Solution Architecture

Date	15 July 2025
Team ID	LTVIP2025TMID36397
Project Name	*Pollen's Profiling: Automated Classification of Pollen Grains*
Maximum Marks	4 Marks

🔍 Solution Architecture:

Solution architecture bridges your AI-based classification goal with effective technical implementation. Its purpose is to:

- Identify the best AI-driven approach to automate pollen classification.
- Illustrate the flow, components, and tools behind the deployed application.
- Specify all necessary backend/frontend elements used in the web-based solution.
- Align development tasks with clear milestones for deployment.

🦴 Key Components and Technologies:

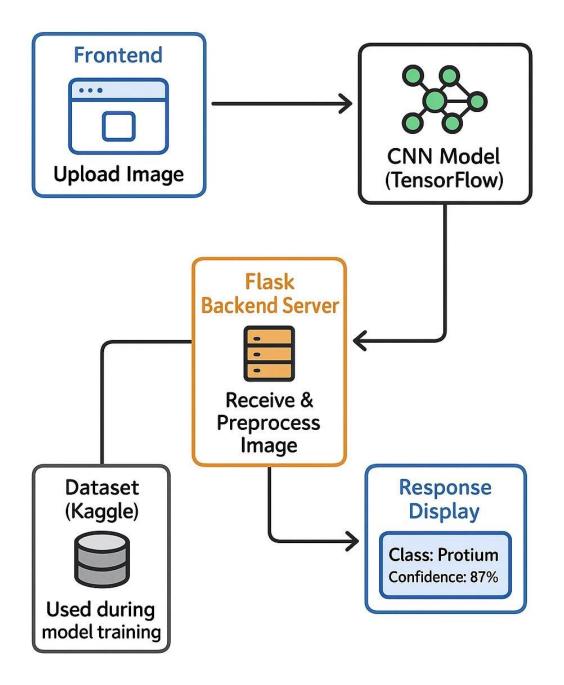| Component	Details
Frontend	HTML/CSS-based upload page for pollen grain images.
Backend	Python Flask server managing requests, inference, and responses.
AI Model	CNN model built with TensorFlow and Keras (trained on 23 pollen classes).
Libraries	NumPy, OpenCV, Pillow, Keras, TensorFlow, Scikit-learn
Dataset	Brazilian Savannah Pollen Dataset (from Kaggle), with JPG images.
Development	Google Colab (training), VS Code & Jupyter Notebook (experimentation)
Deployment	Local Flask App (extendable to Heroku, AWS, etc.)

🔁 System Flow (End-to-End Pipeline):

Step	Process Description
1	User accesses web app via browser.
2	User uploads a microscope image of a pollen grain.
3	Flask backend receives the image and applies preprocessing (resizing, normalization).
4	Preprocessed image is passed to the CNN model.
5	The model predicts the class (e.g., *Protium*) and confidence score (e.g., 87%).
6	Backend sends the result back to frontend.
7	User sees final prediction on the webpage.

📦 Deployment Structure and Tools

Area	Technology Used
Image Upload	HTML form with `<input type="file">` , sends image to `/predict` endpoint
Model Inference	CNN model loaded using `tensorflow.keras.models.load_model()`
Prediction Logic	Uses `numpy.argmax()` to identify class with highest probability
User Interface	Rendered using Flask's `render_template()` with real-time response from model inference

⚙️ Architecture Diagram

Pollen's Profiliing – Solution Architecture