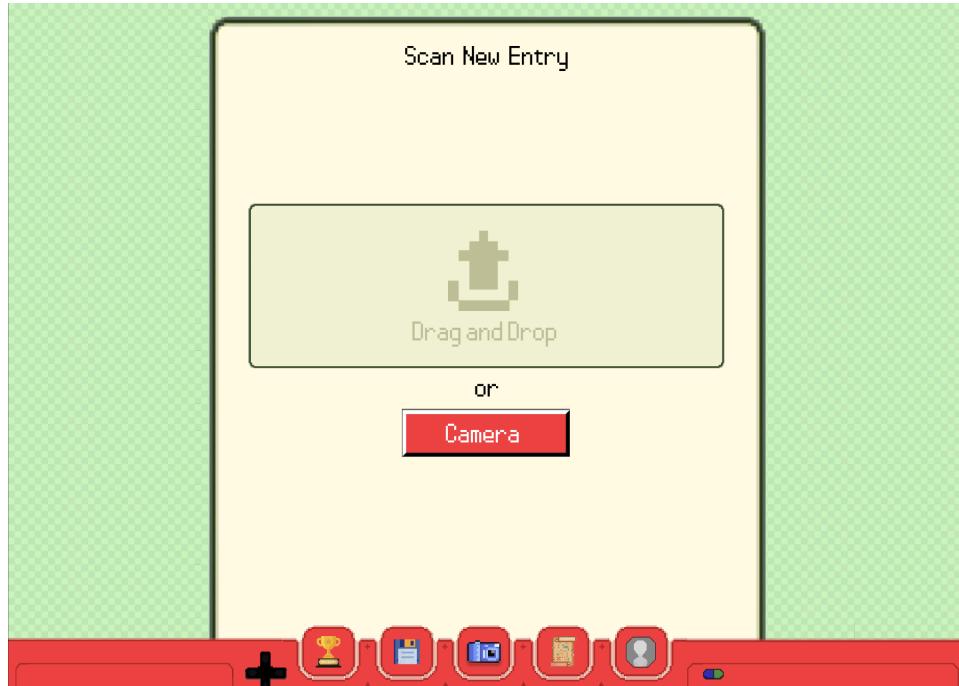
2. **Leaderboard Screen** - The screen showing the leaderboard with users ranked based on their catches.



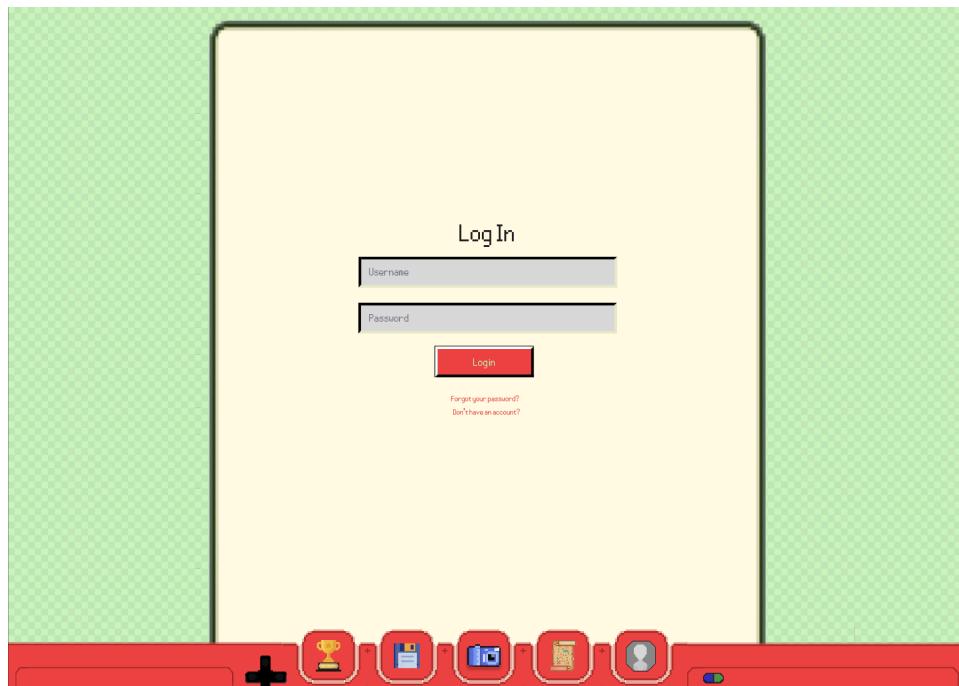
3. **Map View Screen** - The screen displaying a map with Pokémon sightings and details below.



