Problem ID: PS009005
Problem Statement : Smart Application For Medicinal Plants Information
Of, Health and Family Welfare Department
PSU: Gujarat Medicinal Plants Board
Sector : Health and Sports
Problem Description : Medicinal plants are useful for person's health. Medicinal Plants Information application gives immediate information in Gujarat, Hindi and English language about medicinal plants to the public and students. When the user scans the plant itself or photograph of plant or Predefined QR-code of plant it will provide all useful information about it.

Team name : Botanix

Members:

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Comparative analysis of Literature Survey(Of papers and models):

Title	Comparison of machine learning algorithms for detection of medicinal plants	Ayurvedic plant identification using image processing and artificial intelligence	Recognition of medicinal plants based on its leaf features	AI based indigenous medicinal plants identification
Overview	Classification of medicinal plants based on shape features of leaf	Identification of Ayurvedic plants using image processing and machine learning	Classification of medicinal plants Through Gaussian distribution	Classification of medicinal plants using CNN
Key Points	1. Focus on shape features 2. Use of SVM and KNN 3. Training and testing dataset 4. Feature extraction techniques	1. Focus on leaf-based classification 2. Use of various classifiers including SVM, KNN 3. Pre-processing techniques 4. Challenges in differentiating species	1. Image segmentation and feature extraction 2. Gaussian distribution of leaf features 3. Successful clustering of plant species 4. Inclusion of additional features for accuracy	1. Utilization of CNNs for classification 2. Comparison of CNN models for classification 3. High accuracy with GoogLeNet and AyurLeaf CNNs 4. Performance evaluation based on accuracy
Gaps identified	1. Limited focus on leaf-based features 2. Limited mention	1. Limited discussion on feature extraction	1. Challenges in differentiating species	1. Longer processing time for some models 2. Limited

	of real-time applications 3. Lack of discussion on other classifiers	methods 2. Limited analysis of variations in plant features	2. Limited real-world implementation details 3. No discussion on real-time applications	discussion on scalability 3. Limited discussion on real-time applications

Existing applications:

Name	Drawback
PlantNet	1. **Inaccurate Plant Identification**: The app struggles with correct plant identification, even after multiple attempts with various photos, which impacts its reliability. 2. **Navigation Complexity:** The app's interface and navigation are challenging to figure out, making it frustrating for users to find the main screen and desired options. 3. **Limited Multiple Photo Uploads:** The inability to upload multiple photos of the same plant for more accurate identification reduces the app's effectiveness.
Blossom	1. **Misleading Subscription Offers:** The app aggressively promotes subscriptions, often before users can properly evaluate it, which can be frustrating and off-putting. 2. **Poor Plant Identification:** The app provides inaccurate plant identification, even for obvious cases, leading to doubts about its reliability. 3. **Annoying Pop-Ups:** Constant pop-up ads and requests for ratings can disrupt the user experience and make the app feel intrusive.
PlantCam	1. **Identification and Loading Issues:** The app struggles to identify plants and often gets stuck loading without providing any useful information, making it frustrating for users. 2. **Pressure for Premium:** Users are pressured into a premium subscription before using the app, which limits basic functionality and identification checks, resulting in an unsatisfactory user experience.

	3. **Inaccurate Identification:** The app frequently fails to correctly identify plants, even with clear photos, leading to doubts about its reliability. 4. **Missing Plant Names:** Some users report that the app lacks certain plant names in its database, which reduces its usefulness for identifying specific plants accurately.
Plant App	1. **Inaccurate Plant Identification:** The app struggles with correct plant identification, providing incorrect results even after multiple attempts. 2. **Price Concerns:** Users find the app's pricing, especially the $200 lifetime membership, to be too expensive, limiting accessibility. 3. **Unreliable Results:** Users report inconsistent and incorrect plant identification, making the app unreliable for their needs. 4. **Limited Accuracy:** The app often fails to correctly identify common plants, such as spearmint and spinach, leading to frustration and uninstalls.

Our proposed solution:

We are going to build a Mobile Application which can **identify the Ayurvedic Medicinal Plant** and provide extra details about the plant.

We will implement a **chatbot** feature to identify the **Phenotype** and suggest a **precautionary drug** (Mixture of plants) as a novelty feature.

We will add a section for plant care, where people can learn how to take care of various plants and a section for blog sharing and writing, where users can write and share their blogs.

Another feature is a **marketplace** where the users can buy authentic Ayurvedic plants. It will minimize the chances of adulteration and substitution.

