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Team ID	**190**			
Semester	**6th**			
Course:	**Interdisciplinary Project**			
Team Details		**Program**	**USN**	**Name**
	1	**Electronics & Communication Engineering**	**1RV23EC408**	**RAVIKANT**
	2	**Electronics & Communication Engineering**	**1RV23EC410**	**SAGAR NAYAK**
	3	**Biotechnology Engineering**	**1RV23BT404**	**YOGEESH**
	4	**Computer Science & Engineering**	**1RV23CS405**	**KIRAN H R**
	5	**Computer Science & Engineering**	**1RV23CS407**	**MANOJ KUMAR B V**
Project Title	**Real Time Cashew Kernel Classification using Deep Learning**			
Center of Excellence				
Internal Guide				
Name Designation & Department	Dr. Veenadevi S V Associate Professor Electronics & Communication Engineering			

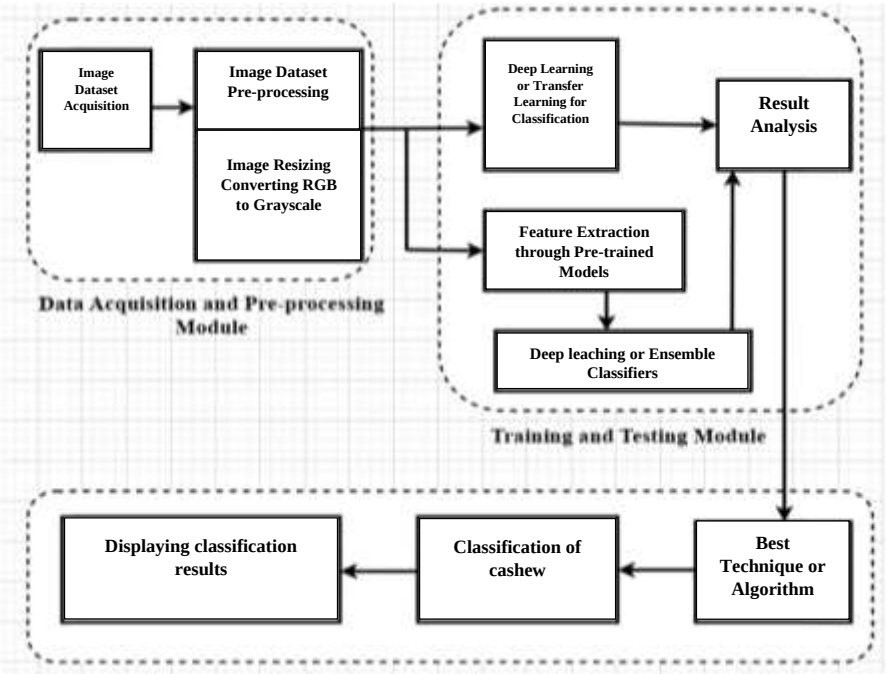
INTRODUTION:

Cashew kernels are a valuable product in the global food market, and their quality affects both price and consumer choice. Traditionally, kernels are graded by hand based on size, shape, color, and surface condition. Skilled workers visually inspect and sort them into categories like whole, split, or scorched. However, manual grading is slow, tiring, and prone to mistakes, leading to inconsistencies in quality and profit loss. To solve this, the industry is moving toward automation using artificial intelligence and computer vision. Deep learning is especially useful because it can learn to recognize complex visual patterns from large sets of images. This project focuses on developing a real-time system that automatically classifies cashew kernels using deep learning. It aims to replace manual inspection with a faster, more reliable, and scalable method, helping improve product quality, reduce labor needs, and boost overall efficiency in cashew processing.

OBJECTIVES:

1. Design an Image processing unit for capture the raw cashew kernel images and data preprocessing.
2. Implement an Algorithm for data analysis, feature extraction and classification to determine the variations in the raw cashew kernels.
3. Employ AI algorithms to classify and grade cashew defects.
4. Integrate robust hardware and software for efficient testing and grading.

METHODOLOGY:



The above figure illustrates the block diagram of the proposed methodology for automated cashew classification. The process begins with the acquisition of high-resolution images of cashew nuts representing various quality grades. These images undergo preprocessing steps such as resizing to a standard dimension (224x224 pixels) and converting from RGB to grayscale to simplify computations

and highlight essential features. The preprocessed images are then used to train a deep learning or ensemble classification model, with feature extraction carried out through pre-trained networks. The model is evaluated for performance, and the best-performing algorithm is selected for deployment. In real-time operation, new images are processed through the same pipeline, classified by the trained model, and the results are displayed on a user-friendly graphical interface (GUI). This interface provides immediate feedback and helps determine whether each cashew sample meets quality standards or requires further inspection, enabling efficient and automated quality assessment.

