



Digital Naturalist - AI Enabled tool for Biodiversity Researchers

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report “**Digital Naturalist - AI Enabled tool for Biodiversity Researchers**” is the bonafide work of “**Abishek M, Deenadhayalan E, Deepan S, KarthikSelvanM**” who carried out the project work under my supervision. Our **Team ID-PNT2022TMID42852**.

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1. INTRODUCTION

1.1 Project overview:

A naturalist is someone who studies the patterns of nature, identifies a different kind of flora and fauna in nature. Being able to identify the flora and fauna around us often leads to an interest in protecting wild spaces, and collecting and sharing information about the species we see on our travels is very useful for conservation groups like NCC.

When venturing into the woods, field naturalists usually rely on common approaches like always carrying a guidebook around everywhere or seeking help from experienced ornithologists. There should be a handy tool for them to capture, identify and share the beauty to the outside world.

In this project, we are creating a web application which uses a deep learning model, trained on different species of birds, flowers and mammals (2 subclasses in each for a quick understanding) and get the prediction of the bird when an image is been given.

1.2 Purpose

- Augmenting a dataset to virtually increase the size of small datasets in order to make our machine learning models work better.
- Preprocess the images to a machine-readable format.
- Applying CNN algorithm on the dataset.
- How deep neural networks are predicting the class and subclass of a given image.
- You will be able to know how to find the accuracy of the model.
- You will be able to build web applications using the Flask framework.

2.LITERATURE SURVEY

2.1 Existing Problem:

Biases in our data arise in part from differences between the aims of the original data collectors (i.e., the photographers) and our aims as biodiversity researchers and ecologists. For example, the spatial distribution of our images was biased toward areas where extensive managed gardens or other displays exhibited large collections of flowering plants. These biases could be addressed by choosing alternative sources, changing the search terms used, or pre-filtering images. Images may also be biased taxonomically or in terms of certain traits, for example, toward species that are typically considered more photogenic due to large colorful flowers or leaves. Search terms could be modified to either focus on a specific subgroup, e.g., searching using scientific names, or to exclude non-target images, e.g., excluding images that include the words “show” or “garden” in their metadata. Finally, high-level image classifiers could be trained to remove images that are clearly not plants, e.g.: removing images of animals, paintings. High-level classifiers developed to separate images that contain plants from those that do not, without looking to identify species, could be used to find images worthy of further examination in large datasets that do not have metadata (such as titles and descriptions), removing the need for keyword searches, such as that used in this study.

2.2 References:

1. Aldhebiani AY (2018) Species concept and speciation. Saudi J Biol Sci 25:437–440.
2. AI naturalists might hold the key to unlocking biodiversity data in social media imagery, TA August, OL Pescott, A Joly, P Bonnet - Patterns, 2020 - Elsevier.
3. Digitalization to achieve sustainable development goals: Step towards a Smart Green Planet, ME Mondejar, R Avtar, HLB Diaz, RK Dubey... - Science of the Total ..., 2021 - Elsevier.
4. The real-world use of big data, M Schroeck, R Shockley, J Smart, D Romero-Morales-IBM Global Business ..., 201

2.3 Problem Statement Definition:

- **Main Problem Statement (Common):**

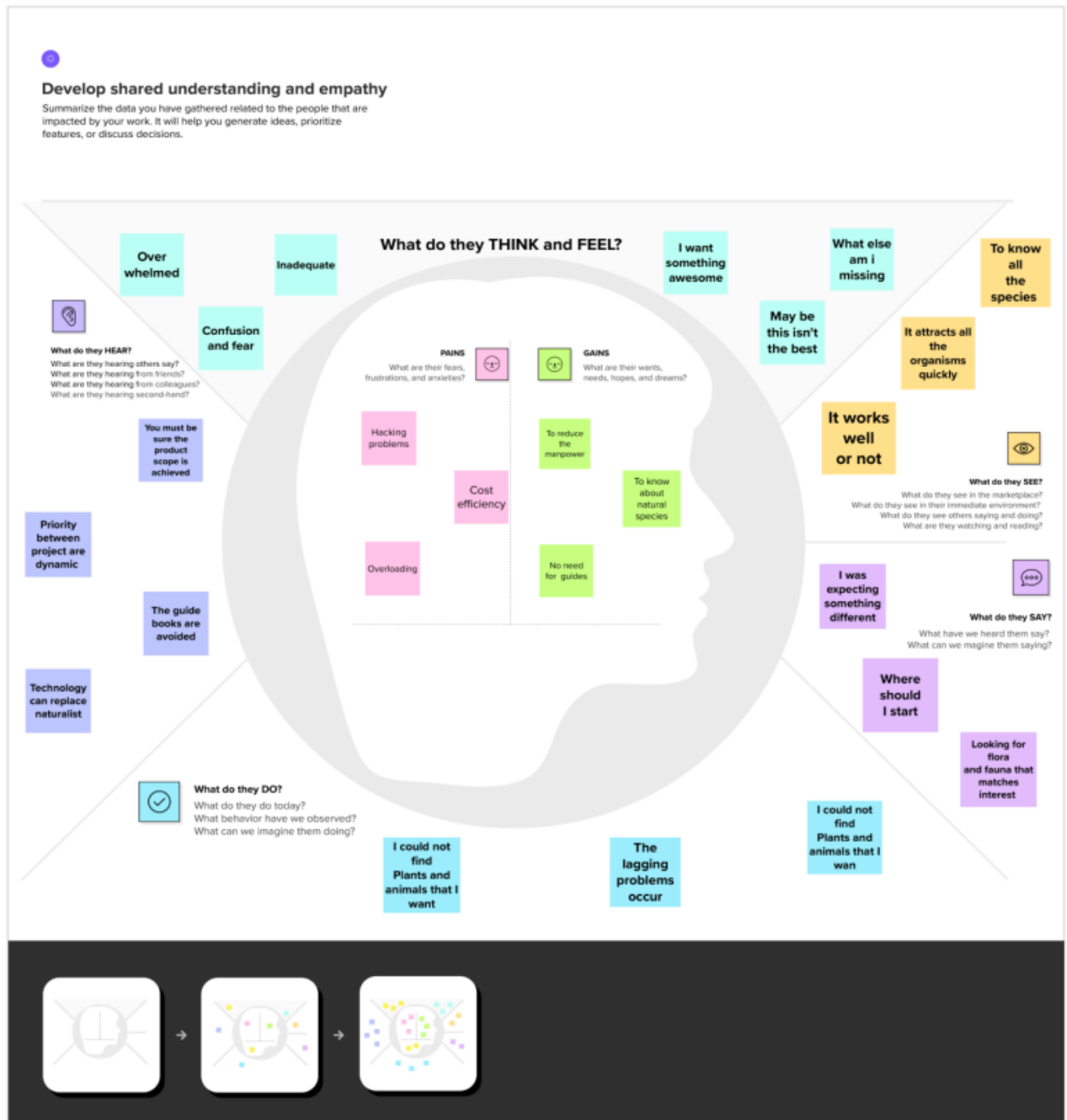
- I. How might we help both experienced and inexperienced user to identify species of plants and animals and their characteristics with related information?

