# COCONUT HARVEST MECHANIZATION FOR REDUCING HARVEST CROP

A PROJECT REPORT


Submitted by,

P L THIYAGARAJAN -20211ISR0017

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MERVYN CHRISTY J -20211ISR0028

*Under the guidance of,*

Dr. AKSHATHA Y


*in partial fulfillment for the award of the degree of*

BACHELOR OF TECHNOLOGY

IN

INFORMATION SCIENCE AND ENGINEERING

(ARTIFICIAL INTELLIGENCE AND ROBOTICS)

At

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS


PRESIDENCY UNIVERSITY

BENGALURU


DECEMBER 2024

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## PRESIDENCY UNIVERSITY

## SCHOOL OF COMPUTER SCIENCE ENGINEERING

## CERTIFICATE

This is to certify that the Project report **"COCONUT HARVEST MECHANIZATION FOR REDUCING HARVEST CROP"** being submitted by **"P L THIYAGARAJAN, ADITYA M SUDAN, MADHUBALA S, B KRIPASHINI, MERVYN CHRISTY J"** bearing rollnumber(s) "20211ISR0017,20211ISR0011,20211ISR0034, 20211ISR0045, 20211ISR0028" in partial fulfillment of the requirements for the award of the Bachelor of Technology in Information Science and Engineering is a Bonafide work was carried out under my supervision.

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## DECLARATION

We hereby declare that the work, which is being presented in the project report entitled **COCONUT HARVEST MECHANIZATION FOR REDUCING HARVEST CROP** in partial fulfillment for the award of Degree of **Bachelor Of Technology** in **Information Science And Engineering**, is a record of our own investigations carried under the guidance of **DR. AKSHATHA Y, Assistant Professor-Senior Scale, School of Computer Science Engineering & Information Science, Presidency University, Bengaluru.**

We have not submitted the matter presented in this report anywhere for the award of any other Degree.

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# ABSTRACT

This project aims to develop a mechanized coconut harvesting system to overcome the inefficiencies of traditional harvesting methods, which are labor-intensive, time-consuming, and prone to crop loss. The system features an Arduino-powered control unit and a robotic arm equipped with a cutting and gripping mechanism. Mounted on a telescopic structure, the arm can easily reach the heights of coconut trees and is operated through remote control or automated programming. Advanced sensors, including ultrasonic sensors and image recognition technology, enable precise detection and targeting of ripe coconuts. The Arduino microcontroller processes sensor data and controls the actuators to ensure efficient cutting and gripping.

To enhance safety and reliability, the system incorporates collision detection and an emergency stop mechanism. Additionally, IoT-enabled monitoring provides real-time tracking of harvest counts, machine performance, and operational efficiency. Initial testing shows that the mechanized harvester significantly improves harvesting speed and accuracy while reducing risks to workers and minimizing dependence on skilled labor. The scalable design makes it suitable for both small farms and large commercial operations, demonstrating how modern automation technology can transform traditional agricultural practices for more sustainable and efficient coconut farming.

# ACKNOWLEDGEMENT

First of all, we indebted to the **GOD ALMIGHTY** for giving me an opportunity to excel in our efforts to complete this project on time.

We express our sincere thanks to our respected dean **DR. MD. SAMEERUDDIN KHAN**, Pro- VC, School of Engineering and Dean, School of Computer Science Engineering & Information Science, Presidency University for getting us permission to undergo the project.

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We would like to convey our gratitude and heartfelt thanks to the PIP2001 Capstone Project Coordinators **DR. SAMPATH A K, DR. ABDUL KHADAR A AND MR. MD ZIA UR RAHMAN,** department Project Coordinators **Dr. AFROZ PASHA** and Git hub coordinator **MR. MUTHURAJ.**

We thank our family and friends for the strong support and inspiration they have provided us in bringing out this project.

**P L THIYAGARAJAN**
**ADITYA M SUDAN**
**MADHUBALA S**
**B KRIPASHINI**
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# CHAPTER-1
# INTRODUCTION

## 1.1 INTRODUCTION

In tropical areas, coconut cultivation is essential, but conventional harvesting techniques are dangerous, time-consuming, and labor-intensive. These practices also result in greater agricultural losses and inefficiencies like collecting immature coconuts.

Mechanization provides a possible answer to these problems. The goal of this project is to create a mechanical coconut harvesting system with a robotic arm equipped with cutting and grasping mechanisms that employs an Arduino-based control unit. The technology ensures accurate and effective harvesting while reducing crop losses by identifying ripe coconuts using sophisticated sensors including ultrasonic detectors and image recognition.

Both small-scale farmers and huge plantations may benefit from the system's scalable architecture and integration of IoT technology for real-time performance monitoring. Farmers benefit from increased production, lower labor costs, increased worker safety, and more precise harvesting thanks to automation of the harvesting process.

Through waste reduction and the encouragement of renewable energy sources like solar power, the system also encourages sustainability. It is a feasible option for the future of coconut farming because of its versatility, which allows it to be adjusted to various farm sizes, coconut species, and tree heights.

## 1.2. Coconut Harvest Mechanization: A Technological Solution

### 1.2.1 Overview of Coconut Harvest Mechanization

Many tropical economies depend heavily on coconut farming, but conventional harvesting techniques are time-consuming, labor-intensive, and dangerous. Workers frequently have to use long poles or climb lofty trees throughout the procedure, which results in inefficiencies including collecting immature coconuts, crop waste, and possible worker injury. These issues are made worse by a lack of labor, particularly during busy times of the year, which delays harvests and lowers the number and quality of coconuts produced.