SOFTWARE REQUIREMENTS:

1. Python (with PyTorch/TensorFlow, OpenCV, NumPy, Pandas)
2. Labeling Tools (e.g., CVAT, LabelMe)
3. Libraries for feature extraction VGG16, ResNet50, ResNet101, InceptionV3.
4. GUI framework (Tkinter / PyQT / Streamlit)
5. MATLAB (for comparison or validation analysis)

HARDWARE REQUIREMENTS:

1. High-resolution Camera
2. Raspberry Pi
3. Lighting Setup for consistent image capture
4. Conveyer System, Stepper Motor
5. GPU-enabled laptop or workstation

INTERDISCIPLINARY RELEVANCE:

1. **Electronics and Communication Engineering:**
   - Responsible for the hardware setup, including the selection and integration of the camera, and other sensors.
   - Design and implementation of communication protocols for interfacing with the embedded system.
   - Control and automation of the Cashew classification system through electronics and embedded programming.

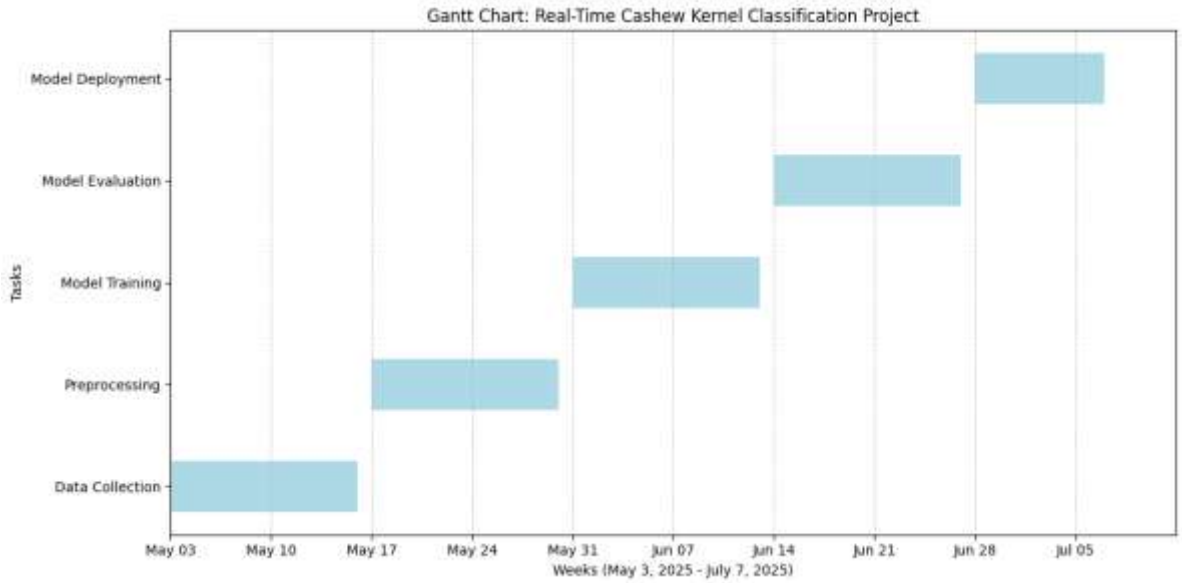
2. **Computer Science and Engineering:**
   - Responsible for the software development, including image processing, machine learning model implementation, and system integration.
   - Applying algorithms for defect detection, classification, and feature extraction.
   - Developing a GUI for real-time monitoring and control, as well as database management.

3. **Biotechnology:**
   - Defines quality parameters of cashew kernels based on biological and nutritional standards to guide accurate classification.
   - Supports dataset labeling and validation using domain knowledge to identify visual and biochemical defects.
   - Ensures the system aligns with industry standards by providing insights into biological variations affecting kernel quality.

INNOVATION / CONTRIBUTION TO THE FIELD:

- Develops a real-time deep learning-based system for accurate and automated classification of cashew kernels.
- Replaces traditional manual grading methods, reducing human error, labor dependency, and subjectivity.
- Incorporates image acquisition, pre-processing, and classification in a seamless pipeline suitable for industrial deployment.
- Enables consistent, scalable, and objective quality grading based on visual attributes such as shape, size, and surface defects.
- Enhances processing efficiency and product uniformity, contributing to improved profitability and quality assurance in the cashew industry.

TimeLine (GANTT CHART):



Signature
Internal Guide

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