- **Specific problem statement:**

- i. Inexperienced users need to know about poisonous plants and dangerous animals so that they can stay away from it.
- ii. Both experienced and inexperienced users need to know about the medicinal values of a plant because they need to use it in case of emergencies.
- iii. All the users need to know the types of species of birds, plants and animals so that they can learn about it in more detailed manner.
- iv. All the users need to know about the rarity of the species of birds, animals or plants so that they can preserve and save it.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas:



3.2 Ideation & Brainstorming:

Template

Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

- 10 minutes to prepare
- 1 hour to collaborate
- 2-8 people recommended

[Share template feedback](#)

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

10 minutes

Team gathering

Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

Set the goal

I think about the problem you'll be focusing on solving in the brainstorming session.

Learn how to use the facilitation tools

Use the Facilitation Superpowers to run a happy and productive session.

[Open article](#) →

Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

PROBLEM

How might the Biodiversity researcher identify Different Species of Flora and Fauna in Some Wild Spaces For his Research Purpose?

Key rules of brainstorming

To run an smooth and productive session

Stay in topic.

Encourage wild ideas.

Defer judgment.

Listen to others.

Go for volume.

If possible, be visual

Need some inspiration?

See a related session or this template in Microsoft Teams.

[Open example](#) →

Step-1: Team Gathering, Collaboration and Select the Problem Statement

2

Brainstorm

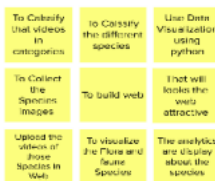
Write down any ideas that come to mind that address your problem statement.

🕒 10 minutes

S.Deepan



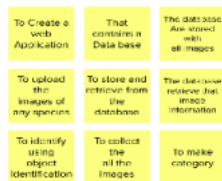
E.Deenadhayalan



M.Abishek



M.Karthik selvan



3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

🕒 20 minutes

S.Deepan



M.Abishek



E.deenadhayalan



M.Karthik selvan



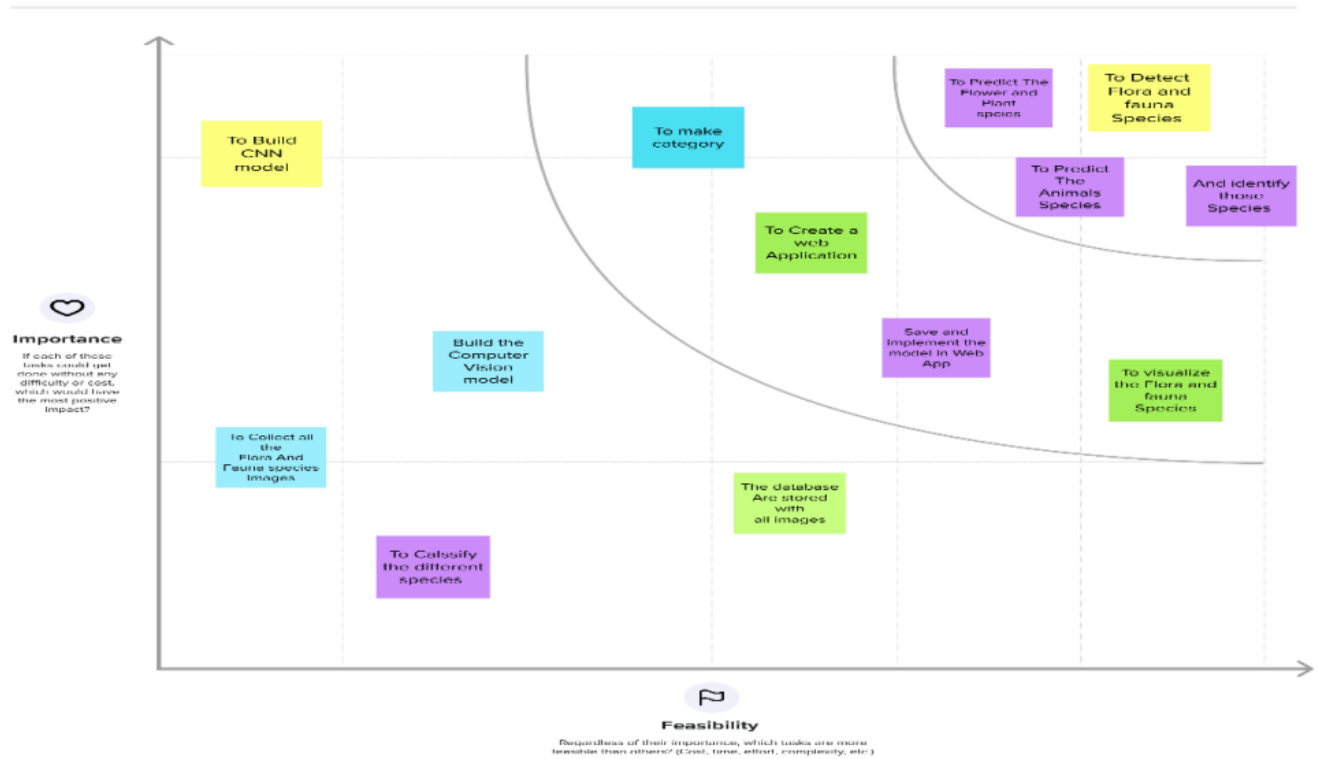
Step-2: Brainstorm, Idea Listing and Grouping

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

🕒 20 minutes



Step-3: Idea Prioritization

3.3 Proposed Solution:

S.No	Parameter	Description
1	Problem Statement (Problem to be solved)	<ul style="list-style-type: none"> a. How might we help both experienced and inexperienced users to identify species of plants and animals and their characteristics with related information? b. Inexperienced users need to know about poisonous plants and dangerous animals so that they can stay away from it. c. Both experienced and inexperienced users need to know about the medicinal values of a plant because they need to use it in case of emergencies. d. All the users need to know about the rarity of the species of birds, animals or plants so that they can preserve and save it.
2	Idea / Solution description	<ul style="list-style-type: none"> a. Display Botanical names b. Display alert messages for plants/animals using different colours c. small description about them

