Arecanut Tree Climber and Pesticide Sprayer

Submitted in partial fulfilment of the requirements

of the degree of

Bachelor of Engineering

by

1. Priyam More

2. Neeraj Mishra

3. Nitin Rajbhar

4. Shriyan Pagadala

Supervisor

Prof. Sweta Waghmare

PILLAI COLLEGE OF ENGINEERING

Department of Electronics & Telecommunication Engineering

MES's Pillai College of Engineering,

New Panvel, Navi Mumbai 410 206

2021-22

Department of Electronics & Telecommunication Engineering

MES's Pillai College of Engineering,

New Panvel – 410 206

CERTIFICATE

This project report entitled **"Arecanut Tree Climber and Pesticide Sprayer"** by the following students

Priyam More

Neeraj Mishra

Nitin Rajbhar

Shriyan Pagadala

is certified for the submission for the degree of Bachelor of Electronics& Telecommunication Engineering.

Prof. Sweta Waghmare	Prof. Ajit Saraf
SUPERVISOR	PROJECT COORDINATOR
Department of	Department of
Electronics & Telecommunication Engineering	Electronics & Telecommunication Engineering

Prof. Avinash R. Vaidya

HEAD
Department of Electronics & Telecommunication Engineering

Dr.Sandeep M. Joshi

PRINCIPAL

MES's Pillai College of Engineering

Date: Place:NewPanvel

Department of Electronics & Telecommunication Engineering

MES's Pillai College of Engineering,

New Panvel – 410 206

Project Report Approval

This project report entitled **"Arecanut Tree Climber and Pesticide Sprayer"**

By

1. Priyam More
2. Neeraj Mishra
3. Nitin Rajbhar
4. Shriyan Pagadala

is approved for the degree of Bachelor of Electronics & Telecommunication Engineering.

Examiners

1.--

2.--

Supervisors

1.--

2.--

Chairman

Date: Place:NewPanvel

Declaration

We declare that this written submission for B.E project entitled "Arecanut Tree Climber and Pesticide Sprayer" represents our ideas in our own words and where others ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Priyam More	-----------------------------------
(Name of student.)	(Signature)
Neeraj Mishra	-----------------------------------
(Name of student.)	(Signature)
Nitin Rajbhar	-----------------------------------
(Name of student.)	(Signature)
Shriyan Pagadala	-----------------------------------
(Name of student.)	(Signature)

Date:

ACKNOWLEDGEMENT

It gives us great pleasure and immense satisfaction to present this report on our project "Arecanut Tree Climber and Pesticide Sprayer", which became possible due to the unstinted guidance and focused direction of, Prof. Ajit Saraf , Electronics & Telecommunication Department.

We express our sincere gratitude to Dr. Avinash Vaidya , HOD, Electronics & Telecommunication Department without whom it would not have been possible to successfully accomplish our project.

We also thank to our senior faculty members of Electronics department, Prof. Jayshree Bhosale , Prof. Ishmeet Sir , Prof. Sweta Waghmare for their time to time suggestions to develop the project.

Furthermore, we are indebted to the Principal Dr. Sandeep Joshi whose constant encouragement and motivation inspired us to do our best.

Last, but not the least, we sincerely thank our family members, colleagues and all the others who directly or indirectly contributed in making our task easier.

INDEX

ABSTRACT

This paper presents a compact, cost-friendly Arecanut Tree climber and Pesticide Sprayer with a spraying mechanism for spraying pesticides. The movement is offered by claws made of lightweight and recycled material fitted with four 5V DC motors and IR sensors. The central control is provided by Raspberry Pi 4 with a pump for the spraying mechanism. This spraying mechanism will spray the pesticide in stored in the container. The system is powered by 5v adapter which gives Ac supply and is given with a 16x2 display, which displays the commands given by Raspberry pi4. The design and fabrication of arecanut tree climbing and spraying machine is presented in this paper. The device consists of a hexagonal base frame which supports all the components to be built upon. It is fitted with three DC motors. A specially designed remote- controlled unit is mounted on the frame. Power from the Adapter is supplied to the motors using flexible wires. Movement of the dc motors and the spraying pump are controlled by the IR operated 8 channel relay system. To accommodate for change in the diameter of arecanut tree as the device moves up and down,a screw loaded mechanism is used for exerting sufficient tension required for gripping the tree .

Index Terms— Arecanut, Raspberry Pi, Claws, Robot, Tree climbing machine, Spraying machine.

LIST OF FIGURES, DIAGRAMS AND TABLE

Chapter 1

INTRODUCTION

SIGNIFICANCE

Arecanut farming being one of the most important agricultural practices in India forms the financial backbone of a lot of farm families. India has the largest areca nut production in the world. India's climatic conditions are ideal for Arecanut plantations. However, large-scale Arecanut farming needs a substantial amount of manures and pesticides for a good yield. Arecanut trees live over 60 years and can grow as tall as 70 feet with a trunk diameter of 15-20 cm.