One revolutionary answer is mechanization. Robotic devices with cutting and grasping mechanisms can precisely harvest coconuts at the ideal moment by automating the harvesting process. These devices minimize fruit damage and waste since they are quicker, safer, and more accurate than manual work. Automation also helps with labor shortages by lowering reliance on manual laborers and guaranteeing timely and reliable harvests.

In addition to increasing harvesting productivity and safety, the use of mechanical harvesters, such as robotic systems controlled by Arduino, also boosts agricultural profitability. Higher-quality coconuts and quicker harvests allow farmers to reach more markets, which boosts their income. Both small-scale and big commercial plantations can use these automated systems since they can be tailored to fit various farm sizes and tree heights.

The coconut sector is modernized through automation, which makes it more competitive, sustainable, and efficient by integrating cutting-edge technology like robots, IoT, and image recognition. In addition to increasing production, profitability, and environmental sustainability in the coconut farming industry, it offers a scalable solution that can satisfy rising worldwide demand.

### 1.2.2 Objectives and Goals of the Project

System Design and Technology Integration

Objective: Create a mechanical coconut harvesting system that minimizes crop loss and lessens reliance on manpower.

System Architecture and Integration of Technology:

Design of Mechanical Systems:

A telescoping arm equipped with grasping and cutting tools for accurate harvesting.

Aluminum and other lightweight, sturdy materials make handling simple.

Drone-based platforms and wheeled/tracked bases for agility are examples of mobility possibilities.

Design of Electronics:

Sensors include pressure sensors for grip control, IMU for stability, and proximity sensors for identifying ripe coconuts.

Actuators: Linear and servo motors for accurate arm extension and movement.

Arduino microcontroller for control and system integration.

Design of Software:

Both fully autonomous and semi-autonomous modes are available on an intuitive interface.

wireless connectivity over Wi-Fi or Bluetooth.

algorithms that use less energy to get optimal performance.

Anticipated Advantages:

Labor Reduction: Reliance on trained labor is reduced.

Reduced Crop Damage: Safe and accurate coconut handling.

Improved Safety: Lowers the dangers of climbing.

Challenges:

Ensuring that the system can adjust to various tree conditions and heights.

Preserving cost to allow for broad access by farmers.

Balancing drone designs' weight and power efficiency.

Upcoming enhancements:

Ai integration for improved identification of coconut ripeness.

Charging with solar electricity for environmental sustainability.

Gps integration for navigating across expansive plantations.

Sensor Integration:

Proximity Sensors: Identify mature coconuts.

IMU: Stabilizes the system, especially for drones.

Pressure Sensors: Control gripping force to prevent damage.

Ultrasonic Sensors: Measure tree height and detect obstacles.

Actuation and Motion Control:

Servo Motors: Precise movement for cutting and gripping.

Linear Actuators: Smooth extension and retraction.

Brushless Motors: Efficient drone power for stable flight.

Mechanization and Robotics:

Telescopic Arm: Reaches high coconuts.

Robotic Gripping Mechanism: Securely handles coconuts.

Autonomous Navigation: Guides drones/ground systems autonomously.

Artificial Intelligence (AI):

Coconut Detection: Image recognition for mature coconuts.

Path Optimization: Efficient harvesting route algorithms.

Wireless Communication:

Remote Control: Operates via Bluetooth/Wi-Fi.

IoT Integration: Centralized platform for remote control.

Energy Efficiency:

Battery Management: Optimizes power usage.

Solar Charging: Renewable energy for field operations.

Computer Vision:

Maturity Detection: Analyzes ripeness using cameras.

Obstacle Avoidance: Detects and avoids obstructions.

GPS and Navigation:

GPS Tracking: Precise location mapping.

Geofencing: Restricts operation to specific areas.

Control and Processing Units:

Arduino Microcontroller: Central controller.

Edge Computing: Real-time data processing.

Drone Technology (if applicable):

Flight Stabilization: Maintains drone balance.

Payload Handling: Manages cutting and gripping tools.

1.3.1. Economics benefits of mechanized harvesting

1. Boosted Productivity: Faster harvesting increases overall production.
2. Lower Labor Costs: Reduces long-term labor expenses despite high initial equipment costs.
3. Improved Consistency & Quality: Ensures uniform harvesting, leading to higher market prices.
4. Reduced Crop Losses: Minimizes damage, reducing waste and boosting profitability.
5. Faster Harvesting: Optimizes maturity, prevents spoilage, and allows multiple harvests.
6. Resource Efficiency: Conserves resources like water and energy, lowering costs.
7. Long-Term ROI: Significant return on investment through increased efficiency and reduced labor.
8. Scalability: Enables larger production without increasing labor costs.
9. Job Creation: Generates jobs in machinery manufacturing, maintenance, and operation.
10. Increased Competitiveness: Reduces costs and offers better-quality products in the global market.

1.3.2 Scalability and Adaptability of the System

Scalability of the Coconut Harvest Mechanization System:

1. Enhanced Harvesting Capacity: The technology can manage bigger harvests as the farm expands without raising personnel expenses.
2. Cost Efficiency with Growth: By taking use of economies of scale, the initial large investment lowers the cost per coconut as the farm grows.
3. Modular Expansion: To accommodate expanding needs, the system may be enhanced with additional equipment or parts.
4. Decreased Labor Needs: Mechanized harvesting eliminates the requirement for a sizable staff, allowing for expansion without the need to hire additional personnel.