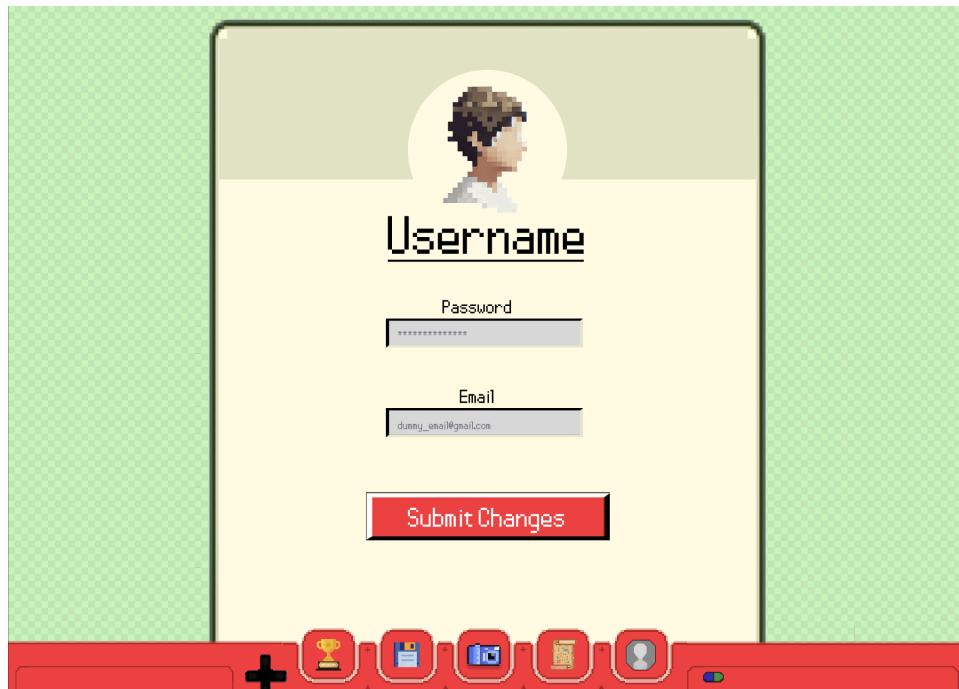
4. **New Entry Upload Screen** - The screen where users can upload a new entry either by dragging and dropping or using the camera.



5. **Login Screen** - The screen where users enter their credentials to log in.



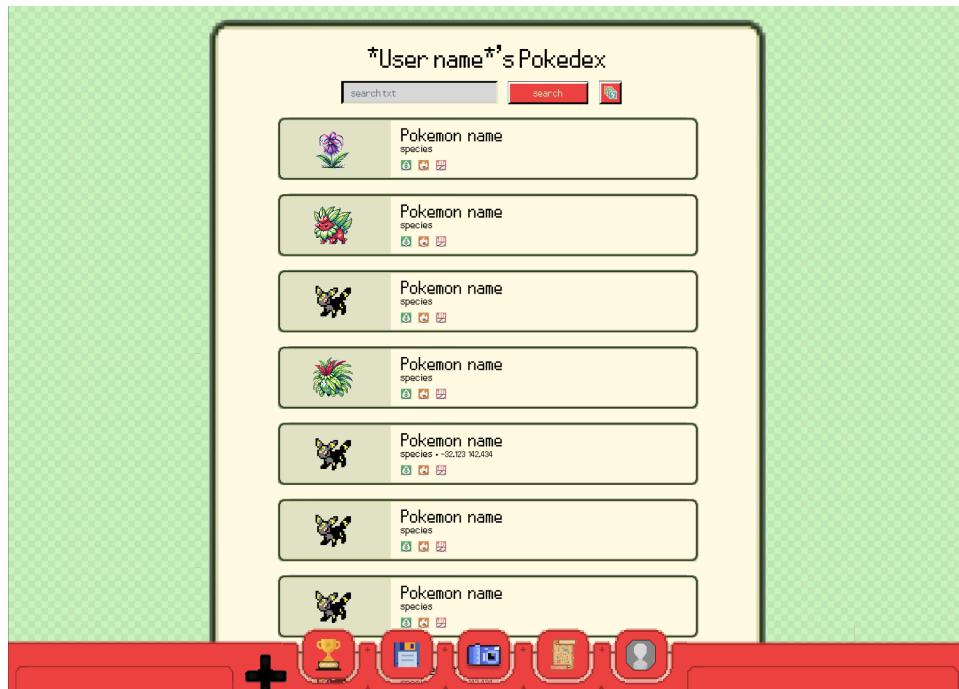
6. **Edit Profile Screen** - The screen where users can edit their username, password, and email.