Arecanut farming is one of the most labor-intensive processes and requires skilled farmers throughout production. However, labour shortage has become a challenge for Arecanut farmers. Processes in Arecanut farming include climbing the trees several times a year for pesticide spraying to prevent various diseases such as Bud-rot, fungal diseases, etc., especially in high rainfall regions. This can cause a great reduction in the Arecanut harvest. To protect Arecanut trees from these diseases as well as pests and insects, regular pesticide spraying is essential. In the traditional method, a farmer is required to climb the tree up to the top in order to spray the pesticides, and jump to the other tree posing a huge risk to the laborer’s life, especially as the laborers or farmers do not tend to be medically insured. Furthermore, exposure to these pesticides can cause severe damage to humans ranging from skin irritation to death. Even with the use of mechanical or electrical pumps for spraying pesticides, the farmer is required to climb halfway before spraying the Arecanut bushes with a nozzle. This turns out to be a waste of time and pesticide as not all of it reaches the bushes. The prototype presented here solves the problem of labour shortage as well as prevents risk to the lives of farmers. The farmers are not required to climb to a dangerous height and are not risked exposure to pesticides. The Arecanut Tree Climber and Sprayer with claws for moving up and down trees delivers pesticide directly to the bushes while the farmer can safely look over the process from the ground.

The objectives of this system are:

- To design a compact tree climber.
- To reduce the labour of tree climbing farmers.
- To make sure the tree receives organic manures and chemical fertilizers in time.
- To spray the fertilizers without human labour.

1.2 BACKGROUND

Arecanut (Areca catechu L.) is an important cash crop of India. The economic product is the fruit called "betel nut" which is used mainly for masticatory purposes. Being a highly profitable commercial plantation crop. It is important to understand the package of practices to be followed in an arecanut garden and adopt the same for maximizing the returns. All this wouldn't be possible without proper cultivation and harvesting of the Arecanut. During the season change, the Arecanut tends to be infected with bacteria which indeed spoils the nut.The plant grows in well drained, deep clay loamy soil; Laterite, red loam and alluvial soils are considered most suitable. Areca nut farming needs large application of organic manures and chemical fertilizers. The gestation period for the areca nut tree to yield fruits varies from four to eight years. Its life span is up to 60 years and in some cases even 100 years. The Arecanut tree grows to a height of 60 feet to 70 feet and measures 15 cm in diameter.It is mandatory to climb the trees a minimum of five times a year for a successful harvest - twice for the preventive spray against fungal disease, and thrice to harvest the areca nut. Koleroga is another such disease prevalent in high rainfall regions. Bud- rot, foodrot, stem breaking, inflorescence die- back, stem bleeding are other diseases which affect areca yield and cause damage in varying degrees. Yellow leaf disease has also been causing a lot of damage to arecanut. Above-mentioned problems pesticides are sprayed frequently to the Arecanut. This also solves labor problems. Also, it reduces the wastage of pesticides. The farmers are exposed to the toxicityof pesticides and suffer from pesticide poisoning which ranges from skin irritation to coma or even death.Lately, labor scarcity has emerged as one of the foremost challenges in farming. Certain crops require skilled labor throughout the process and as a result such crops have been affected the most by the aforementioned challenge. Among these, is the Arecanut. It is mandatory to climb the tree a minimum of five times a year for a successful harvest i.e., twice for the preventive spray against fungal disease, and thrice to harvest the arecanut.

1.3 SCOPE

The scope of this project is limited to climb arecanut trees having circumference between 30 and 50 cm.Therefore, maintaining sufficient friction force capable of handling the self-weight, maintaining the stability of the structure while in motion, reducing the total weight, and achieving the precise gripping are the important parameters that have to be considered. The machine should be capable of adjusting to vary the cross-section of the tree during upward and downward moments. The machine should grab the tree firmly to maintain its position during operation. The geared motor should be powerful enough to carry the payloads and weight of the machine. The tension maintained by the spring must be good enough to maintain the gripping force between the wheel and the tree. In this study, considering all the above parameters, a safe, reliable and efficient climbing and spraying machine is designed and fabricated

Chapter 2

LITERATURE REVIEW

2.1 HISTORY:

Arecanut (Areca catechu) is an important commercial plantation crop of India. The industry forms the economic backbone of a substantial number of farm families. India ranks first both area (49%) and production (50%) in the world in arecanut growing [5]. In India, as of 2013-2014, Karnataka is the largest producing state, resulting in 62.69 percent of the country's output. The plant grows in well drained, deep clay loamy soil; Laterite, red loam and alluvial soils are considered most suitable. Areca nut farming needs large application of organic manures and chemical fertilizers. The gestation period for the areca nut tree to yield fruits varies from four to eight years. Its life span is up to 60 years and in some cases even 100 years. The Arecanut tree grows to a height of 60 feet to 70 feet and measures 15 cm in diameter [6].