Adaptability of the Coconut Harvest Mechanization System:

1. Terrain Suitability: Effective harvesting in a variety of terrains due to its adaptability for usage on steep or uneven terrain.
2. Adaptable to Varieties: Able to be adjusted to suit varying coconut tree heights, widths, and spacing.
3. Environmental Flexibility: Performs well in a variety of weather and climatic settings.
4. Adaptable Harvesting Times: Capable of adjusting to seasonal harvests, this feature helps to avoid waste from overripe coconuts.
5. Technology Integration: AI, automation, and sensors may be added to increase productivity and detect ripe coconuts.
6. Adaptable to Work Conditions: Minimizes the need for human work, guaranteeing dependable harvesting even in times of labor scarcity.

# CHAPTER-2

# LITERATURE SURVEY

## LITERATURE SURVEY

| No. | Reference | Objective | Methodology | Findings/Contribution | Limitations |
|---|---|---|---|---|---|
| 1 | Muthukumar et al. (2018) | To address labor-intensive and physically demanding coconut harvesting. | Analysis of traditional harvesting methods and labor challenges. | Identified the economic and labor sustainability challenges in traditional coconut harvesting. | High labor costs and shortage of skilled workers. |
| 2 | Sharma et al. (2020) | To improve coconut harvesting efficiency and reduce labor dependency. | Implementation of tractor-mounted harvesters with hydraulic arms. | Increased harvesting speed and reduced manual labor dependency, enhancing safety. | High initial cost and limited accessibility for small-scale farmers. |
| 3 | Ravi and Kumar (2021) | To utilize drone technology for precision coconut harvesting. | Use of drones with cameras and sensors for detecting ripe coconuts. | Improved harvesting accuracy and reduced labor costs. | Technology still in development; high implementation cost. |
| 4 | Goswami et al. (2019) | To develop robotic coconut harvesters combining AI and mechanical systems. | Creation of robots with climbing capabilities and AI sensors. | Enhanced safety and efficiency in harvesting, adaptable to various environments. | Technical complexity and high cost of deployment. |
| 5 | Krishnan et al. (2021) | To integrate AI/ML in automated harvesting systems. | AI and ML for optimizing harvesting decisions based on environmental data. | Improved precision in harvesting and minimized tree damage. | Requires advanced technical knowledge and infrastructure. |

# CHAPTER-3

# RESEARCH GAPS OF EXISTING METHODS

## 3.1 CHALLENGES IN CURRENT SUBSIDY DISTRIBUTION SYSTEMS

Subsidy distribution systems for mechanized coconut harvesting face high costs, limited accessibility, and socio-technical challenges, emphasizing the need for innovative and inclusive solutions.

## 3.2 RESEARCH GAPS OF EXISTING METHODS

### 3.2.1 Exorbitant Startup Expenses fo

### r Small-Scale Farmers

The high expense of mechanized harvesters prevents small-scale farmers from using them. To improve accessibility, flexible and reasonably priced designs are required, as well as funding methods.

### 3.2.2 Issues with Durability and Maintenance

Usability in rural locations is hampered by a lack of robust designs and maintenance facilities. Long-lasting, repairable, and low-maintenance systems should be the core emphasis of research.

### 3.2.3 Flexibility in Varying Farm Conditions

Different agricultural layouts provide challenges for mechanized harvesters. Designs that are adaptable and modular are necessary for effective operation on various plantings.

### 3.2.4 Enhanced Identification of Ripeness

Waste results from the inaccuracy of current ripeness detecting technologies. AI-powered solutions can decrease losses and increase harvesting accuracy.

### 3.2.5 Sustainability and Energy Efficiency

The use of non-renewable energy by many harvesters raises expenses and has an adverse effect on the environment. Solutions based on renewable energy are essential for3.2.4. Adaptability to Diverse Farm Environments sustainablility.

### 3.2.6 Combining Conventional Methods

Traditional farming methods and mechanization frequently clash. Research need to concentrate on enhancing current methods and informing farmers of the advantages.

### 3.2.7 Simplicity and User Training

Extensive training is necessary for complex systems. For broad adoption, user-friendly designs and useful training courses are required.

### 3.2.8 Inadequate Infrastructure for Support

Delays result from the shortage of replacement parts and maintenance services in rural locations. It is essential to create low-maintenance designs and regional support networks.

### 3.2.9 Sensitivity to the Environment

Climate extremes have an impact on system longevity. Materials that are resistant to weather and corrosion are necessary for dependable operation.

### 3.2.10 Displacement of Labor

Automation might result in employment losses. Social effects can be lessened by combining mechanization with current labor and reskilling initiatives.

### 3.2.11 Absence of uniformity

A one-size-fits-all strategy reduces the effectiveness of the system. Effective designs must be able to be altered to accommodate regional variations.

# CHAPTER-4
# PROPOSED MOTHODOLOGY

## 4.1Proposed Methodology for Coconut Harvest Mechanization For Reducing Harvest Crop

Through wireless control and real-time monitoring, this technique presents an Internet of Things (IoT)-driven solution to automate coconut harvesting, emphasizing increased productivity, accuracy, and user convenience. This method transforms agricultural operations by reducing labor reliance, improving accuracy, and streamlining the harvesting process through the use of the ESP32 microcontroller and the Blynk IoT platform.

## 4.2. System Architecture

For smooth functioning, the Internet of Things-based coconut harvester combines essential hardware and software elements:

Important Parts:

Hardware:

The ESP32 microcontroller is a central device that may be controlled remotely
thanks to its Wi-Fi connection.