		<p>d. Rarities of the species</p> <p>e. What disease does the plant cure</p>
3	Novelty / Uniqueness	<p>a. Providing alerts based on if a species is harmful or not</p> <p>b. Alerting the user on the rarity of the species</p> <p>c. Gives the complete description about the species being viewed</p> <p>d. If the plant being viewed has a medicinal value, it gives a description about it.</p> <p>e. Display the scientific name of the species.</p>
4	Social Impact / Customer Satisfaction	Being able to identify the flora and fauna around us often leads to an interest in protecting wild spaces.
5	Business Model (Revenue Model)	<p>a. Can make money through subscription based.</p> <p>b. Partnership with many laboratories and scientists around the world</p>

3.4 Problem Soution Fit:

Define CS, fit into CC	<div>1. CUSTOMER SEGMENT(S)<div>CS</div><ul style="list-style-type: none">OrnithologistStudentsHikersMigratorsBiologistZoologistTouristerResearch people</div>	<div>6. CUSTOMER CONSTRAINTS<div>CC</div><ul style="list-style-type: none">Network issuesInsufficient knowledge about the biodiversity.Cannot remember all the basic life saving tipsMaking observations among species.</div>	<div>5. AVAILABLE SOLUTIONS<div>AS</div><ul style="list-style-type: none">Need to always carry a guidebook around everywhereInternet databases where we must search for certain species from the mountain of images from the web using modern algorithms.Usage of ai to tackle different complex difficulties in the wildlife.</div>	Explore AS, differentiate
	<div>2. JOBS-TO-BE-DONE / PROBLEMS<div>J&P</div><ul style="list-style-type: none">Unable to identify sub species of certain amphibians or birds.Cannot find a suitable place to work in the workplaceCannot find the exact habitat of certain species.</div>	<div>9. PROBLEM ROOT CAUSE<div>RC</div><ul style="list-style-type: none">complexities in identificationInformation gatheringNeed to depend on external resourcesLarge datasetMoney problemDepend upon Guide</div>	<div>7. BEHAVIOUR<div>BE</div><ul style="list-style-type: none">Volunteering for jobs where we can actively work with wildlife<ul style="list-style-type: none">Finding rare and endangered species of flora and fauna and help them navigate in current</div>	Focus on J&P, tap into BE, understand RC
Identify strong TR & EM	<div>3. TRIGGERS<div>TR</div><ul style="list-style-type: none">Save natureSave Endangered SpeciesExpanding the lifespan of certain species through medicineHelps to gather aerial species away from places where they are prone to tower kill or other dangers</div>	<div>10. YOUR SOLUTION<div>SL</div><ul style="list-style-type: none">It can be in offline modeAll information about the Species should be displayed.Medical Benefits of different plants can be displayed.Display alert messages for plants/animalsDisplay alert messages for plants and animals.</div>	<div>8.CHANNELS of BEHAVIOUR<div>CH</div><div>8.1 ONLINE<ul style="list-style-type: none">Capture image and search itBrowse using the internet</div><div>8.2 OFFLINE<ul style="list-style-type: none">Hand notesGetting the information from experienced user</div></div>	Identify strong TR & EM
	<div>4. EMOTIONS: BEFORE / AFTER<div>EM</div><ul style="list-style-type: none">Co2 to o2Imbalanced world to sustainable worldAccumulation of waste to renewable energy</div>			

4.REQUIREMENT ANALYSIS:

(Following are the functional & non-functional requirements of the proposed solution)

4.1 Functional Requirement:

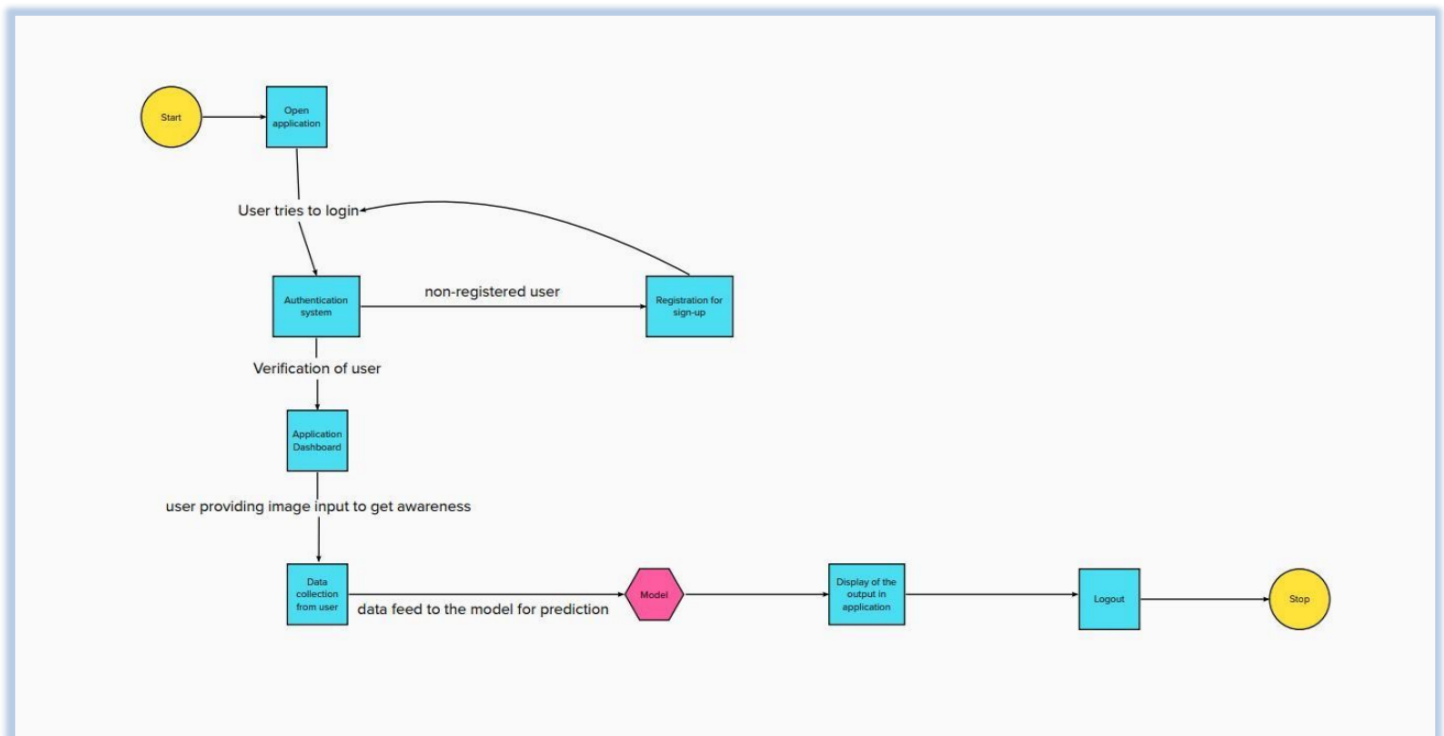
FR NO	Functional Requirements (Epic)	Sub Requirements(Story/Sub-Task)
FR-1	User Registration	Registration through Form
		Registration through Gmail
		Registration through LinkedIn
FR-2	User Confirmation	Confirmation via Email
		Confirmation via OTP
FR-3	Navigation Service	GPS
FR-4	Database	My SQL, IBM Cloud
FR-5	Premium features	Location sharing,
		Adding information of new data by User
FR-6	Updating and bug fixing	Updating the application based on user feedback
FR-7	Final Output	Final description of the image (species) captured.
FR-8	Alerts	System should alert about dangerous plants and animals