2.2 COMPARISON WITH EXISTING IMPLEMENTATIONS

Earlier, farmers used to climb the trees till the top and spray pesticide to the areca nut bush. After spraying pesticides to the Arecanut they would jump to the adjacent tree. This proved out to be a very risky job as they could slip and fall down and sustain serious injuries. Moreover, the tree climbers did not have any kind of medical insurance, this only worsened the problem. The modern day farmers use mechanical pumps or electric pumps to spray pesticide to the Arecanut. First the farmer has to climb the tree halfway and then use a nozzle to spray pesticide to the Arecanut. This method involves lesser risk, but it consumes a lot of time and lot of pesticide is wasted as all the pesticide does not reach the Arecanut. Therefore, a prototype electric robot is developed which climbs the tree for the required height and spray pesticides more quickly and efficiently without wasting pesticide.

SN	Paper	Advantages and Disadvantages
1.	M.I. Nor Faizal et al. [1]	Advantages: Simple, compact and low-cost pole-like tree climbing robot developed using modular mechanism. Disadvantages: Robot is unable to avoid any obstacles because there is no obstacle avoidance function installed.
2.	Shrivathsan Narayanan et al. [2]	Advantages: Maneuverability of the proposed design surpasses the state of the art tree climbing robots.. Disadvantages: In practice, the continuum manipulator is limited by the length of the springs. The springs need to be kept in constant distance throughout the manipulator to keep a uniform shape.
3.	Y. Li et al. [3]	Advantages: The robot motion analysis proves the feasibility of the design. Disadvantages: Alternate movement of the robot claws is not perfect. Claws are too rigid. Flexibility is also limited.
4.	P. S. Devang et al. [4]	Advantages: Capability of adjusting for varying diameters without an intelligent monitoring system. Reduced cost of implementation, light-weight and minimal power consumption.

Table 1.1 Literature Survery

2.3 PROBLEM DEFINITION

Lately, labor scarcity has emerged as one of the foremost challenges in farming. Crops such as the Areca nut, require skilled labour at various stages throughout production. Arecanut trees attain a height of about 60-70 feet. It is mandatory to climb the trees a minimum of five times a year for a successful harvest - twice for the preventive spray against fungal disease, and thrice to harvest the areca nut. Koleroga is another such disease prevalent in high rainfall regions. Bud- rot, food rot, stem breaking, inflorescence die- back, stem bleeding are other diseases which affect areca yield and cause damage in varying degrees. Yellow leaf disease has also been causing a lot of damage to areca nut. As a result, there is reduction in the size of leaves and nuts, tapering of the stem and mature nutfall occurs. It is estimated that about 35- 40 % of areca plantation in Kerala has been affected by this disease. In addition to the diseases mentioned above areca nut are also affected by many pests and insects. Therefore, in order to prevent the above-mentioned problems pesticides are sprayed frequently to the Arecanut. This also solves labour problem. Also, it reduces the wastage of pesticides. The farmers are exposed to the toxicity of pesticides and suffer from pesticide poisoning which range from skin irritation to coma or even death.

Chapter 3

SYSTEM REQUIREMENT AND ANALYSIS

3.1 HARDWARE REQUIREMENT

Sr.No	Description	Qty.
1	Raspberry pi 4	1
2	Dc motor	3
3	Rack and Pinion	2
4	Claw Arms	2
5	Bevel Gear	4
6	Worm Gear	2
7	LCD	1
8	IR sensor	2
9	Motor driver	3
10	PCB	1

Table 3.1-Hardware Requirement

3.1 RASPBERRY PI 4 MODEL B

Raspberry Pi 4 Model B is the latest product in the popular Raspberry Pi range of computers. It offers ground-breaking increases in processor speed, multimedia performance, memory, and connectivity compared to the prior-generation Raspberry Pi 3 Model B+, while retaining backwards compatibility and similar power consumption. For the end user, Raspberry Pi 4 Model B provides desktop performance comparable to entry-level x86 PC systems. This product's key features include a high-performance 64-bit quad-core processor, dual-display support at resolutions up to 4K via a pair of micro-HDMI ports, hardware video decode at up to 4Kp60, up to 4GB of RAM, dual-band