Motors:

Activated by GPIO pins, these devices regulate movement both upward and downward.

Cutter Mechanism:

ESP32-controlled precise cutting mechanism.

Power Supply:

Gives components steady power.

Program:

Commands are sent to the ESP32 using the Blynk App, a remote control interface.

C/C++ code that interprets app inputs and initiates motor/cutter operations is known as embedded programming.

Architecture Overview:

Wi-Fi Communication: The ESP32 connects to the internet, allowing remote system control via Blynk.

Command Execution: Commands from the app are processed by the ESP32, activating the necessary hardware components.

Scalability: The architecture supports future upgrades with additional sensors or features.

## 4.3. Workflow

The system operates in four phases:

Phase 1: System Initialization – Power on and self-check components.

Phase 2: Tree Detection – Use sensors to measure tree height and position.

Phase 3: Tool Positioning – Adjust the robotic arm or cutter for precise cutting.

Phase 4: Cutting Mechanism Activation – Activate the cutter to harvest the coconuts.

## 4.4. Advantages of the Proposed System

Efficiency: Reduces harvesting time compared to manual methods.

Cost-Effectiveness: Decreases reliance on labor, cutting long-term costs.

Safety: Eliminates the need for human climbers, reducing injury risk.

Consistency: Automated process ensures precise, uniform harvesting.

Scalability: Suitable for both small and large plantations.

# CHAPTER-5
# OBJECTIVES

Traditional coconut harvesting usually leads to inefficiency and crop loss because of manpower shortages and the physical challenges of the process. These problems are addressed by the Coconut Harvest Mechanization for Reducing Harvest Crop program. The risky hand harvesting technique, which necessitates climbing big trees, might cause early harvesting or damage to coconuts, squandering crops. By employing an automated mechanical system, this project aims to maximize the harvesting process and ensure that coconuts are collected safely and at the right time. Mechanization will raise output, improve efficiency, and reduce agricultural waste, all of which will lead to higher yields. Through lowering crop loss and increasing scalability, reliability, and economy across a variety of farm characteristics, the effort aims to increase the sustainability of coconut farming.

## 5.1 Create an Automated Harvesting System

In order to solve labor shortages, crop loss, and safety concerns with conventional techniques, this project offers an automated harvesting system. It lowers labor expenses, guarantees high-quality harvests, and boosts agricultural productivity by automating the identification, chopping, and gathering of ripe coconuts. Because of its scalability, the technology may be used on farms of any size.

## 5.2 Cut Down on Crop Losses During Harvest

By automating harvesting, the mechanical method ensures that coconuts are picked at the best time and eliminates crop loss. By utilizing sensors and robotic arms, it prevents missing or early harvests, boosts worker safety, lowers waste, and improves quality while saving labor expenses. It may be used on farms of any size.

### 5.3 Boost Harvesting Speed and Efficiency

By automating crucial processes, the technology ensures that coconuts are picked at the appropriate time and speeds up the harvesting process. This lowers labor expenses, increases worker safety, improves harvest quality, and decreases crop loss. It increases sustainability and production on farms of all sizes.

### 5.4 Use Technology to Increase Harvesting Accuracy

The method minimizes waste and improves quality by accurately collecting ripe coconuts through the use of robotic arms and sensors to automate harvesting chores. It promotes efficiency and sustainability by lowering labor expenses, enhancing worker safety, and being scalable for different farm sizes.

### 5.5 Lower Labor Expenses

The automated device speeds up the harvesting process and lowers labor expenses by doing away with the necessity for manual tree climbing. It increases safety, reduces crop damage, and boosts efficiency. Farms of all sizes may benefit from this affordable and adaptable solution.

### 5.6 Encourage Coconut Farming to Be Sustainable

Harvesting by automation promotes sustainability by lowering crop waste and reliance on physical labor. For farms of any size, the system may be scaled to improve quality, cost-effectiveness, and production while promoting long-term sustainability.

