

## Project Design Phase Problems and Solutions

Date	27 June 2025
Team ID	LTVIP2025TMID41438
Project Name	GrainPalette - A Deep Learning Odyssey In Rice Type Classification Through Transfer Learning
Maximum Marks	2 Marks

### Problem:

Rice variety identification is a critical but often overlooked issue in agriculture. Farmers, especially in rural or resource-limited areas, face difficulty distinguishing between rice grain types. This leads to incorrect crop planning, misuse of fertilizers, and poor yield. The lack of affordable, fast, and accurate identification tools results in seed mismanagement and economic loss.

### 2. Target Group / Customers:

Farmers and seed producers, Agriculture extension workers, Research scientists and crop analysts, Educational institutions and home growers, NGOs and agri-startups promoting smart farming

### 3. Existing Alternatives:

Manual inspection of grains by experts, Traditional seed testing and certification labs, Visual comparison with reference samples, Basic mobile farming apps without grain-level AI detection

### 4. Problems With Existing Alternatives:

- Inaccessible to remote farmers
- Prone to human error
- Require expert involvement
- Time-consuming and costly
- Not real-time or image-based
- Ineffective for grains with similar appearance

### Solution:

GrainPalette is an AI-based tool that uses **transfer learning with MobileNetv4** to classify rice grain types from images. Users can upload a rice grain photo using a simple web interface and instantly receive the predicted rice variety along with advisory support. This enables **data-driven farming**, minimizes reliance on manual checks, and supports **precision agriculture** at the grassroots level.

### Purpose:

1. **Enable Early and Accurate Rice Variety Identification:** Help farmers confirm seed types before sowing to improve productivity.
2. **Support Informed Agricultural Decisions:** Deliver crop-specific recommendations based on identified rice types.
3. **Reduce Time and Cost:** Offer an instant, low-cost alternative to laboratory testing.
4. **Democratize Agri-Tech:** Make advanced AI tools accessible to rural users with minimal infrastructure.

5. **Encourage Learning and Awareness:**Foster agricultural biodiversity education among students and home growers.
6. **Promote Smart Farming Practices:**Contribute to sustainable agriculture using AI-powered classification systems.

**Problem and Solutions:**

## Problem-Solution Fit Canvas

<b>1. CUSTOMER SEGMENTS</b> <ul style="list-style-type: none"> <li>• Farmers and growers</li> <li>• Agricultural extension vorkers</li> <li>• Seed suppliers and researchers</li> <li>• Individuals with incorrect or risky knowledge</li> </ul>	<b>6. CUSTOMER LIMITATIONS</b> <ul style="list-style-type: none"> <li>• End-of-field concerns</li> <li>• Need for a fine-tuned classifier</li> <li>• Dependency on uploading images for analysis</li> </ul>	<b>5. AVAILABLE SOLUTIONS (PROS &amp; CONS)</b> <ul style="list-style-type: none"> <li>• Reliance on seed labels</li> <li>• Lack of instant, reliable assistance to validate rice varieties</li> </ul>
<b>3. PROBLEMS / PAINS</b> <p>Difficulty distinguishing similar looking rice varieties</p> <ul style="list-style-type: none"> <li>• Incorrect use of water, fertilizers, and pest control</li> </ul>	<b>4. PROBLEM ROOT / CAUSE</b> <ul style="list-style-type: none"> <li>• Lack of early diagnostic tools</li> <li>• Dependence on seed label verification</li> </ul>	<b>8. BEHAVIOR – ITS INTENSITY</b> <ul style="list-style-type: none"> <li>• Farmers rely on networks to identify rice grains</li> <li>• Strong need for real-time, accurate validation</li> </ul>
<b>4. TRIGGERS TO ACT</b> <p>Rising rice disease cases</p> <ul style="list-style-type: none"> <li>• Boredom and inefficiency</li> </ul>	<b>SOLUTION</b> <ul style="list-style-type: none"> <li>• Machine Learning AI using MobileNetV4 (transfer learning)</li> <li>• Fine-tuned CNN model</li> <li>• AI-based rice classifier from uploaded images</li> </ul>	<b>9. CHANNELS OF BEHAVIOR</b> <p><b>ONLINE:</b> Using the AI cassifier from uploaded images</p> <p><b>OFFLINE:</b> Possibly integrated into field tools</p>