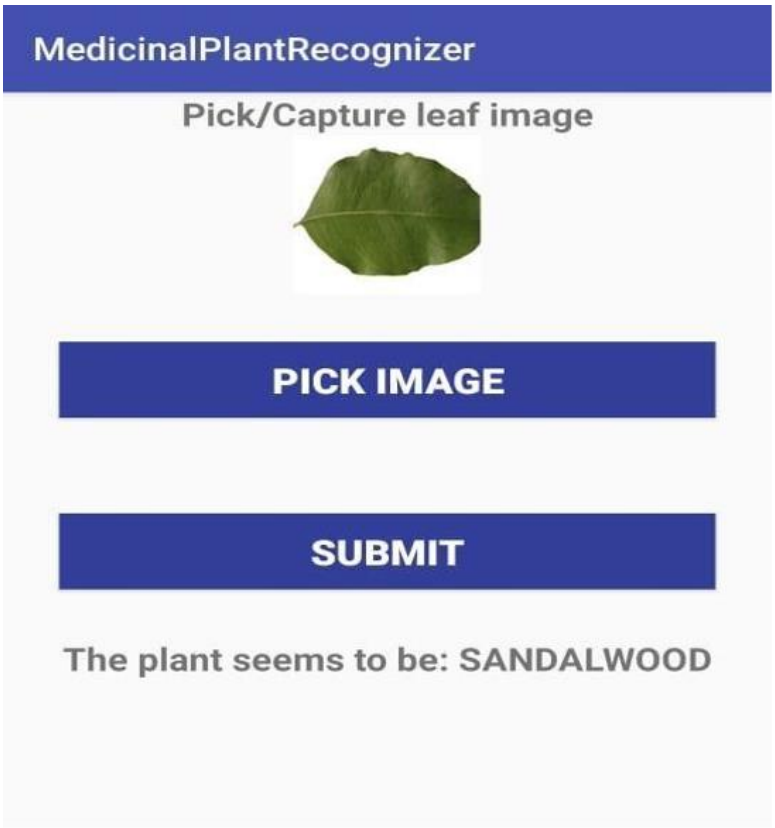

Medicinal Plant Recognizer

Nov 19, 2024

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Product Idea

Overview

Medicinal Plant Recognizer is an intelligent mobile application that uses deep learning to identify medicinal plants based on photographs of their leaves. It gives users complete information on the plant's scientific name and health advantages, promoting awareness and proper use of medicinal plants.

Customers (Who)

• **Healthcare professionals**: For quick identification and accurate usage of medicinal plants.

• **Researchers**: In botany, pharmacology, and related fields.

• **General users**: Interested in herbal remedies and natural medicine.

• **Farmers**: To identify medicinal plants for sustainable farming, cultivation, pest control, and to explore potential economic benefits from cultivating high-demand medicinal plants.

Problem (What)

Many people lack the expertise and access necessary to identify therapeutic plants. Incorrect identification can result in inefficient or hazardous therapies. The present procedures frequently include manual inspection, which is time-consuming and error prone.

Scope

• **30%** of medicinal plant identification tasks rely on botanists, consuming approximately 2-3 hours per plant for accurate classification.

• **40%** of collected medicinal plants are either incorrectly identified or substituted, leading to inefficacy in Ayurvedic medicine and **$2 million** in annual losses for the herbal medicine industry.

• **60%** of farmers lack access to tools for identifying high-value medicinal plants, resulting in missed opportunities for sustainable farming and economic benefits.

• Using **Medicinal Plant Recognizer**, the identification time can be reduced by **90%**, saving **2 hours per task** and cutting costs associated with misidentification by **50%**.

Root cause (Why)

The absence of easily accessible, dependable, and user-friendly instruments for identifying medicinal plants has hampered their widespread usage.

Problem Validation

Complexity

Adding more resources such as people, budget, or processes cannot effectively solve this problem because:

1. **Specialized Knowledge Requirement**: Accurate identification of medicinal plants necessitates extensive expertise, which is difficult to scale up by adding more personnel. More botanists would require a significant amount of time and resources to train.

2. **Variability in Plant Features**: Differences in plant traits (e.g., seasonal changes, dried or processed forms) make manual identification difficult even for experts, lowering the effectiveness of simply adding human resources.

3. **Economic Inefficiency**: Small-scale farmers and local manufacturers cannot afford to increase their budgets to hire more experts or conduct manual quality control.

4. **Lack of Scalability**: Manual methods cannot match the demands of businesses such as herbal medicine production or agriculture, which require large-scale and precise identification.

Thus, the problem is **unsolvable or uncontrollable** with traditional resource-based approaches, making an AI-driven solution necessary for scalability, accuracy, and efficiency.