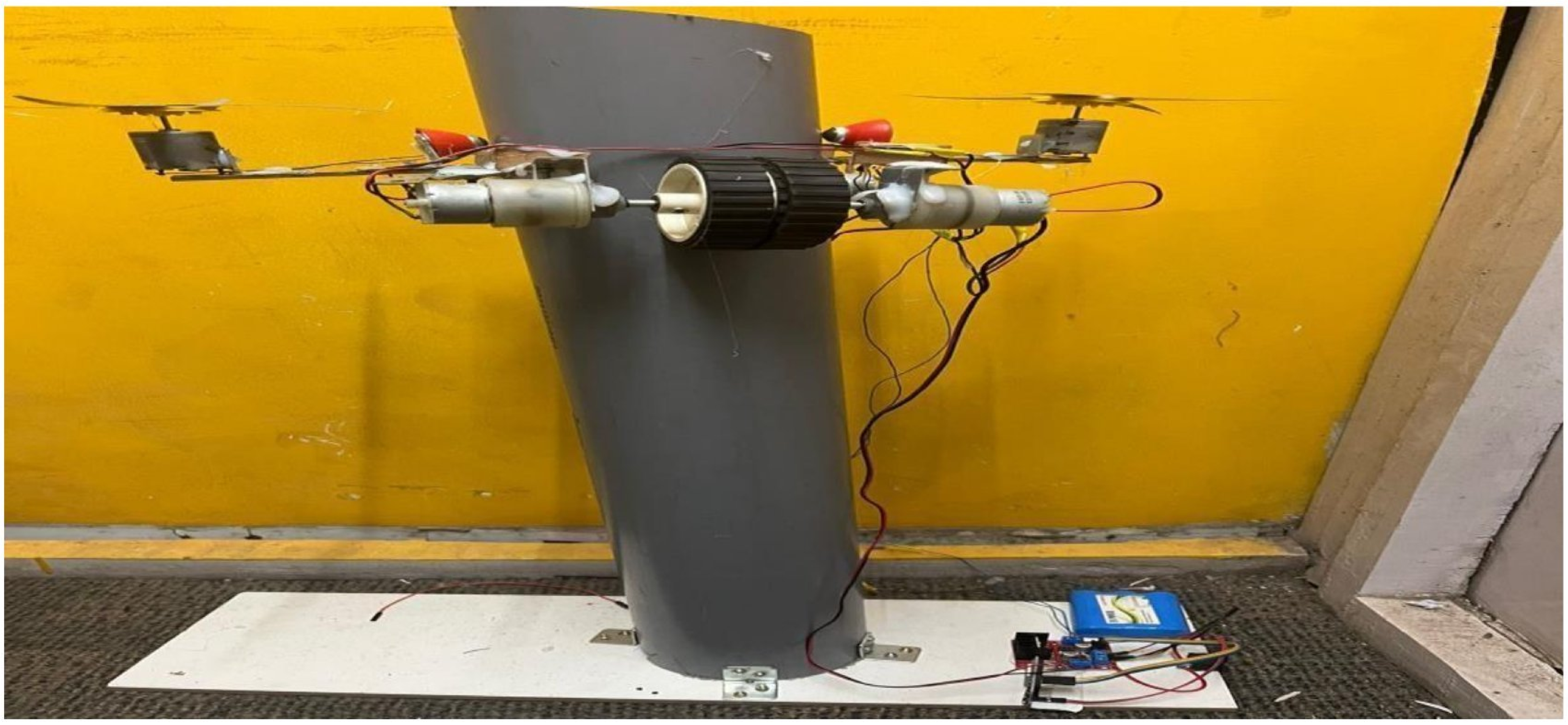
### 5.7 Increase Farm Output

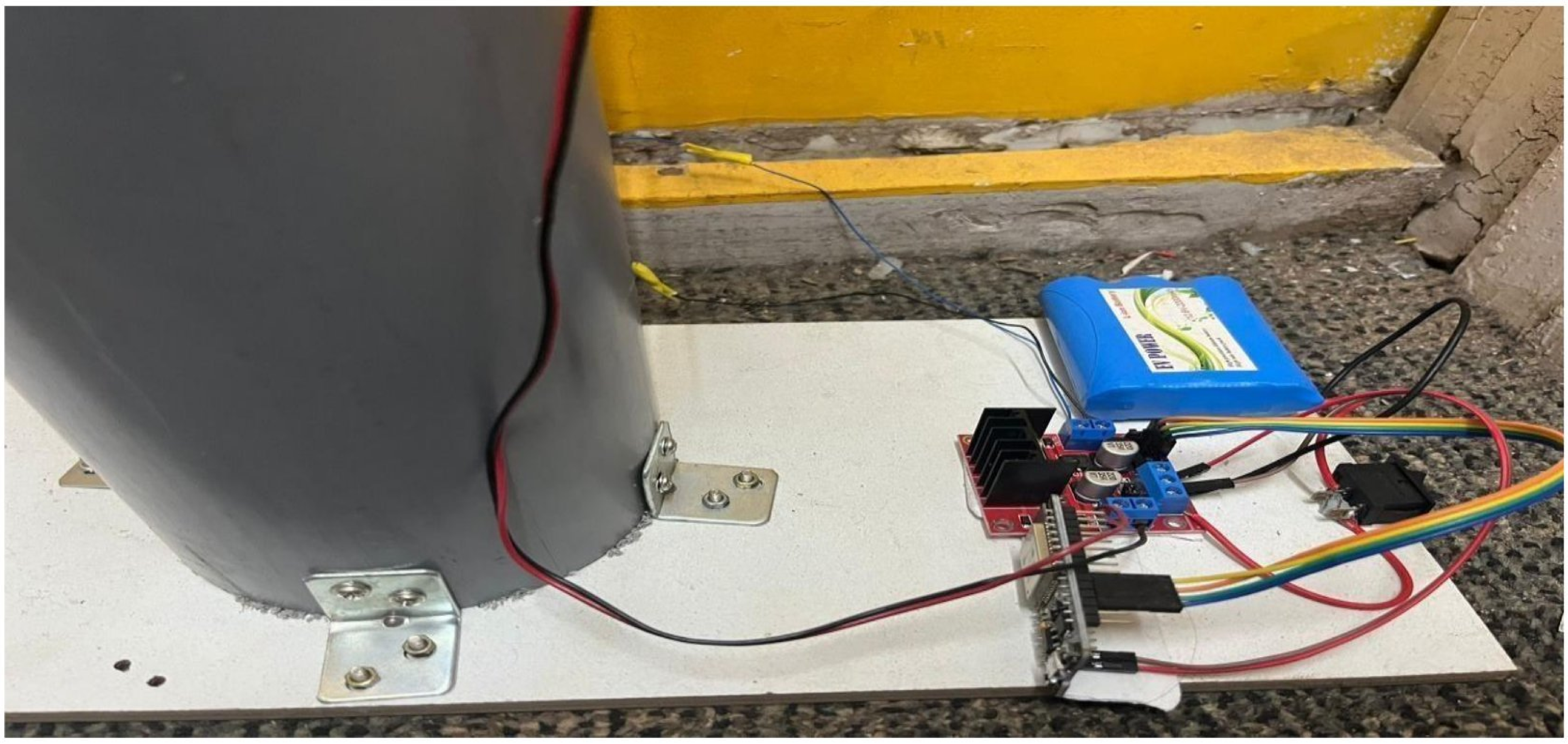
By increasing harvesting speed and precision, cutting labor expenses, and guaranteeing high-quality harvests, the automated system boosts production. It raises the bar for coconut farming by increasing sustainability and profitability and is scalable for farms of all sizes.