2.4/5.0 GHz wireless LAN, Bluetooth 5.0, Gigabit Ethernet, USB 3.0, and PoE capability (via a separate PoE HAT add-on). The dual-band wireless LAN and Bluetooth have modular compliance certification, allowing the board to be designed into end products with significantly reduced compliance testing, improving both cost and time to market.is the latest product in the popular Raspberry Pi range of computers. It offers ground-breaking increases in processor speed, multimedia performance, memory, and connectivity compared to the prior-generation Raspberry Pi 3 Model B+, while retaining backwards compatibility and similar power consumption. For the end user, Raspberry Pi 4 Model B provides desktop performance comparable to entry-level x86 PC systems. This product's key features include a high-performance 64-bit quad-core processor, dual-display support at resolutions up to 4K via a pair of micro-HDMI ports, hardware video decode at up to 4Kp60, up to 4GB of RAM, dual-band 2.4/5.0 GHz wireless LAN, Bluetooth 5.0, Gigabit Ethernet, USB 3.0, and PoE capability (via a separate PoE HAT add-on). The dual-band wireless LAN and Bluetooth have modular compliance certification, allowing the board to be designed into end products with significantly reduced compliance testing, improving both cost and time to market.

Figure 3.1 Raspberry Pi4 Model

3.2 DC MOTOR

A direct current motor is a type of electric machine that converts electrical energy into mechanical energy. DC motors take electrical power through direct current, and convert this energy into mechanical rotation. DC motors use magnetic fields that occur from the electrical currents generated, which powers the movement of a rotor fixed within the output shaft. The output torque and speed depends upon both the electrical input and the design of the motor. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight motor used for portable power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills.

Figure 3.2 DC MOTOR ESC-208 DC3-6V

3.3 RACK AND PINION

Rack and Pinion come in 3 types:

- Straight teeth
- Helical teeth
- Roller pinion

In the below **Figure** we have used Straight teeth Rack and Pinion. Rack and Pinion gears are used to convert rotation into linear motion. The flat, toothed part is the rand and the gear is known as Pinion.

Working: The Rack and Pinion is responsible for the movement of our robot. It is connected in such a way that it is capable of taking the robot upward and downward with the help of mechanical claws attached to it. Partial upward movement, using the claw to grip onto the tree. Our robot will climb like a Sloth.

Up down motors are connected to this system for up and down transport of the robot frame.

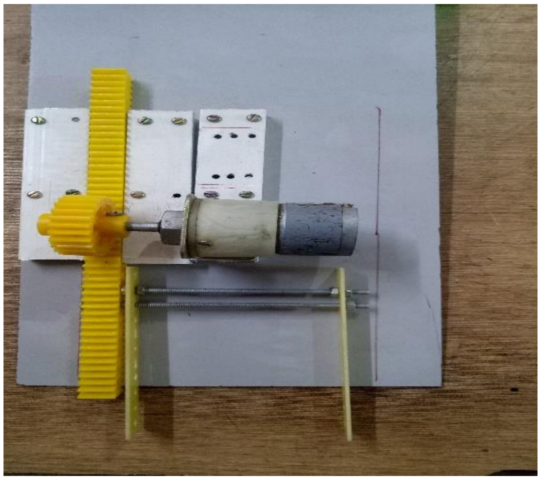


Figure 3.3 Rack and Pinion

3.4 CLAW ARMS

The claw arms are the most important aspect of the tree climber. The claw arms are equipped with Saw Teeth, which helps it grip and un-grip on the bark of a tree. With this mechanism the robot will slowly climb the tree. The claw consist of Saw Teeth, Worm Gear, a Dc motor for the claw mechanism movement. The command for the claw to grip and un-grip would be given by Raspberry-Pi. Two claws of same type are needed for the project.

Figure 3.4 Claw Arms

3.5 BEVEL GEAR

A bevel gear is a toothed rotating machine element used to transfer mechanical energy or shaft power between shafts that are intersecting, either perpendicular or at an angle. This results in a change in the axis of rotation of the shaft power. Aside from this function, bevel gears can also increase or decrease torque while producing the opposite effect on the angular speed

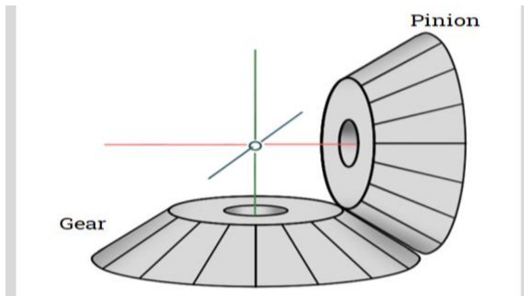


Figure 3.5 Bevel Gear

A bevel gear can be imagined as a truncated cone. At its lateral side, teeth are milled which interlock to other gears with its own set of teeth. The gear transmitting the shaft power is called the driver gear, while the gear where power is being transmitted is called the driven gear. The number of teeth of the driver and driven gear are usually different to produce a mechanical advantage. The ratio between the number of teeth of the driven to the driver gear is known as the gear ratio, while mechanical advantage is the ratio of the output torque to the input torque. This relationship is shown by the following equation:

3.6 WORM GEAR

A worm gear is a staggered shaft gear that creates motion between shafts using threads that are cut into a cylindrical bar to provide speed reduction. The combination of a worm wheel and worm are the components of a worm gear. Speed reduction is determined by the number of worm threads and the number of teeth on the worm wheel.

