

Section 1: Administrative and Core Identity

Project Title

Smart Areca Nut Plucking Machine with Remote Control and Sensor-Based Ripe Nut Detection

Student Team

Name	Role
Mohammed Fahad Khan	Team Leader, Mechanical Design & System Integration
Kotesha N	Electrical Systems and Power Electronics
Punith Gowda B K	Electrical Control and Hardware Integration
Darshan H D	Sensors and Instrumentation Integration
Shravani G	Image Processing

Academic Details

Name	Programme	Department	Status
Mohammed Fahad Khan	B.E.	Mechanical Engineering	Graduated in 2025
Kotesha N	B.E.	Electrical and Electrical Engineering	Graduated in 2025
Punith Gowda B K	B.E.	Electrical and Electrical Engineering	Graduated in 2025
Darshan H D	B.E.	Electronics and & Instrumentation Engineering	Graduated in 2025
Shravani G	B.E.	Computer Science and Engineering	Currently in Final Year (4th Year)

Institution: Malnad College of Engineering, Hassan

Project Duration

Dates: December 2024 – March 2026

Key Adviser / Mentor

Name: Dr. Mohana Lakshmi J, Associate Professor, Dept. of Electrical & Electronics Engineering

Grant Information

Grant Approved: ₹2,00,000

Section 2: Visual Assets

Student Profile Photo



Mohammad Fahad Khan



Kotesha N



Punith Gowda B K



Darshan H D



Shravani G

Project Photo



Section 3: Narratives

The Hook

“An automated harvesting system that identifies and plucks ripe areca nuts, reducing labor dependency and minimizing crop losses for farmers.”

Problem Statement

Areca nut farming faces severe labor shortages and inefficient harvesting methods, significantly affecting farmer income and productivity. Farmers rely on manual labor to identify ripe crops and harvest them from tall trees, which is physically demanding, time-consuming, and expensive.

Field surveys conducted with more than 50 farmers in Karnataka revealed that up to 30% of crops are wasted due to delayed harvesting or incorrect ripeness detection, leading to 20–30% loss in potential income. Additionally, farmers often spend nearly ₹50,000 annually on labor while still experiencing crop losses.

These challenges highlight the urgent need for an affordable technological solution that can assist farmers in detecting ripe crops accurately and harvesting them efficiently, thereby improving productivity, reducing labor dependency, and enhancing rural livelihoods.

Proposed Solution

The proposed solution is a Smart Areca Nut Plucking Machine that uses robotic actuation to automate the harvesting process. The system uses a camera-based module to detect the ripeness of areca nuts in real time. A trained machine learning model processes the visual data and sends commands to the microcontroller, which triggers a pneumatic cutting mechanism to harvest only the ripe nuts.

The machine is designed with a lightweight mechanical structure, automated actuators, and sensor-based control to ensure precise and efficient harvesting. The prototype also incorporates an ESP32-based control unit that processes machine learning predictions and activates harvesting mechanisms with minimal delay. By automating ripeness detection and harvesting, the system significantly improves efficiency, reduces labor requirements, and minimizes crop waste, making it a practical and scalable solution for precision agriculture.

Methodology and Key Technology

The system integrates embedded control systems for automated harvesting. The control system is implemented using an ESP32-S3 microcontroller, which receives classification outputs and activates a pneumatic cutting blade mechanism for harvesting. The system also incorporates sensors, actuators, and adaptive lighting correction to ensure reliable operation under varying field conditions.

Key Findings and Results

The developed prototype demonstrates significant improvements over traditional harvesting methods. The following table summarizes the key performance metrics:

Parameter	Traditional Method	Smart Machine	Improvement
Ripeness Detection Accuracy	65–75%	~92%	Up to 27% improvement
Labour Dependency Reduction	—	—	Up to 90%
Harvesting Time (per acre)	~5 hours	~1.5 hours	3x faster
Crop Waste	~30%	<5%	~25% reduction
Harvesting Cost (per acre)	₹2,500	₹800	₹1,700 savings

These improvements demonstrate the system's potential to increase farmer profitability and efficiency substantially.

Future Scope and Next Steps

The next phase of development involves conducting field trials with farmers in Hassan district to validate the system under real agricultural conditions. Future improvements will focus on enhancing the machine learning model to support additional crops such as coconut and fruit harvesting.

Integration of IoT-based monitoring systems can enable real-time yield analytics and remote monitoring. The project also has strong potential for commercialization through AgriTech startups, with plans to pilot the technology with 100 farmers initially and expand to larger agricultural markets across Karnataka and other states.