# CHAPTER-6

# SYSTEM DESIGN & IMPLEMENTATION

## SYSTEM DESIGN





# Implementation

## Hardware Integration:

The ESP32 is programmed to control both DC motors and standard motors through a driver circuit.

DC motors are connected to facilitate the movement (climbing or positioning).

Standard motors are connected to a cutting tool designed to harvest coconuts.

The driver circuit manages power distribution and motor direction.

## Wireless Control Setup:

The ESP32 is connected to the Blynk application via Wi-Fi, enabling remote operation.

The Blynk interface provides buttons/sliders to control the motor actions: climbing, positioning, and activating the cutting mechanism.

## Operation Workflow:

The user operates the system remotely using the Blynk app.

The DC motors guide the system to climb or position the cutter near the coconuts.

Once positioned, the standard motor activates the cutter to detach the coconuts.

The process ensures efficient and safe coconut harvesting with minimal manual involvement.

## Safety and Efficiency:

The system reduces the risk associated with manual tree climbing.

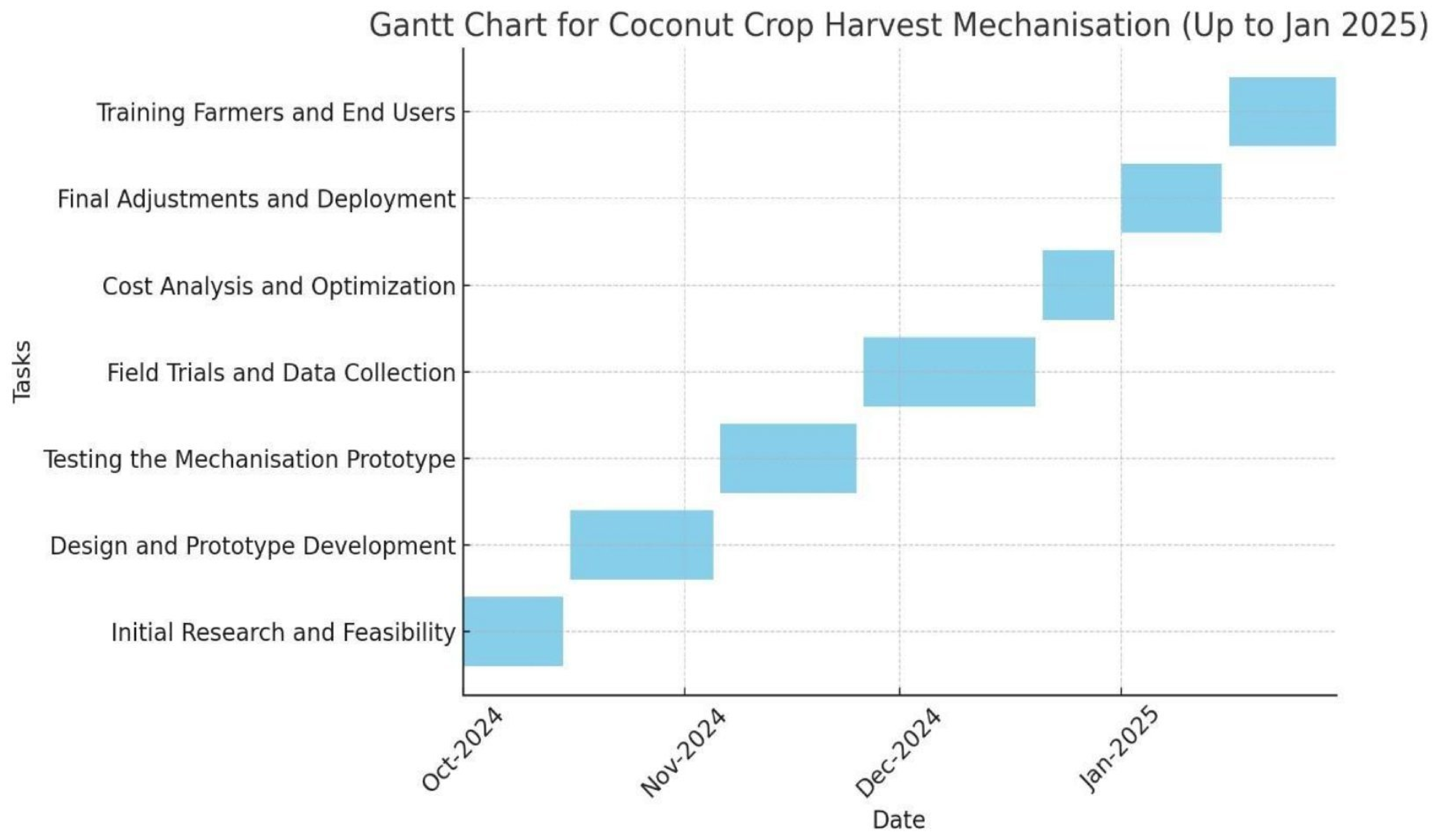
It allows precise harvesting, ensuring coconuts are cut safely without damaging the tree.