Frequency

There is **no way for users to escape facing this problem altogether**, such as:

1. **Integral to Industries**: Healthcare professionals, farmers, and academics rely on accurate medicinal plant identification. Misidentification affects product efficacy, study results, and agricultural income.

2. **Persistent Need**: The usage of therapeutic plants in Ayurveda, herbal medicines, and natural medicine assures that the condition persists and cannot be averted.

3. **No Alternative for Identification**: Users need accurate plant identification tools to assure safety and efficacy in their applications, which cannot be avoided.

Hence, this problem is **persistent and unavoidable**.

Timing

Yes, now is the right time to solve this problem because:

1. **Rising Demand for Herbal Remedies**: The global interest in alternative medicine, including Ayurveda and natural treatments, is developing quickly, necessitating proper medicinal plant identification.

2. **Technological Readiness**: Advances in AI and mobile computing make it viable to deploy a scalable, accurate, and cost-effective solution today.

3. **Economic Losses**: Misidentification of medicinal plants presently costs the herbal medicine industry $2 million per year in lost revenue, as well as inefficiencies in farming and manufacturing.

4. **Health Implications**: Incorrect plant identification reduces the efficacy of therapies, perhaps causing injury or side effects.

5. **Sustainability**: Delays in addressing this issue may result in the overharvesting of non-medicinal or replacement plants, causing environmental degradation and decreased biodiversity.

If not solved in time, the problem will continue to grow in scope with increasing financial, environmental, and health-related damage.

Existing Alternative Solutions

Manual identification, internet databases, or limited-use plant-identifying apps with insufficient medicinal plant-specific insights and accuracy.

Product Details

Proposed Product

The solution is **Medicinal Plant Recognizer**, an AI-powered mobile application that enables users to identify medicinal plants accurately and efficiently through leaf images.

Scope

• **80% reduction** in time taken for plant identification.

• A user-friendly app with an intuitive interface.

• **98% classification accuracy** for medicinal plant species.

MVP

What will be the simple MVP version of your product?

• Capture or upload a leaf image.

• Classify plants and provide information.

• Offline functionality for users in remote areas.

Who will make up your MVP customer segment?

• Healthcare professionals and students.

• Herbal product researchers.

• Everyday users interested in natural remedies.

Discarded Alternative

Manual inspection by botanists is time-intensive and not scalable for broader use.

Product Validation

For the **Medicinal Plant Recognizer** product, all three categories—**Defensibility**, **Disruptiveness**, and **Pain-vs-Gain**—are applicable because they directly address the unique attributes and impact of the product.

Defensibility

Competitive Advantages:

• **Proprietary Dataset**: A curated dataset of 1,550 images covering 34 medicinal plant species makes the model highly specific and difficult to replicate.

• **ResNet50 Model Customization**: The use of a tailored ResNet50 architecture optimized for medicinal plant identification enhances accuracy and scalability.

• **Health Benefit Insights**: Integrating plant-specific health information provides added value beyond simple identification, making the app unique.

• **User Trust**: High accuracy (98%) combined with user-friendly functionality ensures a loyal customer base.

Additional advantages include the potential for IP or trade secrets around the dataset curation process and AI model fine-tuning.

Disruptiveness

Our product is **Leap Forward**.

• The product is a significant improvement over state-of-the-art alternatives, which focus solely on generic plant identification without specific insights into medicinal uses.

• By combining deep learning with actionable health benefits, it disrupts traditional methods of manual identification and generic apps that lack domain focus.

Pain-vs-Gain

• **Pain**:

  • Minimal effort required to switch to the app compared to manual processes.

  • Users may need to adapt to using mobile devices or ensure proper image quality for optimal results.

• **Gain**:

  • **90%-time reduction** in identification.

  • **50% cost savings** from reduced misidentifications.

  • Enhanced accuracy (**98%**) ensures confidence in results, making it a highly valuable tool.

No significant risk factors prevent users from switching, as the app provides both improved efficiency and added insights into existing solutions.

Specifications

ML Feature: This product offers a deep learning-based capability for recognizing medicinal plants using leaf photos. The ResNet50 model processes photos to handle the problem of accurate identification while also providing health-benefit information. The ML model is embedded into the app and provides real-time identification results.

Stakeholders

• **Ayurvedic Practitioners**: Use the app for accurate plant sourcing.

• **Farmers**: Rely on the app for plant identification and farming insights.

• **Healthcare Professionals**: Use the app for selecting plants with specific medicinal benefits.

• **Researchers**: Leverage the app for studies on plant-based treatments.

• **General Public**: Use the app to explore herbal remedies.

User Personas

1. **Farmer Ravi**: Tech-savvy farmer looking to identify medicinal plants for farming and economic benefits.
2. **Ayurveda Student Sneha**: Uses the app to learn plant properties during her studies.
3. **Home Remedy Rina**: Wants to identify plants in her garden for herbal teas or remedies.
4. **Botany Researcher Raj**: Requires detailed information about plant species for academic research.