4.2 Non-functional Requirements:

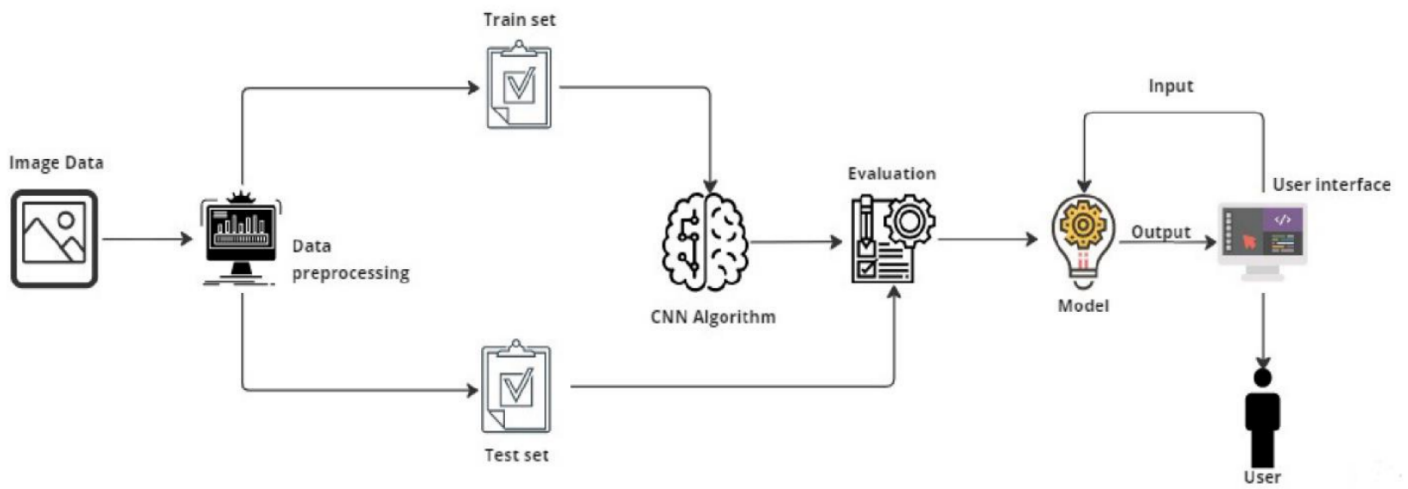
NFR NO	Non Functional Requirements	Description
NFR-1	Usability	The users must be able to use the application without any problems and difficulties. The app is easy to view and does not strain the eyes. All information are in simple terms. The error rate of the final output must not be more than 20%
NFR-2	Security	SHA-256, Encryptions, AES etc.
NFR-3	Reliability	The system must perform without failure in 80 percent of the time.
NFR-4	Performance	Under normal load, the system must show the results within 15 seconds, and under maximum it can take up to load 30 seconds
NFR-5	Availability	The application will be available 99 % of the time in a month.
NFR-6	Scalability	The system must be able to support 10,000 users while using it. As the usage and user base of this application grows, more features can be added like languages based on the geographical usage, premium or subscription model, etc.

5.PROJECT DESIGN:

5.1 Data Flow Diagram:



5.2 Solution & Technical Architecture:



5.3 User Stories:

Use the below template to list all the user stories for the product

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority
Customer(Mobile user)	Image capture	USN-1	As a user, I can take photos of the plantlife, animals and birds	I can take photos when required	High
		USN-2	As a user, I will receive processed information about the type of species	I can see the type of plant or animal or plant	High
		USN-3	As a user, I can share it with others	I can share using share option	Low
	Data process	USN-4	Data must be trained and tested and CNN algorithm must work properly.	I must see the correct processed information	High
	Output	USN-5	As a user, I can see the scientific name of the species	I must see the correct data	High
		USN-6	As a user, I can see the characteristics and alert messages	I must see the correct data	High
Administrator	Manage	USN-1	As a admin I must add various data and edit information	I must edit the data present	High

6.PROJECT PLANNING& SCHEDULING:

6.1 Sprint planning & Estimation:

Use the below template to create productbacklog and sprintschedule

Sprint	Functional Requirements (Epic)	User Story Number	User Story/Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a biogeography, I can register for the application by entering my Email, Password, and confirming my password	2	High	S.Deepan M.Abishek M.Karthikselvan E.Deenadhyalan
Sprint-1	User Confirmation	USN-2	As a biogeography, I will receiveconfirmation email once I have registered for the application	1	Medium	S.Deepan M.Abishek M.Karthikselvan E.Deenadhyalan
Sprint-1	Login	USN-2	As an biogeography, I can log into the application by entering email & password	2	High	S.Deepan M.Abishek M.Karthikselvan E.Deenadhyalan
Sprint-2	Data Collection	USN-1	Download the datasetused in Digital Naturalist – AI Enabledtools for Biodiversity Researchers	2	Medium	S.Deepan M.Abishek M.Karthikselvan E.Deenadhyalan
Sprint-2	Image Preprocessing	USN-1	Improving the image data that suppresses unwilling distortions or enhances some image features important for furtherprocessing,although	1	High	S.Deepan M.Abishek M.Karthikselvan E.Deenadhyalan

			performing some geometric transformations of images like rotation, scaling, etc.			
Sprint-3	Getting started with convolution a Neural network	USN-1	Neural network are integral for teaching computers to think and learn by classifying information, similar to how we as humans learn. With neural networks, the software can learn to recognize images, for example. Machines can also make predictions and decisions with a high level of accuracy based on data inputs	2	Medium	S.Deepan M.Abishek M.Karthikselvan E.Deenadhyalan
Sprint-3	Evaluvation Mosdel Saving	USN-1	well a model behaves after each iteration of optimization. An accuracy metric is used to measure the algorithm's performance in an interpretable way. The accuracy of a model is usually	1	Medium	S.Deepan M.Abishek M.Karthikselvan E.Deenadhyalan

			determined after the model parameters and is calculated in the form of a percentage. Saving The Model get weights , set weights .			
Sprint-4	Application Building	USN-2	After the model is built, we will be integrating it to a web application so that normal users can also use it. The users need to give the images of species	1	High	S.Deepan M.Abishek M.Karthikselvan E.Deenadhyalan
Sprint-4	Train the Model on IBM	USN-2	Build Deep learningmodel andcomputervision Using the IBMcloud	2	Medium	S.Deepan M.Abishek M.Karthikselvan E.Deenadhyalan