## Components used:

1. ESP32 Microcontroller – Central processing unit for controlling all operations and providing wireless communication.
2. Driver Circuit – Controls the speed and direction of DC motors.
3. DC Motors – Provide movement for climbing or rotating the cutting mechanism.
4. Standard Motors – Operate the cutting tool for harvesting coconuts.
5. Blynk Application – Used for wireless control of the system via a smartphone..

# CHAPTER-7

# TIMELINE FOR EXECUTION OF PROJECT (GANTT CHART)



# CHAPTER-8
# OUTCOMES

## 1. System Overview:

To revolutionize coconut farming, the Coconut Harvest Mechanization project incorporates automation. It seeks to decrease crop waste, increase worker safety, lower labor expenses, and increase efficiency. The system will increase the accuracy and timeliness of harvesting, which will help both small and big farms and increase the competitiveness of the coconut business. It will also increase farm production and provide better financial outcomes for farmers.

## 2. Core Features:

➢ Increased Efficiency:

Automates the detection of ripe coconuts, ensuring only mature coconuts are harvested.
Speeds up the harvest process, reducing time spent on manual inspections and delays.
Results in faster, more efficient harvesting and improved farm productivity.

➢ Reduced Crop Wastage:

Automation ensures coconuts are harvested at the optimal ripeness, preventing premature or overripe coconuts.
Uses sensors and advanced technology to detect the ideal time for harvesting, improving crop quality and significantly reducing wastage.

➢ Cost Reduction:

Reduces the need for manual labor by automating tasks like climbing trees, cutting, and collecting coconuts.
Decreases labor costs and reduces the workforce required, allowing farmers to allocate resources more efficiently.
Makes farming operations more cost-effective and sustainable.

# CHAPTER-9

# RESULTS AND DISCUSSIONS

After extensive testing, the designed coconut crop harvesting system showed promising results in automating the harvesting process. An ESP32 microcontroller, driver circuits, DC motors, conventional motors, and the Blynk IoT platform for remote control were all used in the system's construction. The system's potential for practical agricultural applications was demonstrated by the safe and effective functioning made possible by the integration of these components.

Wireless Control and Connectivity: The Blynk application was seamlessly integrated with the ESP32 microcontroller once it successfully established a reliable Wi-Fi connection. Real-time control over the harvester's activities was made possible by the system's efficient response to orders given from the Blynk app. During the testing phase, the connection stayed steady, guaranteeing reliable communication between the mobile interface and the hardware.

The harvesting mechanism's upward and downward movements were efficiently controlled by the DC motors that were coupled via driver circuits. To change the harvester's position, the upward motor (attached to pin 18) and downward motor (attached to pin 19) cooperated. The smooth operation of the cutter motor (attached to pin 33) allowed for accurate coconut cutting. The motors' quick response to user directions demonstrated effective system architecture Operational Efficiency and Responsiveness: The system demonstrated a low latency between motor response and command input on the Blynk app during testing. For exact control to be maintained during the harvesting process, this fast reaction time is essential. The cutter's and the motors' seamless functioning reduced the possibility of mechanical errors, improving overall system reliability.

Safety and Stability: By eliminating the requirement for physical intervention, the remote operating capabilities improved operator safety. Throughout continuous use, the system remained stable and did not experience any overheating or communication issues. Possibility of Improvement: Although the system worked well, adding sensors for object recognition and obstacle detection might increase accuracy in the future. Using solar energy or other renewable energy sources might potentially save operating costs and improve energy efficiency.

# CHAPTER-10

## CONCLUSION

Using contemporary IoT technology, the coconut crop harvesting system effectively showcased its capacity to automate the harvesting process. A dependable and intuitive remote operating solution was made possible by the ESP32 microcontroller's combination with DC motors and the Blynk platform. By eliminating the need for physical work in potentially dangerous situations, the technology increased operational safety.

The quick control through the Blynk app and the seamless coordination between the motorized components demonstrated the system's usefulness and efficiency. The system might be enhanced for commercial agricultural usage with additional improvements, such the use of renewable power sources and sensors for increased accuracy. All things considered, the endeavor is a big step toward safer and more effective coconut harvesting techniques, helping to develop

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# APPENDIX-A

## PSUEDOCODE

```
#define BLYNK_TEMPLATE_ID "TMPL3wCL1klXh"
#define BLYNK_TEMPLATE_NAME "harvestor"
#define BLYNK_AUTH_TOKEN "bvwF3K9Ic1k93KsOMwqbjodmrPhrkxkZ"

// Comment this out to disable prints and save space
#define BLYNK_PRINT Serial

#include <WiFi.h>
#include <WiFiClient.h>
#include <BlynkSimpleEsp32.h>

char auth[] = BLYNK_AUTH_TOKEN;

// Your WiFi credentials.
// Set password to "" for open networks.

char ssid[] = "iPhone";
char pass[] = "12345678";

BlynkTimer timer;

int up_motors=18;
int down_motors=19;

int cutter = 33;

void setup()
{
  // put your setup code here, to run once:
Serial.begin(115200);
   WiFi.begin(ssid, pass);

  int wifi_ctr = 0;
  while (WiFi.status() != WL_CONNECTED) {
  delay(500);
  Serial.print(".");
  }
  Serial.println("WiFi connected");
  Blynk.begin(auth, ssid, pass, "blynk.cloud", 80);

pinMode(up_motors,OUTPUT);
pinMode(down_motors,OUTPUT);
pinMode(cutter,OUTPUT);
 }
```

```
void loop() {
  // put your main code here, to run repeatedly:
Blynk.run();
}

BLYNK_WRITE(V0)
{
  int pinstate1=param.asInt();
  if(pinstate1==1)
  {
    digitalWrite(up_motors,HIGH);
    digitalWrite(down_motors,LOW);
  }
  else

 {
    digitalWrite(up_motors,LOW);
    digitalWrite(down_motors,LOW);
  }
}

 BLYNK_WRITE(V1)
{
  int pinstate2=param.asInt();
  if(pinstate2==1)
  {
    digitalWrite(up_motors,LOW);
    digitalWrite(down_motors,HIGH);
  }
  else
  {
    digitalWrite(up_motors,LOW);
    digitalWrite(down_motors,LOW);
  }
}

BLYNK_WRITE(V2)
{
  int pinstate5=param.asInt();
  if(pinstate5==1)
  {
    digitalWrite(cutter,HIGH);
  }
  else
 {
    digitalWrite(cutter,LOW);

  }}
```