User Journeys

1. **[Critical]** Capture or upload a leaf image for identification.
2. **[Critical]** Receive plant name, scientific name, and health benefits on the app interface.
3. Save identified plants for future reference.
4. Enable offline mode for remote access to identification.

Limiting Scope

• The app will **not diagnose medical conditions** or provide treatment advice.

• It will **not identify non-medicinal plants** unless explicitly added to the dataset.

• It does **not replace professional botanists** with complex tasks like disease identification in plants.

Requirements

User Interaction/UX

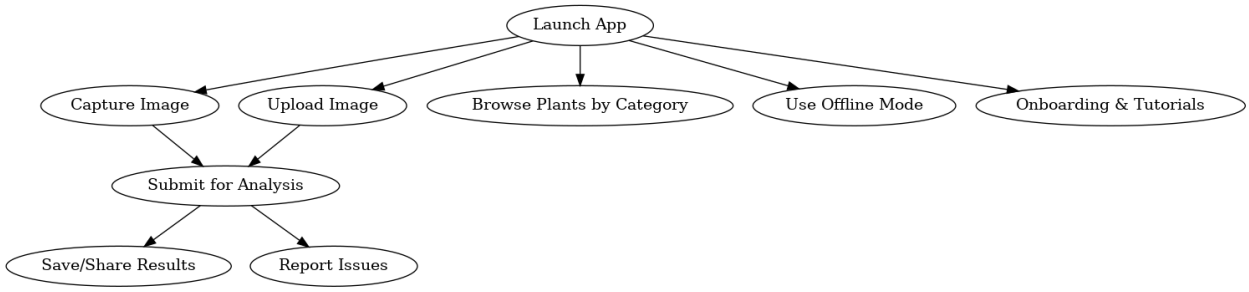

Fig: User Interaction of the Product

1.**Launch App**: Users start by tapping the app icon, leading to the home screen with multiple options.

2. **Capture or Upload Image**: Users can either take a new photo of a plant leaf or upload an existing image from their gallery.

3. **Submit for Analysis**: The app processes the image to identify the plant and displays results including the common name, scientific name, and medicinal benefits.

4. **Browse Plants by Category**: Users can explore plant species and their uses through filters like health benefits or plant types.

5. **Use Offline Mode**: Offline functionality enables plant identification from pre-downloaded data without internet access.

6. **Save/Share Results**: Users can save the identified plant details or share them with others through social media or email.

7. **Report Issues**: If identification errors occur, users can provide feedback and attach additional images.

8. **Onboarding & Tutorials**: First-time users can access guided tutorials to familiarize themselves with the app's features.

INTEGRATION

N/A: The product is standalone and not dependent on external systems for integration.

HARDWARE

N/A: No hardware-specific requirements beyond a smartphone with a camera.

FAILURE CASES

1. **Poor-quality image uploads:** Suggest users retake the photo.
2. **Unknown plants:** Notify users and recommend manual review or dataset updates.

Fallback Policy

• Use cached data for offline mode to allow identification of previously trained plants.

• Notify users when cloud resources are unavailable and prompt them to retry later.

BEHAVIORAL CHANGES

N/A: No significant behavioral changes expected other than users adopting the app.

SAFETY

• Ensure **data privacy** by encrypting image uploads.

• Prevent misuse by including disclaimers that the app is not a substitute for professional advice.

TRUST

• Display **confidence scores** for predictions.

• Provide a simple explanation of how plant identification works (e.g., AI processes leaf features).

ETHICS

• Avoid bias by ensuring the dataset represents diverse regions and plant species.

• Periodically review predictions to ensure no harmful misinformation is being provided.

LEGAL

N/A: No immediate legal compliance requirements unless the app expands into regulated areas like pharmaceuticals.

Model Research*

1. **Classify**:

    • Classify the uploaded or captured plant leaf image into one of the **medicinal plant species** available in the dataset.

    • Classify unidentified images as “Unknown.”

2. **Predict**:

    • Predict the medicinal **benefits** associated with the identified plant based on its classification.

    • Predict plant health status (optional for future expansion).

3. **Find**:

    • Find specific **visual features** in the leaf image (e.g., shape, texture, color) that match with known species.

    • Identify incomplete or poor-quality images that require user intervention.

4. **Rank**:

    • Rank identified plants by their **relevance to specific health conditions** (e.g., digestion, immunity) when users browse by category.

    • Rank similar plants for users if the primary classification is uncertain, offering alternative suggestions.

Data*

WHAT TO COLLECT

1. **Data Required**:

Images of plant leaves:

• High-resolution images of medicinal plant leaves from various angles.

• Includes different lighting conditions, textures, and sizes.

Features Needed:

• Shape, color, texture, edge patterns, and vein structures of the leaves.