6.2 Sprint DeliverySchedule:

Project Tracker, Velocity & Burndown Chart:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as onPlanned EndDate)	Sprint Release Date (Actual)
Sprint-1	20 days	4 Days	24 Oct 2022	27 Oct 2022	20	29 Oct 2022
Sprint-2	20 days	5 Days	28 Oct 2022	01 Nov 2022	20	04 Nov 2022
Sprint-3	20 days	7 Days	02 Nov 2022	09 Nov 2022	20	11 Nov 2022
Sprint-4	20 days	9 Days	10 Nov 2022	18 Nov 2022	20	19 Nov 2022

6.3 Reports from JIRA:

	OCT	NOV
Sprints	DIG S...	DIG S... DIG S... DIG S... DIG S...
<div><div>▼</div><div>DIG-9 Resigtration</div><div></div><div>DIG-1 As a user, I can regis... DONE VIMOSH A...</div><div>DIG-2 As a user, I will receiv... DONE SYED ABR...</div><div>DIG-3 As a user, I can regist... DONE 4042-SN...</div><div>DIG-4 As a user, I can regist... DONE DEVSWA94</div></div>	<div></div> <div></div> <div></div> <div></div> <div></div>	
<div><div>▼</div><div>DIG-17 Login</div><div></div><div>DIG-18 As a user,I can log i... DONE SYED ABR...</div></div>		<div></div> <div></div>
<div><div>▼</div><div>DIG-19 Dashboard</div><div></div><div>DIG-6 As a user, I will explor... DONE SYED ABR...</div><div>DIG-7 As a user, I will perfo... DONE VIMOSH A...</div></div>		<div></div> <div></div> <div></div>
<div><div>▼</div><div>DIG-20 Input/Output</div><div></div><div>DIG-8 As a user, I will give t... DONE SYED ABR...</div><div>DIG-11 As a user, I can get... DONE VIMOSH A...</div></div>		<div></div> <div></div> <div></div>

7.Coding & Soution:

7.1 Feature 1:

- Display Botanical names
- Display alertmessages for plants/animals using different colours
- Small description about them
- Rarities of the species

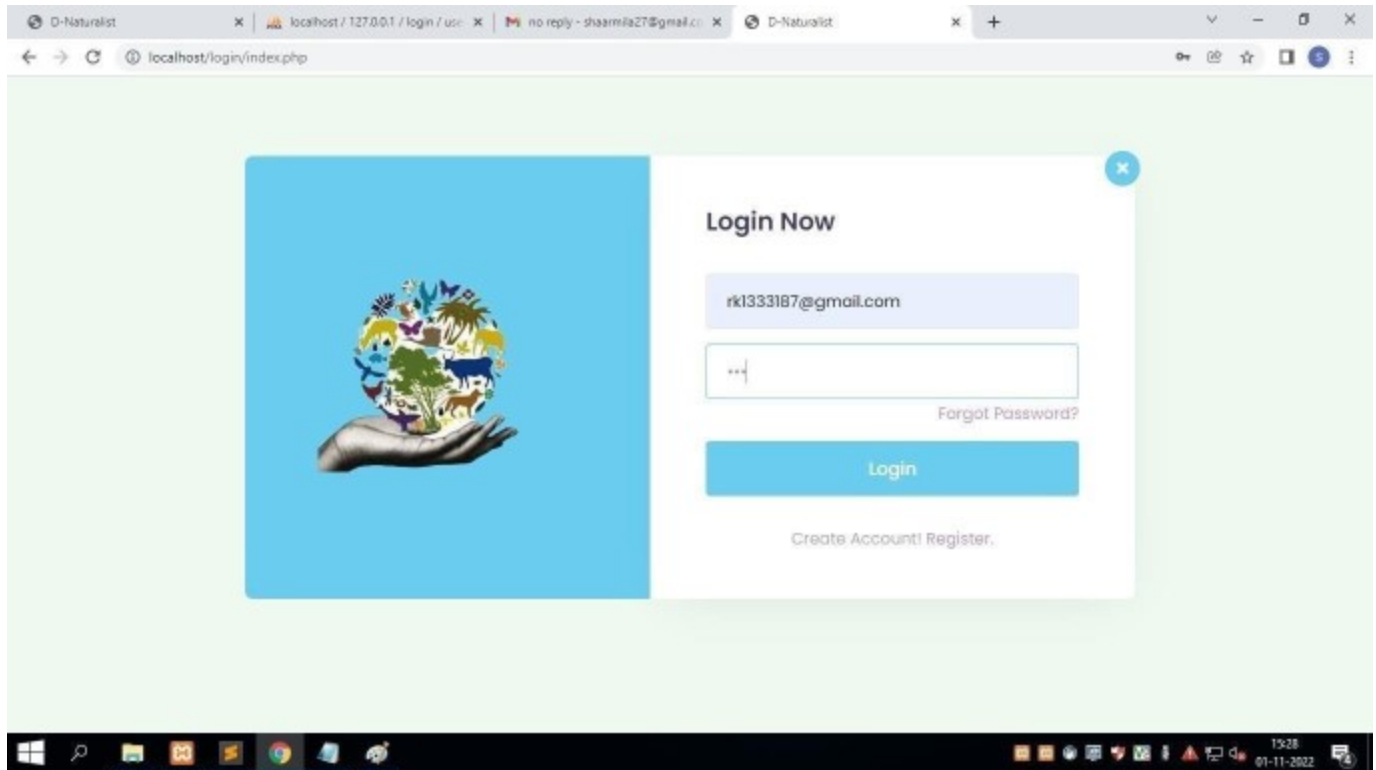
7.2 Feature 2:

- What diseasedoes the plant cure
- Providing alertsbased on if a speciesis harmful or not