Figure 3.6 Worm Gear

A worm gear is the most compact type of gearing system. They are capable of being placed in very small spaces and still providing high ratio speed reduction. With proper mounting and installation, worm gear systems operate smoothly and quietly.The typical method for manufacturing worm gears is hobbing using a hob or cutting tool; this cutting tool is similar to the gear with which the worm gear will mate. Worms can be turned, hobbed, milled, or ground.

3.7 LCD

An electronic device that is used to display data and the message is known as LCD 16×2. As the name suggests, it includes 16 Columns & 2 Rows so it can display 32 characters (16×2=32) in total & every character will be made with 5×8 (40) Pixel Dots. So the total pixels within this LCD can be calculated as 32 x 40 otherwise 1280 pixels.

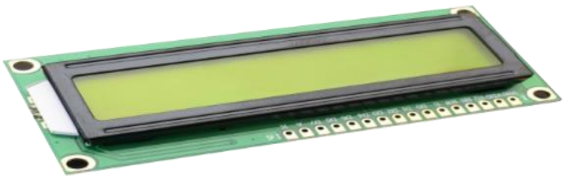


Figure 3.7 LCD

The registers used in LCD are two types like data register & command register. The register can be changed by using the RS pinout. If we set ‘0’ then it is command register and if it is ‘1’ then it is data register. The registers used in LCD are two types like data register & command register. The register can be changed by using the RS pinout. If we set ‘0’ then it is command register and if it is ‘1’ then it is data register.

3.8 IR SENSOR

IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR Sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations.

Figure 3.8 IR sensor

There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LED’s of specific wavelength used as infrared sources.

3.9 MOTOR DRIVER

Motor drivers acts as an interface between the motors and the control circuits. Motor require high amount of current whereas the controller circuit works on low current signals. So the function of motor drivers is to take a low-current control signal and then turn it into a higher-current signal that can drive a motor.

Figure 3.9 Motor drver

3.10 PCB LAYOUT

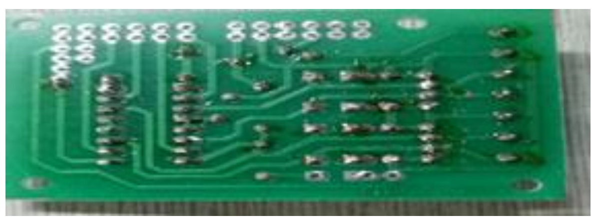


Figure 3.10 Pcb Layout

Chapter 4

METHODOLOGY

4.1 BLOCK DIAGRAM

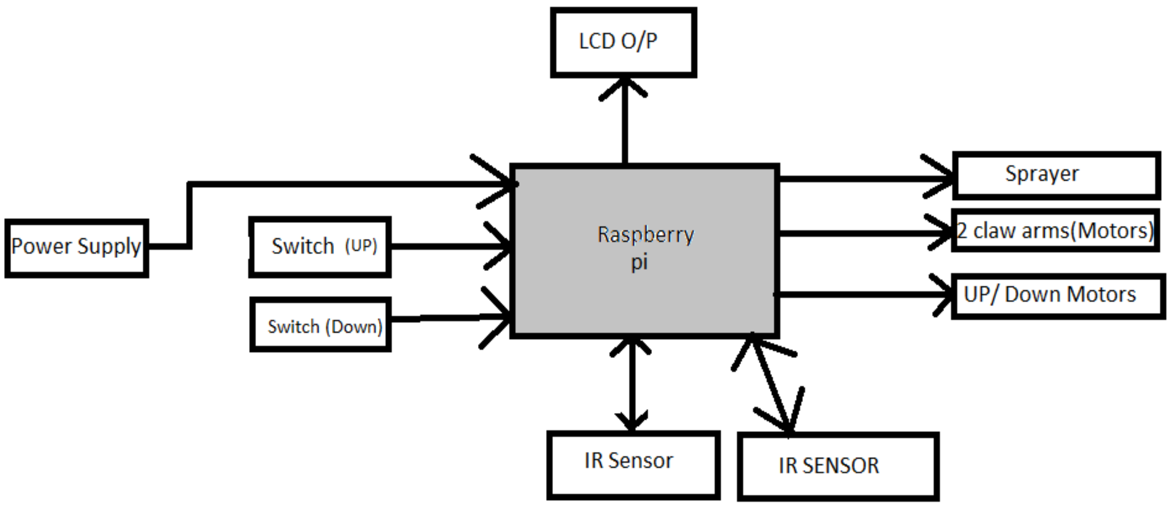


Figure 4.1 Block Diagram

Powersupply powers the RaspberryPI

To which 2 switches are connected Up and down responsible for Up and down protocol

IR sensors detect when robot has reached the top and bottom : one for the top and one bottom.