Supplementary Data:

• Scientific names, common names, and associated medicinal benefits for each plant species.

2. **Training Data**:

• Annotated dataset with labeled images of **34 medicinal plant species**.

• A mixture of **2D images** captured from smartphones, cameras, and scanners.

PRIVATE AND SENSITIVE DATA

PII (Personally Identifiable Information):

• No sensitive or PII data is directly collected, as the data primarily consists of plant images.
• User-uploaded images (if stored) may become sensitive if identifiable human or personal information is inadvertently captured.

DATA COMPLIANCE

Legal and Regulatory Requirements:

- Adhere to **data privacy laws** such as GDPR or CCPA
- Ensure that user-uploaded images are processed locally or encrypted if stored.
- Provide users the option to delete their uploaded images and related metadata.
- If integrating with Ayurvedic organizations, ensure compliance with **domain-specific data-sharing agreements**.

COLLECTION PROCESS

Data Sources:

- Public plant databases (e.g., PlantSnap, Kaggle datasets).
- Research collaborations with Ayurvedic or botanical organizations.
- Crowdsourcing images from users via an in-app contribution feature.

User-Generated Data:

- Encourage users to upload labeled leaf images with appropriate permissions.

GENERATING LABELED DATA

Labeling Process:

- Use domain experts (botanists or researchers) to verify and label plant images.
- Leverage **pretrained models** to generate preliminary labels, followed by human validation.

Retraining and Label Updates:

- Periodically retrain the model as new data is collected or existing labels are refined.
- Add new plant species by collecting and annotating sufficient image data.

Gathering User Feedback

Goals and Milestones

I. Short-term Goals

• Build the ResNet50 based model and test accuracy.

• Launch the Android app MVP.

Success Criteria

• Achieve 95% classification accuracy.

• 500 downloads in the first month.

II. Medium-term Goals

• Expand dataset to 50+ plant species.

• Add offline functionality.

Success Criteria

1. **Dataset Expansion**:

    • **Metric**: Number of plant species in the dataset.

    • **Target Value**: 50+ species.

2. **Offline Functionality**:

    • **Metric:** App functionality in offline mode (successful identification accuracy).

    • **Target Value**: Maintain at least **90% classification accuracy** in offline mode.

3. **User Adoption for New Features**:

    • **Metric**: Percentage of app users leveraging offline mode.

    . Target Value: At least **70% adoption rate** of offline functionality within six months of release.

These metrics ensure measurable progress toward achieving the medium-term goals.

III. Long-term Goals

Success Criteria

1. **Partnerships with Ayurvedic Organizations**:

- **Metric**: Number of active partnerships.
- **Target Value:** Establish at least 5 key partnerships with Ayurvedic organizations within two years.

2. **iOS and Web Platform Expansion**:

- **Metric**: Platform availability and user base growth.
- **Target Value**:
- Launch fully functional iOS and web platforms within two years.
- Achieve **20% user base growth** within one year of launch across the new platforms.

These goals and criteria ensure strategic expansion and broader adoption of the product.

Competitive Analysis

Competitors

1.PlantSnap:

How they solve the problem:

General plant identification app using AI to classify plants, including medicinal ones.

Shortcomings:

• Focuses on general plant identification and lacks detailed insights into medicinal uses.

• Accuracy drops significantly for non-mainstream or regional plants.

Drawback of Business Model:

• Subscription-based models may deter casual users.

• Limited focus on medicinal plants reduces appeal for niche users like Ayurvedic practitioners.

2. Picture This:

How they solve the problem: Uses AI for plant recognition and provides brief plant descriptions.

Shortcomings:

• Limited to general plant data; no specialized health or medicinal benefits information.

• Relies heavily on internet connectivity, making it inaccessible in rural areas.

Drawback of Business Model:

• Heavily reliant on premium features for revenue, leading to restricted functionality for free users.

Market Gain Strategy

1. Initial Focus:

• Enter the market by addressing the niche of **medicinal plant identification** with a highly accurate and actionable solution.

• Target underserved groups such as **Ayurvedic practitioners, farmers, and herbal medicine manufacturers**.

2. Long-Term Goal:

• Build trust and user loyalty by offering free essential features with optional premium offerings for advanced functionality (e.g., offline mode, expanded plant database).

• Differentiate by prioritizing **medicinal insights** and partnering with Ayurvedic organizations, creating defensibility against generic competitors.

MVP Timeline

1. **Month 1-2**: Data collection and preprocessing.
2. **Month 3**: Model training and app development.
3. **Month 4**: Testing and MVP launch.

Approvals

Divya Sai Sree Cheedirala - Algorithm Design
Sai Kranth Koneru - User Interface
Subhashini Venkatachalam- Dataset Quality

Appendix

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Relevant Readings (We chose the existing competitors)

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