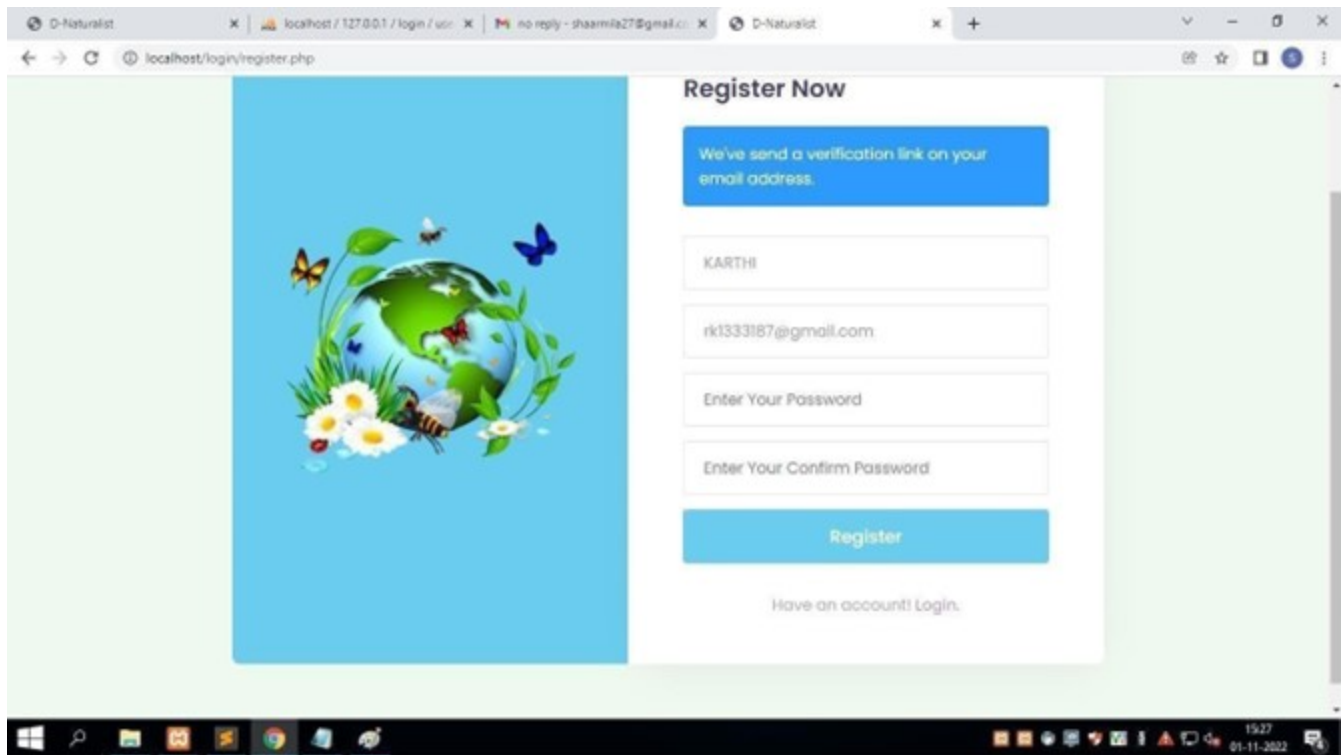
8.Results:

8.1 Performance Metricks:

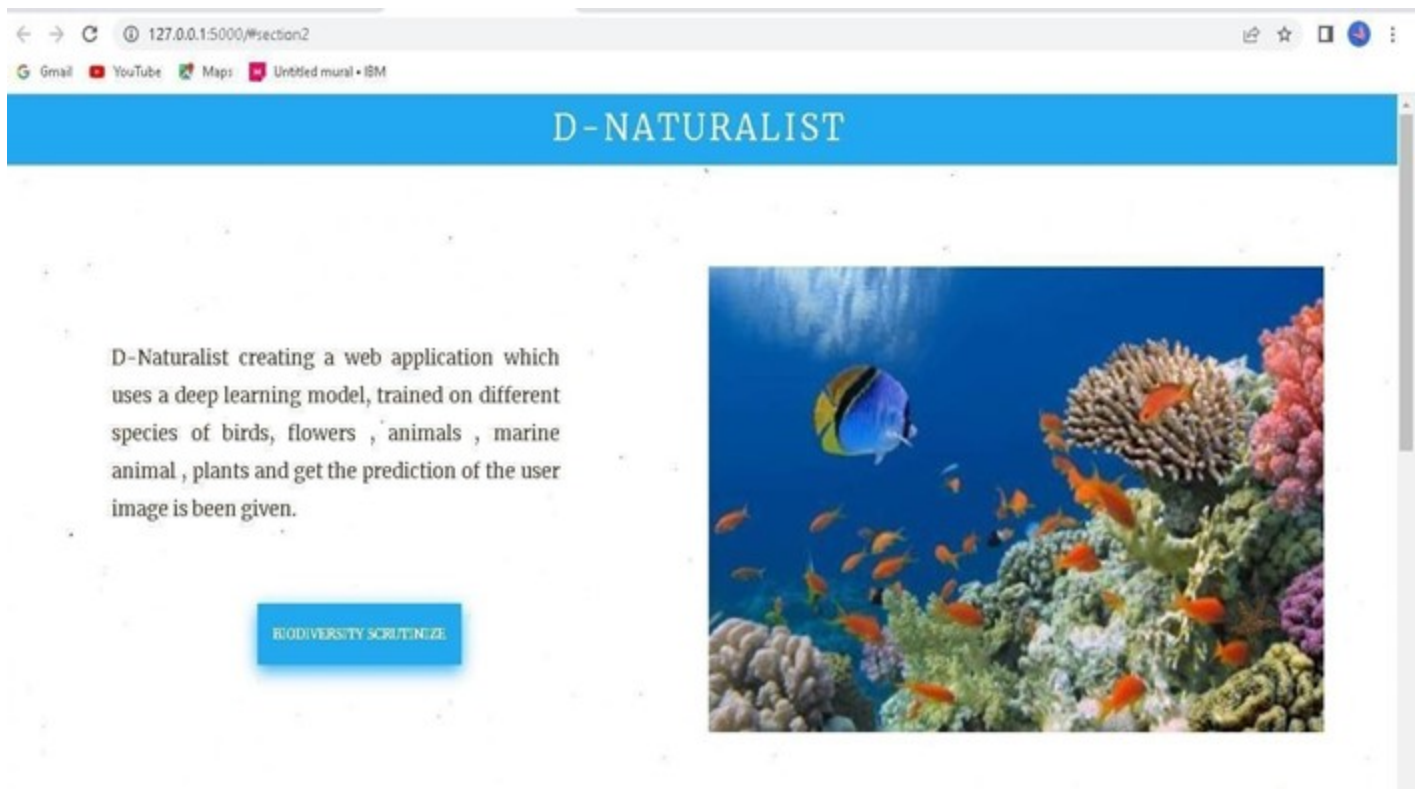
Registration Page:



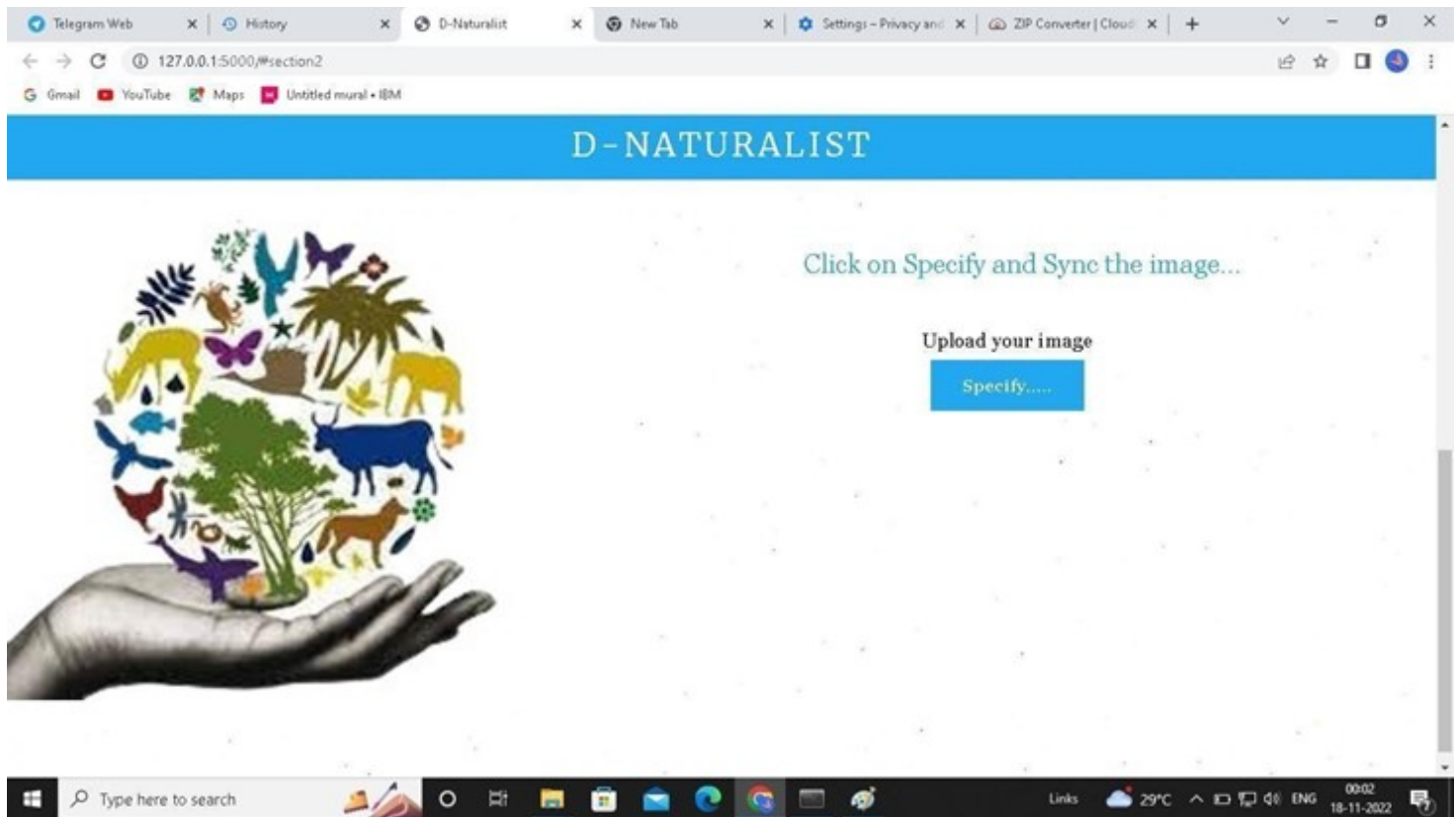
Login page:



Home page:



Input:



Output:

Telegram Web x History x D-Naturalist x New Tab x Settings - Privacy and x ZIP Converter | Cloud x +

127.0.0.1:5000/#section2

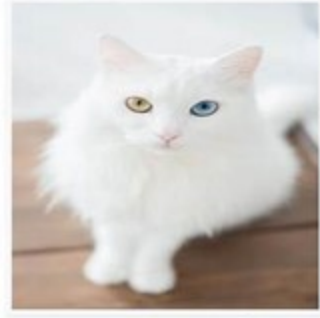

Gmail YouTube Maps Untitled mural IBM

D-NATURALIST

Click on Specify and Sync the image...

Upload your image

Specify.....



Prediction: Animal- Gatto

Type here to search

Links 29°C 18-11-2022

9. Advantage & Disadvantage:

Advantage

- It helps field biologists build their own experimental tools.
- It helps designers explore new interactions with nature.
- It paved the ways to discover new ways of experiencing the natural world.
- It helps to create a sustainable world by saving the endangered species.
- Digital Naturalism unites biologists, designers, engineers, and artists to build and analyze new devices.
- User can get detailed description of any kind of species.
- It is a handy application for a person who is a travel freak.

Disadvantage

- Proper network should be maintained to avoid hitches.
- Difficult to classify sub-classes of same species.

10.Conclusion:

Assessment of regional biodiversity based on global scientific consensus is a scientific basis for the whole society and a tool for local to international discussion and decision making. In the new era of extinction, people would understand the value of (intrinsic or otherwise) of our state's threatened biodiversity. Fewer observations, data points and discoveries would be made of the natural world to help us measure our impacts on it. It provides the opportunity to build a positive identity with science or recognize the value of more holistic ways of thinking such as traditional ecological knowledge. It helps us to engage in environmental stewardship behaviours ranging from resource conservation to building resilience among vulnerable communities. By acknowledging our origins in evolution, the naturalist perspective also enhances our feeling of kinship with the other species with which we share this planet, and our desire to sustain and nurture the planet itself. All sentient beings, including humanity, owe their existence to conditions that extend far beyond us in space and time. The model which was used for the detection of digital naturalists using the species images from the wild life and the species with flora part and with fauna part will be displayed as well. From the resultant graphs, it is proven that the accuracy of the model has reached good level. If it is deployed in the real-time scenario then it will help many people in distinguishing between both without wasting the money on various machines. If the image is confirmed by the model, then the person can know the feature of the species. It can be the best way of practice for people to save money. As we know that the data plays a crucial role in every deep learning model, if the data is more specific and accurate about the species then that can help in reaching greater accuracy with better results in real-time applications.