- **Data Acquisition**: Gather a **comprehensive dataset** of various Ayurvedic Plant images, their labels, and other details about the plant.
- **Data Preprocessing and Feature Extraction and selection**: Preprocess the images and use algorithms like **CLAHE** and **Histogram Equalization**, and perform **Data Augmentation** to improve generalization.
- **Training**: Train a **Machine Learning/ Deep Learning** model to understand the relationship between leaves, their color, shape, vein structure, etc. to identify the plant names, **tune hyperparameters** using Optuna or other libraries.
- **Evaluation**: Evaluate the model’s performance using different metrics.
- **Showing output**: After the plant is identified, the user will be shown additional information, like **price, location, drugs in which that is used.**
- **Continuous Improvement**: The model will be continuously improving and evolving through user feedback, which will be moderated by an Admin.

To get the ideal architecture, we will explore and create different models and test their performance, and take some inspiration from other pretrained models. We will tune hyperparameters through Optuna.

Chatbot feature :

- Take a **Large Language Model** and **fine tune** it to suit our needs.
- Take information from Papers/Internet to feed into the chatbot.

Store the Chatbot model to the **Cloud Storage, to make the app memory efficient.**

Methodologies which we will use:

Feature	Domain	Technology used
Plant Detection	Deep Learning, Transfer Learning (Comparing pretrained models and CNNs)	● Histogram Equalisation(HE) ● Adaptive Histogram Equalisation(AHE) ● Contrast Limited Adaptive Histogram Equalisation(CLAHE) For feature extraction Python, TensorFlow Hub and Papers With Code for getting the models
Plant care section	Backend, frontend	Firebase for backend
Login	Backend, Frontend	FireBase for Backend Flutter (Flet or FlutterFlow) for Frontend
Blog Viewing and Writing	Community Feature: Backend and Frontend	FireBase for Backend Flutter (Flet or FlutterFlow) for Frontend
Chatbot	Large Language Model	LangChain, and a Model from HuggingFace
Buying and Selling	Backend and Frontend	Firebase and Flutter

Use cases:

Accurate Plant Recognition: Users capture plant images, and the CNN model ensures precise identification.

Thus, can be used by common users, plant sellers, medical practitioners and students.

1. Educational Tool for Students: Students studying Ayurveda or botany can use the app to enhance their learning by identifying and exploring Ayurvedic plants.

2. Herbalists and Ayurvedic Practitioners: Professionals in the field can use the app as a quick reference tool for identifying plants and understanding their properties.

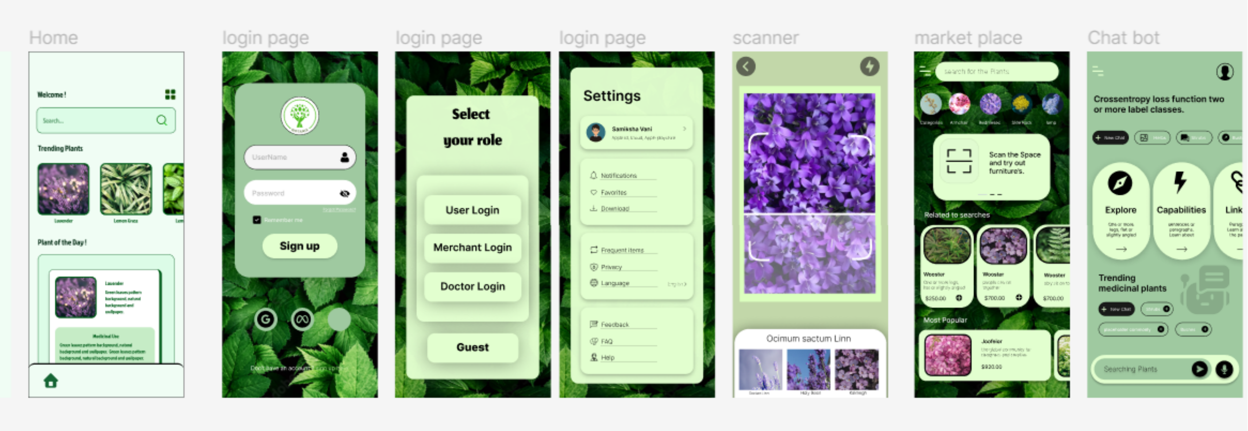
3. Home Herbal Remedies: Users can identify medicinal plants growing around their homes and learn about their potential uses for home remedies.