LCD shows processes and output

Sprayer sprays the pesticide to the arecanut bush

2 Claw Arms fitted with motors ,recive command from raspberry pi and grab on to the tree in succession

This happens with rack and pinion Up down motor taking the robot up and down

The Raspberry Pi sends command to each motor driver for all three motors to move

4.3 CIRCUIT DIAGRAM

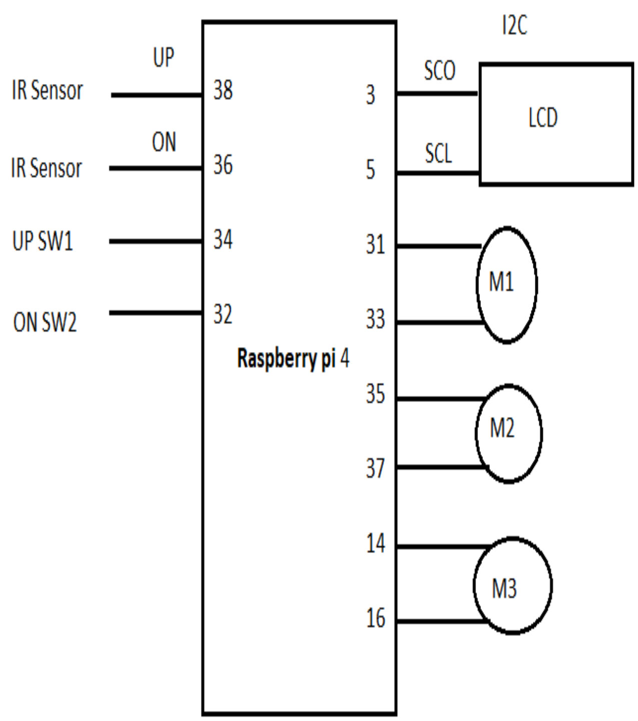


Figure 4.4 Pin Diagram

Chapter 5

HARDWARE AND SOFTWARE IMPLEMENTATION

5.1 HARDWARE IMPLEMENTATION

Agriculture is one of the major sectors in Indian economy. The Arecanut Tree Climber unit has been designed to reduce human effort. The frame of the tree climber consist of 2 claws for gripping the tree. This command is controlled by a remote control/ mobile app, through Raspberry-Pi. The input controls for the project which is given by the mobile app/remote is first received by the IR sensors on the claws of the robot. The model is placed the the bottom of the tree. It starts by gripping the first claw, then pulling the main body upwards using gear movement. As the body reaches the initial claws location, the second claw starts to grip and frees the initial claw pushing it upwards and climbing higher. As the model makes its way to the top, the sprayer module comes in working. The sprayer will empty its cartridge disinfecting the Arecanut and slowly making its way back down using the same mechanism movement.

Circuit diagram is divided into 2 parts. First part contains the following things.

Power Supply : There is power supply of 230V. It is stepped down to 5V. This main circuit board contains a bridge rectifier circuit which rectifies this 12V ac supply. There is a capacitor for filtering this signal. There is a voltage regulator 7805. It is followed by another filtering capacitor of 1 microfarad.

Raspberry Pi 4 : This component is the heart of our Robot, the mini-cpu is embedded with code which allows it to send commands to the Dc motors which in return drive the two claws of the robot and is also responsible for the up/down motion(dcmotor) of robot.

Initially the first claw will hook on to the tree, Rack and Pinion gear with up/down motor will bring the second claw along with the body close to the first claw. Then this second claw will close and attach the robot to the tree leaving the first claw independent. Then the first claw opens up. This process of opening and closing of claw arms and up/down motion is timed in Python and this process is repeated till the robot reaches the top of the tree.

As the robot reaches a certain height of the tree, Spray module comes into action.