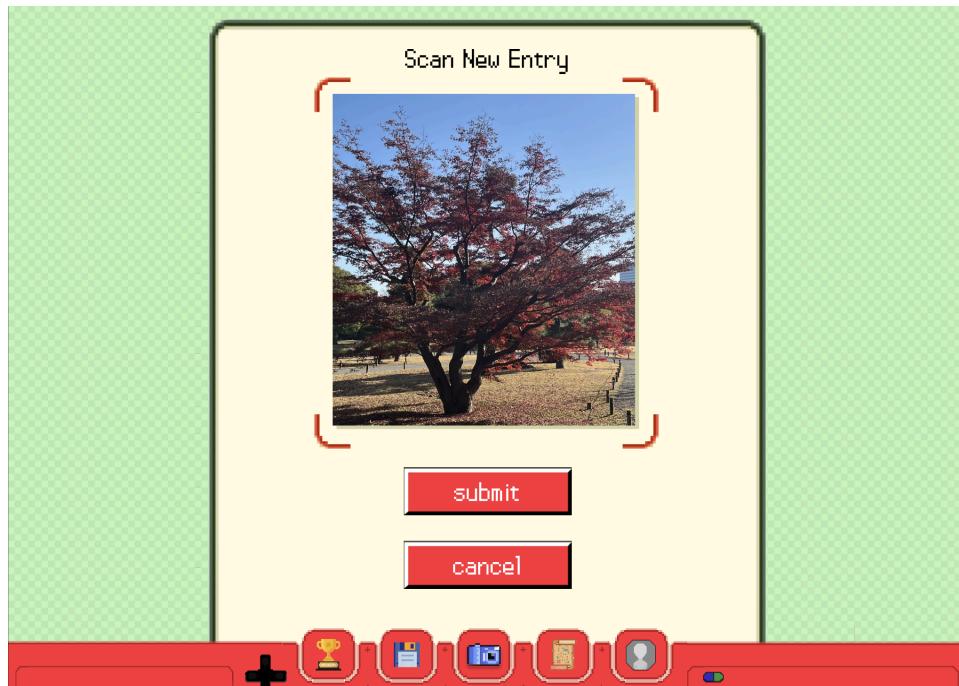
7. **Pokedex View Screen** - The screen showing the user's collection of Pokémon-style entries.



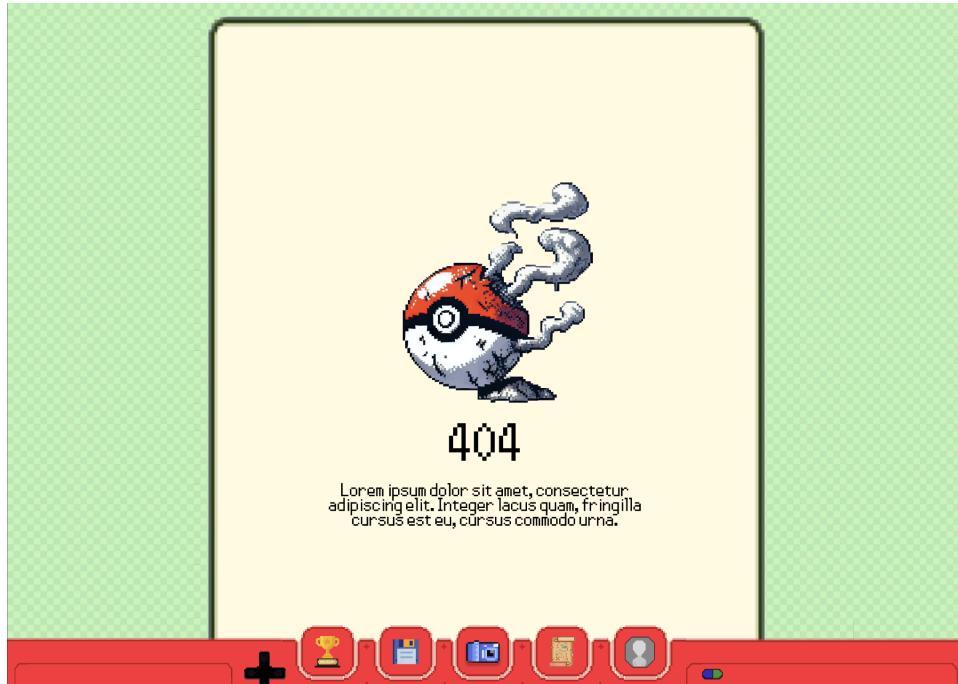
8. **Other User's Pokedex View Screen** - The screen showing another user's collection of Pokéémon-style entries.



9. **Scan New Entry Confirmation Screen** - The screen confirming the scanned image before submission.



10. **404 Error Screen** - The error screen displaying a broken Pokéball with a 404 error message.



11. **Pokémon Entry Detail Screen** - This screen shows the detailed information about a specific Pokémon entry, including its species, location, and other attributes.



12. **Entry Processing Screen** - This screen displays the progress of scanning and processing a new entry.