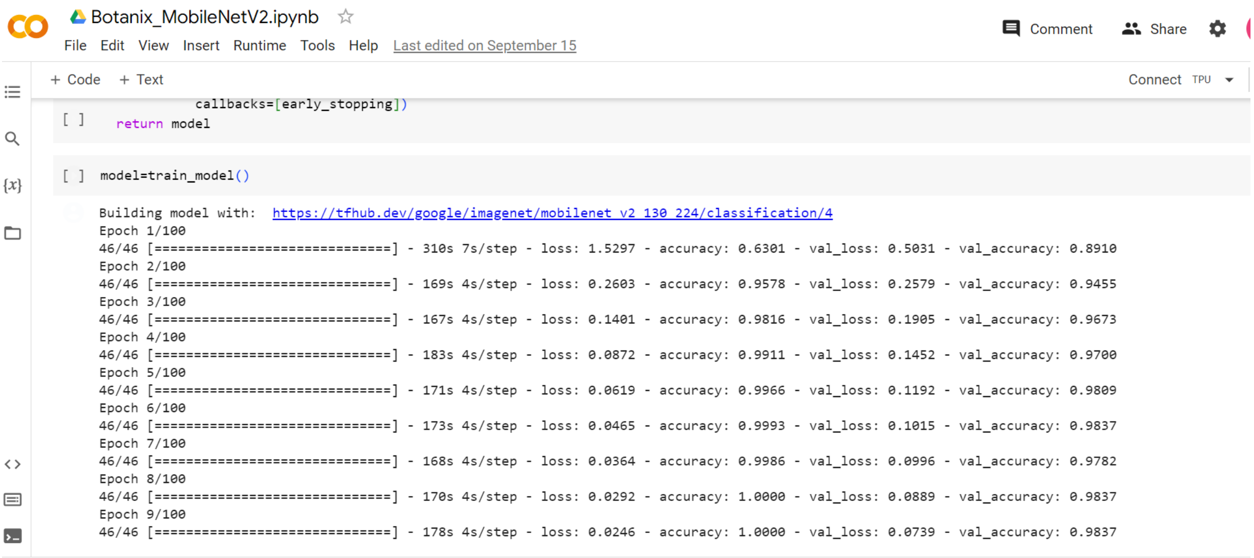
4. Safety Precautions for Foraging: Foragers looking to collect wild plants for medicinal purposes can use the app to ensure they are harvesting the correct species.

5. Ayurvedic Pharmacies: Pharmacies specializing in Ayurvedic medicine can use the app as a tool to help customers identify and understand the plants used in their products.

6. Integration with E-commerce Platforms:The app can be integrated with e-commerce platforms to allow users to purchase Ayurvedic products or seeds of identified plants

Screenshots of work done:





```
                  callbacks=[early_stopping])
[ ]     return model
```

```
[ ]  model=train_model()
```

```
Building model with:  https://tfhub.dev/google/imagenet/mobilenet_v2_130_224/classification/4
Epoch 1/100
46/46 [==============================] - 310s 7s/step - loss: 1.5297 - accuracy: 0.6301 - val_loss: 0.5031 - val_accuracy: 0.8910
Epoch 2/100
46/46 [==============================] - 169s 4s/step - loss: 0.2603 - accuracy: 0.9578 - val_loss: 0.2579 - val_accuracy: 0.9455
Epoch 3/100
46/46 [==============================] - 167s 4s/step - loss: 0.1401 - accuracy: 0.9816 - val_loss: 0.1905 - val_accuracy: 0.9673
Epoch 4/100
46/46 [==============================] - 183s 4s/step - loss: 0.0872 - accuracy: 0.9911 - val_loss: 0.1452 - val_accuracy: 0.9700
Epoch 5/100
46/46 [==============================] - 171s 4s/step - loss: 0.0619 - accuracy: 0.9966 - val_loss: 0.1192 - val_accuracy: 0.9809
Epoch 6/100
46/46 [==============================] - 173s 4s/step - loss: 0.0465 - accuracy: 0.9993 - val_loss: 0.1015 - val_accuracy: 0.9837
Epoch 7/100
46/46 [==============================] - 168s 4s/step - loss: 0.0364 - accuracy: 0.9986 - val_loss: 0.0996 - val_accuracy: 0.9782
Epoch 8/100
46/46 [==============================] - 170s 4s/step - loss: 0.0292 - accuracy: 1.0000 - val_loss: 0.0889 - val_accuracy: 0.9837
Epoch 9/100
46/46 [==============================] - 178s 4s/step - loss: 0.0246 - accuracy: 1.0000 - val_loss: 0.0739 - val_accuracy: 0.9837
```