11.Future Scope:

- AI image classifiers can create biodiversity datasets from socialmedia imagery
- Flickr hosts many images of plants; some can be accurately classifiedto speciesby AI.
- Images are spatially aggregated around tourist sites and under-represent nativespecies.
- Images focusedon a single, non-horticultural, plant are most reliably.

12. Appendix:

Source code:

<----- # index1.php ----->

```
1 <?php
2     session_start();
3     if (isset($_SESSION['SESSION_EMAIL'])) {
4         header("Location: welcome.php");
5         die();
6     }
7
8     include 'config.php';
9     $msg = "";
10
11     if (isset($_GET['verification'])) {
12         if (mysqli_num_rows(mysqli_query($conn, "SELECT *
13             FROM users WHERE code='{$_GET['verification']}'")) > 0) {
14             $query = mysqli_query($conn, "UPDATE users SET
15                 code='' WHERE code='{$_GET['verification']}'");
```



```

14
15         if ($query) {
16             $msg = "<div class='alert alert-
                success'>Account verification has been successfully
                completed.</div>";
17         }
18     } else {
19         header("Location: index.php");
20     }
21 }
22
23 if (isset($_POST['submit'])) {
24     $email = mysqli_real_escape_string($conn,
        $_POST['email']);
25     $password = mysqli_real_escape_string($conn,
        md5($_POST['password']));
26
27     $sql = "SELECT * FROM users WHERE email='{ $email}'

```

```

AND password='{ $password}';

28     $result = mysqli_query($conn, $sql);
29
30     if (mysqli_num_rows($result) === 1) {
31         $row = mysqli_fetch_assoc($result);
32
33         if (empty($row['code'])) {
34             $_SESSION['SESSION_EMAIL'] = $email;
35             header("Location: welcome.php");
36         } else {
37             $msg = "<div class='alert alert-
info'>First verify your account and try again.</div>";
38         }
39     } else {
40         $msg = "<div class='alert alert-danger'>Email
or password do not match.</div>";
41     }
42 }

```

```
43?>

44

45<!DOCTYPE html>

46<html lang="zxx">

47

48<head>

49    <title>Digital Naturalist- </title>

50    <!-- Meta tag Keywords -->

51    <meta name="viewport" content="width=device-width,
        initial-scale=1">

52    <meta charset="UTF-8" />

53    <meta name="keywords"

54        content="Login Form" />

55    <!-- //Meta tag Keywords -->

56

57    <link
        href="//fonts.googleapis.com/css2?family=Poppins:wght@300;
```

```

400;500;600&display=swap" rel="stylesheet">

58

59    <!--/Style-CSS -->

60    <link rel="stylesheet" href="css/style.css"
      type="text/css" media="all" />

61    <!--//Style-CSS -->

62

63    <script
      src="https://kit.fontawesome.com/af562a2a63.js"
      crossorigin="anonymous"></script>

64

65</head>

66

67<body>

68

69    <!-- form section start -->

70    <section class="w3l-mockup-form">

71        <div class="container">

```

```

72         <!-- /form -->

73         <div class="workinghny-form-grid">

74             <div class="main-mockup">

75                 <div class="alert-close">

76                     <span class="fa fa-close"></span>

77                 </div>

78                 <div class="w3l_form align-self">

79                     <div class="left_grid_info">

80                         

81                     </div>

82                 </div>

83                 <div class="content-wthree">

84                     <h2>Login Now</h2>

85                     <p>Lorem ipsum dolor sit amet
consectetur adipisicing elit. </p>

86                     <?php echo $msg; ?>

```

```

87         <form action="" method="post">
88             <input type="email"
class="email" name="email" placeholder="Enter Your Email"
required>
89             <input type="password"
class="password" name="password" placeholder="Enter Your
Password" style="margin-bottom: 2px;" required>
90             <p><a href="forgot-
password.php" style="margin-bottom: 15px; display: block;
text-align: right;">Forgot Password?</a></p>
91             <button name="submit"
name="submit" class="btn" type="submit">Login</button>
92         </form>
93         <div class="social-icons">
94             <p>Create Account! <a
href="register.php">Register</a>.</p>
95         </div>
96     </div>
97 </div>

```

```
98         </div>

99         <!-- //form -->

100        </div>

101    </section>

102    <!-- //form section start -->

103

104    <script src="js/jquery.min.js"></script>

105    <script>

106        $(document).ready(function (c) {

107            $('.alert-close').on('click', function (c)

108                {

109                    $('.main-mockup').fadeOut('slow',

110                        function (c) {

111                            $('.main-mockup').remove();

112                        });

113                });

114        });
```

```
113     </script>
```

```
114
```

```
115 </body>
```

```
116
```

```
117 </html>
```

```
<----- # app.py ----->
```

```
1 from __future__ import division, print_function
```

```
2 import os
```

```
3 import numpy as np
```

```
4 import tensorflow as tf
```

```
5 from tensorflow.keras.preprocessing import image
```

```
6 from tensorflow.keras.models import load_model
```

```
7 from flask import Flask, request, render_template
```

```
8 from werkzeug.utils import secure_filename
```

```
9 global graph
```



```

10 #graph=tf.get_default_graph()
11 # Define a flask app
12 app = Flask(__name__)
13 model = load_model('nature1.h5')
14 print('Model loaded. Check http://127.0.0.1:5000/')
15 @app.route('/', methods=['GET'])
16 def index():
17     # Main page
18     return render_template('digital.html')
19 @app.route('/predict', methods=['GET', 'POST'])
20 def upload():
21     if request.method == 'POST':
22         # Get the file from post request
23         f = request.files['image']
24         # Save the file to ./uploads
25         basepath = os.path.dirname(__file__)
26         file_path = os.path.join(basepath, 'uploads',
27                                 secure_filename(f.filename))
28         f.save(file_path)
29         img = image.load_img(file_path,
30                               target_size=(64,64))

```

```
30 x = image.img_to_array(img)
31 x = np.expand_dims(x, axis=0)
32
33 #with graph.as_default():
34 preds = np.argmax(model.predict(x))
35 found = ["animal- badger",
36          "animal- bat",
37          "animal- bear",
38          "animal- bee",
39          "animal- dolphin",
40          "animal- donkey",
41          "animal- dragonfly",
42          "animal- duck",
43          "animal- eagle",
44          "animal- elephant",
45          "animal-flamingo",
46          "animal-fly",
47          "animal-fox",
48          "animal- gallina",
49          "animal- gatto",
50          "animal- hedgehog",
51          "animal- hippopotamus",
```

```
52  "animal- hornbill",  
53  "animal- horse",  
54  "animal- hummingbird"]  
55  print(preds)  
56  text = found[preds]  
57  
58  if __name__ == '__main__':  
59      app.run(threaded = False)
```

Github & Project Demo Video Link:

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