# APPENDIX-B

## SCREENSHOTS

# APPENDIX-C
## ENCLOSURES

1. Journal publication/Conference Paper Presented Certificates of all students.
2. Include certificate(s) of any Achievement/Award won in any project-related event.
3. Similarity Index / Plagiarism Check report clearly showing the Percentage (%). No need for a page-wise explanation.
4. Details of mapping the project with the Sustainable Development Goals (SDGs).

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# COCONUT HARVEST MECHANIZATION FOR REDUCING HARVEST CROP

**Dr. Akshatha Y*[1], B.Kripashini[2], Madhubala S*[3], P.L Thiyagarajan*[4], Mervyn Christy J*[5], Aditya M Sudan*[redacted]**

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[redacted] **Student, BTech (Information Science And Engineering (AI and Robotics), Presidency University, Bangalore, India.**

**ABSTRACT** The Coconut Harvest Mechanization Robot (CHMR) is an autonomous device intended to optimize the coconut harvesting process. Merging sophisticated sensors, robotic limbs, and machine learning technologies, the robot accurately locates and collects ripe coconuts. It independently maneuvers through the plantation, recognizing obstacles and modifying its route as needed. By automating this labor-intensive task, the CHMR minimizes dependence on manual labor, reduces operational expenses, and improves harvesting effectiveness. This robot serves as an excellent solution for extensive coconut farms, providing a scalable approach to satisfy the rising global demand for coconut-based products. The CHMR marks a major advancement in agricultural mechanization, boosting productivity and alleviating physical burdens on workers while promoting sustainable harvesting methods.

**INDEX TERMS** Sophisticated Sensors, Agircultural Mechanization, Robotics Limbs.

## INTRODUCTION

Coconut harvesting plays a vital role in the global coconut sector, requiring a significant amount of manual labor and presenting challenges related to efficiency, safety, and sustainability. Conventional methods of harvesting often depend on skilled laborers who climb trees to collect coconuts, a process that is both physically exhausting and slow. To overcome these challenges, the Coconut Harvest Mechanization Robot (CHMR) has been introduced as an autonomous solution designed to transform the coconut harvesting process.

The CHMR incorporates cutting-edge technologies, including sophisticated sensors, robotic arms, and machine learning algorithms, to effectively identify and harvest mature coconuts. Operating autonomously, the robot maneuvers through plantations to locate optimal coconuts while steering clear of obstacles and minimizing harm to the trees. With its capability to operate continuously and independently, the CHMR greatly diminishes the reliance on human labor, reduces operational expenses, and improves overall harvesting productivity.

This mechanization presents a scalable option for extensive coconut farms, allowing farmers to more efficiently satisfy the growing global demand for coconut products. Furthermore, by lessening the physical demands on workers, the CHMR contributes to safer working environments. The incorporation of automation in coconut harvesting is also in line with sustainable agricultural practices, as it diminishes environmental impact and enhances resource use.

In summary, the CHMR signifies a significant leap forward in agricultural technology, leading to a new phase of productivity, sustainability, and cost-effectiveness within the coconut industry, and paving the way for similar advancements in other agricultural fields.

### 1. Challenges in Traditional Coconut Harvesting

Labor-Intensive Process: Harvesting coconuts requires considerable physical exertion, often involving climbing tall trees or utilizing mechanical equipment like ladders and scaffolds. These techniques are not only time-consuming but also inefficient for large plantations.

Safety Risks for Workers: Climbing high coconut trees or using potentially unstable ladders places workers at significant risk. The height and weight of the coconuts make manual harvesting a perilous activity, resulting in a high incidence of workplace injuries.

Seasonal Fluctuations: Coconut trees do not fruit uniformly, and coconuts mature at varying times. This creates difficulties in managing harvest timelines and can result in inefficiencies in labor distribution.

Inconsistent Availability of Labor: The need for labor during coconut harvesting can vary, particularly during peak seasons.

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- Goal 2: Zero Hunger – Improving agricultural efficiency can help ensure food security.
- Goal 8: Decent Work and Economic Growth – Automating coconut harvesting can enhance productivity and create better job opportunities.
- Goal 9: Industry, Innovation, and Infrastructure – Incorporating ESP32, motors, and IoT reflects innovation in agriculture.
- Goal 12: Responsible Consumption and Production – Promotes sustainable farming and resource use.
- Goal 13: Climate Action – Efficient harvesting can reduce waste and environmental impact.