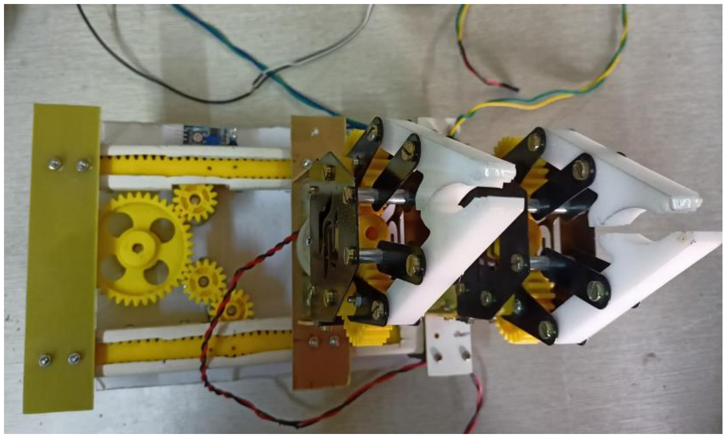


Figure 5.1 Robot hardware

Complete assembly of claw arms, Figure 5.1 shows two arms connected with Rack and Pinion gear for Up/down moment.The first claw grips the tree, while the gears pull the body upwards,the second claw starts to grip.As this continues, the first claw detaches and moves upward hence giving us linear upward moment for efficient climbing

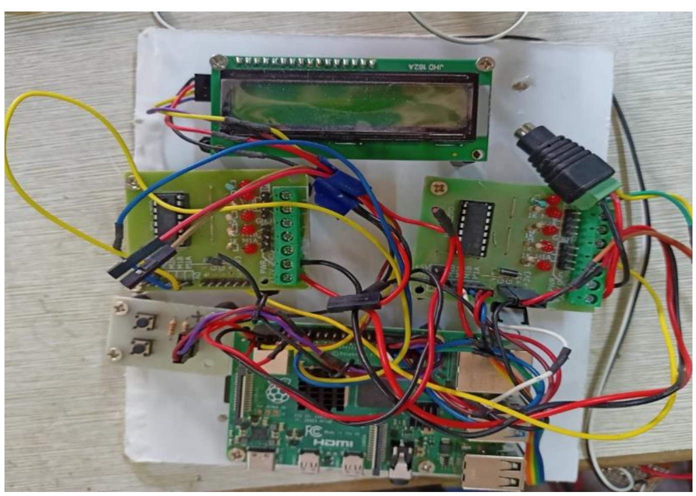


Figure 5.2 Raspberry Pi connections

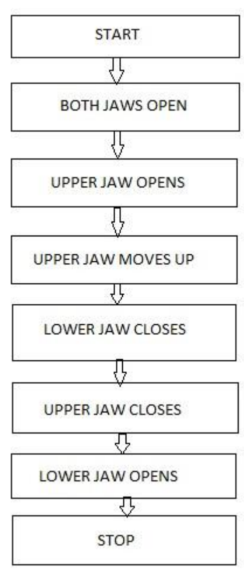
Figure 5.2 shows us the heart of the robot. Raspberry pi powers the project and is connected with two voltage dividers for linear voltage control for the claw arms and chassis .The lcd displays the commands Transmitted and received by the raspberry pi.

5.2 SOFTWARE IMPLEMENTATION

The code of the project is written in the “python”.Python is one of the primary programming languages hosted on the Raspberry Pi.

PyCharm IDE was used

PyCharm allows you to pass contextual information from your project to the external tool as command-line arguments (for example, the currently selected file or the project source path), view the output produced by the tool, configure to launch the tool before a run/debug configuration, and moreThere are several types of external tools that you can add to PyCharm: Local tools are applications that run locally on your computer. Remote tools are applications executed on a remote server over SSH The fastest way to copy files to your Raspberry Pi is with SCP, which stands for “secure copy”. This method might be difficult at first for newer users, but it eliminates the overhead of a GUI application and is both fast and secure.



Chapter 6

DISCUSSION AND RESULTS

Stage 1: Studied various IEEE papers related to tree climbing robots which had very different designs than our project, there were designs available both heavy and light, we wanted ours to be unmanned thus we went for sustainable lighter parts and used motors in our project was the first thing we deduced from all these papers.

Stage 2: The designs we considered suitable for areca nut tree climbing purposes were roller combination with motors or straight friction tires with the tree, then we came across a slower way (sloth body design) the design had good physics with claws that allowed the robot to climb areca nut tree without letting go of the tree at all times.

Stage 3: Researched on mechanical components required for the production of robots. Learning mechanics of the robot

Stage 4: Assembling required mechanical gears to the motors and PCB design and voltage divider design and build to power these motors and raspberry pi.

Stage 5: Making the up and down mechanism of the robot using rack and pillion and motors, joining this mechanism to the claw arms grab the tree.

Stage 6: Raspi is connected to ths system to control the power delivery to the motors and also control claw open-close, coding is done is python where we install raspbian OS on the raspberry pi, python code was uploaded in the raspberry pi

Extra: Studied python raspberry pi control code for the project.

Chapter 7

CONCLUSION

Thus we can save time and energy, blood, and sweat of many farmers as this robot would be a one-time investment and only pesticides need to be bought. This robot will replace a skilled climbing farmer who would normally spray pesticides on the areca nut bush. This robot is lightweight, has the scope to even cut areca nut fruit in the future, and allows connectivity with various devices also making it possible for this robot to be integrated with other systems. The claw arms, motors, and parts used in this project are sustainable.

This project can be more efficient in the following ways

1)Faster climbing: Using durable and efficient materials like Aluminium alloys we can improve the climbing section of this project.

2)Efficient spraying: A 180* rotating head,wide andgled, long range sprayer can be assembled on the project, making complete and efficient use of the pesticide.

3)Connentivity:Dedicating an application on android os, for smoother command and connectivity.

REFERENCES

1. [M.I. Nor Faizal, W.A.F.W. Othman, S.S.N.A. Syed Hassan., “Development of Pole-like TreeClimbing Robot,” FTP: https://www.libraryofbook.com/books/tree-climbing-robot.]
2. [Narayanan, S.; Vinoop, U.; Satish, M.; Yashwanth, N.G., “Autonomous tree climbing robot]
3. [Y. Li, M. Z. Q. Chen, Y. H. Chen and J. Lam, "Design of a one-motor tree-climbing robot," 2015 IEEE International Conference on Information and Automation, 2015, pp. 26-31, doi: 10.1109/ICInfA.2015.7279253]
4. [P. S. Devang, N. A. Gokul, M. Ranjana, S. Swaminathan and B. N. Binoy, "Autonomous arecanut tree climbing and pruning robot," INTERACT-2010, 2010, pp. 278-282, doi: 10.1109/INTERACT.2010.5706160]
5. [Actahort.org. 2022. Arecanut in India - present situation and future prospects. [online] Available at: <https://www.actahort.org/books/1205/1205_99.htm> [Accessed 7 October 2021].]
6. [J. Bekal, M. J. Kamath, Manjunath K, and N. D'Souza, "Arecanut tree climber and pesticide sprayer", 2017]

APPENDIX

CODE OF THE PROJECT

8.1 PIN_CONTROL

```
mport RPi.GPIO as GPIO

import time

GPIO.setmode(GPIO.BOARD)

GPIO.setwarnings(False)

motorOpen_output = 31

motorClose_output = 33

spray_output = 35

buzzer=37

person_input=32

hand_input=36

gateOpen_input=38

gateClose_input=40

GPIO.setup(gateOpen_input, GPIO.IN)

GPIO.setup(gateClose_input, GPIO.IN)
```

```
GPIO.setup(person_input, GPIO.IN)

GPIO.setup(hand_input, GPIO.IN)

GPIO.setup(buzzer, GPIO.OUT)

GPIO.setup(motorOpen_output, GPIO.OUT)

GPIO.setup(motorClose_output, GPIO.OUT)

GPIO.setup(spray_output, GPIO.OUT)

def CloseGate():

print("Closing Gate")

while GPIO.input(gateClose_input):

GPIO.output(motorClose_output,True)

GPIO.output(motorClose_output,False)

def OpenGate():

print("Opening Gate")

while GPIO.input(gateOpen_input):

GPIO.output(motorOpen_output,True)

GPIO.output(motorOpen_output,False)

def SpraySanitizer(delay):

GPIO.output(spray_output,True)

GPIO.output(spray_output,False)
```

```
print("SANITIZING")

def startBuzzer():

GPIO.output(buzzer,True)

def stopBuzzer():

GPIO.output(buzzer,False)

def runBuzzer(delay):

startBuzzer()

time.sleep(delay)

stopBuzzer()

def ifPerson():

if not GPIO.input(person_input):

return True

def ifHand():

if not GPIO.input(hand_input):

return True

def TestFunction():

while True:

 print(GPIO.input(person_input))

  time.sleep(0.5) #TestFunction(
```

8.2 LCD FUNCTION

```
from signal import signal, SIGTERM, SIGHUP, pause

from rpi_lcd import LCD

import time

lcd = LCD()

def safe_exit(signum, frame):

def showData(line1, line2 , clear_flag,delay):

try:

if clear_flag:

#signal(SIGTERM, safe_exit)

#signal(SIGHUP, safe_exit)

lcd.text(line1, 1)

time.sleep(delay)

#pause()

except :

pass    finally: pass  #lcd.clear()
```

8.3 DISPLAY FUNCTION

```
from signal import signal, SIGTERM, SIGHUP, pause

from rpi_lcd import LCD

lcd = LCD()

def safe_exit(signum, frame):

exit(1)

try:

signal(SIGTERM, safe_exit)

signal(SIGHUP, safe_exit)

lcd.text("Hello,", 1)

lcd.text("Raspberry Pi!", 2)

pause()

except KeyboardInterrupt:

pass

finally  lcd.clear()
```