

# Design and Development of Agro Robot Rig

Dr. Shivakumara Swamy.R<sup>1</sup>, Dr.Kusuma Devi<sup>2</sup>, Shiva kumar KS<sup>3</sup>, Gagan Raj S<sup>4</sup>  
<sup>1,2,3,4</sup>Department of MTE. Acharya Institute of Technology, Bengaluru – 560107

**Abstract:** The goal of this project is to create a robot that can climb both Areca nut trees and coconut trees, pick coconuts, and spray insecticide, which will cut down on the amount of time and labour needed to complete the same task. Farmers used to manually climb trees to the top and spray insecticide onto areca nut bushes back in the day. They would leap to the nearby tree after applying pesticides on the areca nuts. They would leap to the nearby tree after applying pesticides on the areca nuts. The arecanut is one of the crops that has been most negatively impacted by this. For a successful harvest, the tree must be climbed a least of five times year, twice for a prophylactic spray against fungus and three times for arecanut harvesting. Only skilled workers are able to complete this task. The harvesting of the coconuts is the issue we are having. The structure and height of the tree is the problem and, in a year, we have to climb coconut trees 4 to 5 times. We have some fuel operated machines to climb the trees but in today's life usage of fuels are very expensive and we have to go along with the machine, all the farmers may not go to such a height because some of them may have height phobia. So, we have come up with this project, which is controlled by remote. This robot lessens the need for labour and saves time. With a high degree of accuracy, the sprayer accurately applies pesticide to the nearby trees. Remote controls are used to manage the pesticide flow. The camera vision is also used in the robot to harvest the coconuts accurately.

Image acquisition system will be integrated with robot arm end effect or using raspberry pi and camera module. This IAS will detect ripen coconut and plug the coconut from the tree, using robot end effect or blade. IAS will also detect the areca nut bunch and it will adjust the spray gun and sprays the pesticide to the areca nuts. Totally it would be a automated system. Even we are planning to implement this rover to harvest yields from palm oil trees.

**Key Words-** Agro robot, areca nut, Controller, Pesticide

## I.INTRODUCTION

The entire coastal strip of India is planted with coconut palms. Kerala, Karnataka, and Tamil Nadu receive the lion's share of the market, followed by Goa, Maharashtra, Andhra Pradesh, and Orissa. One month before they reach full maturity, the well-

developed nuts should be harvested. Nut harvesting is a dangerous and skilled job. Each year, 2 to 6 harvestings are possible. Per tree, averages of 80 to 100 nuts are gathered annually. However, finding manual tree climbers to harvest the coconuts and areca nuts presents significant challenges for the coconut and areca nut farmers.

There is a severe lack of human tree climbers everywhere, not just in India. In India, historically, the socially and economically underprivileged have held this position. People shift to a number of high paying positions as the literacy rate rises and India's economy expands. It's a dangerous work as well, and accidents can sometimes be fatal. If the climber is the only person earning an income and taking care of the family, this might be a blow to the entire family without adequate insurance coverage. Additionally, it has been discovered that persons who work in this field for a long time get skin-related problems. Therefore, improved methods must be developed to collect coconuts.

To overcome this we planned to Design and manufacture agro-robot using Solid works, Master cam CNC programming and Arduino programming. Thus to eliminate labor problems with respect to climbing the tree and to avoid accidents while climbing the coconut and areca nut trees.

## II.PROBLEM DEFINITION

In recent years, non- availability of labor's has emerged as one of the biggest challenges in farming. The crops that have been most affected by this is the areca nut and coconut. In a year we have to climb areca nut and coconut trees around 6 to 7 and 4 to 5 times respectively. Areca and coconut 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 of coconuts - twice for the preventive spray against fungal disease, and thrice to harvest the areca nut.

Ceratobasidium noxium (Koleroga) is another such disease prevalent in high rainfall regions. This disease assumes intensity during south- west monsoon causing heavy damage to the crop.

Yellow leaf disease has been causing much damage to areca nut. This disease is categorized by the yellowing of leaves of leaves. As a result, there is reduction in the size of leaves and nuts, tapering of the stem and mature nut fall occurs. 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 Areca nuts.

### III.SOLUTION FOR THE PROBLEM

We're planning to create a mechanical rower that uses mechanical grip and "Spring Extraction and Retraction" to climb trees 70 to 100 feet in height. When the rower climbs the tree, this spring will automatically adapt based on the diameter of the tree. Depending on the diameter of the tree, the screw rod is utilized to adjust the frame size. Using Arduino, switches, joysticks, and motor drivers, we are creating a robot controller. The rower's up-and-down movement is managed by a joystick. We are creating a robot arm that can pick coconuts and areca nuts as well as spray pesticides

### IV. DESIGN AND IMPLEMENTATAION

This main operation of agro robot rig is to climb the tree & cut the areca nut from the tree & spray chemical on the tree 'as mentioned above'. In our rower that consist of shock absorber. This will act as a locking mechanism. This shock absorber helps when the diameter of tree size increase or decrease, this shock absorber changes according to the diameter. The material of the wheel is nytril it as co-efficient of friction 0.3. Due to the locking mechanism the robot climbs the tree by using 24V 250W E-bike motor. This will be controlled using the robot controller. The robot has arm to spray the pesticides with the movement up, down, left and right. The mechanical blade is attached to the robot for harvesting the areca nuts. The servo motor is used to actuate the disk brake in the robot to prevent the movement of the robot on the tree. This Agro Robot Rig is operated using a 24V 15ah battery.

Design:

Force Calculation

Weight of the robot be

$$W = 15Kg$$

$$Fw = 15*9.81$$

$$Fw = 147.15N$$

Assuming Co-efficient of friction between tree and rubber grip ;  $\mu = 0.4$

Actual Force (FA) require to lift

$$FA = FW / \mu$$

$$FA = 147.15 / 0.3$$

$$FA = 367.87N$$

Power Calculation

$$P = FA*v$$

$$P = 367.87*(\pi*d*N)/60$$

$$P = 367.87*(\pi*0.15*70)/60$$

$$P = 231.39W$$

Torque Calculation

$$T = m*g*r$$

$$T = 15*9.81*0.08$$

$$T = 11.77Nm$$

Battery Storage

$$P*Time(hr)/V$$

$$250*1/24$$

$$10.41AH$$

Battery selected to 15AH

Battery Charging Current

$$Battery\ size/10$$

$$15/10$$

$$1.5A$$

Adapter Selected: 24V-20.08A

Fig.1 represents the block diagram of our agro robot controller. It mainly consists of arduino uno, l298N motor driver and motor controller. 24V battery supply is provided to 24V motor controller through the capacitor C as shown in the figure. The same battery supply is provided to l298N motor driver.

The two motor M1 and M2 are driven by driven by L298N motor driver and this motor speed is controlled using the joystick. Key is used to turn on the agro robot rig. Break switch is used to actuate the breaking mechanism. When break switch is turned, a red led light is used as break indicator. Battery level indicator consists of three led lights indicating high, medium and low battery voltages respectively. DPDT switch is used to control the to direction of rotation of the motor M. Accelerator is connected at the 24V motor controller to control the speed of rotation of the motor M which in turn controls the speed of entire body through the gear-chain mechanism.

Fig 1: Robot Controller Block Diagram

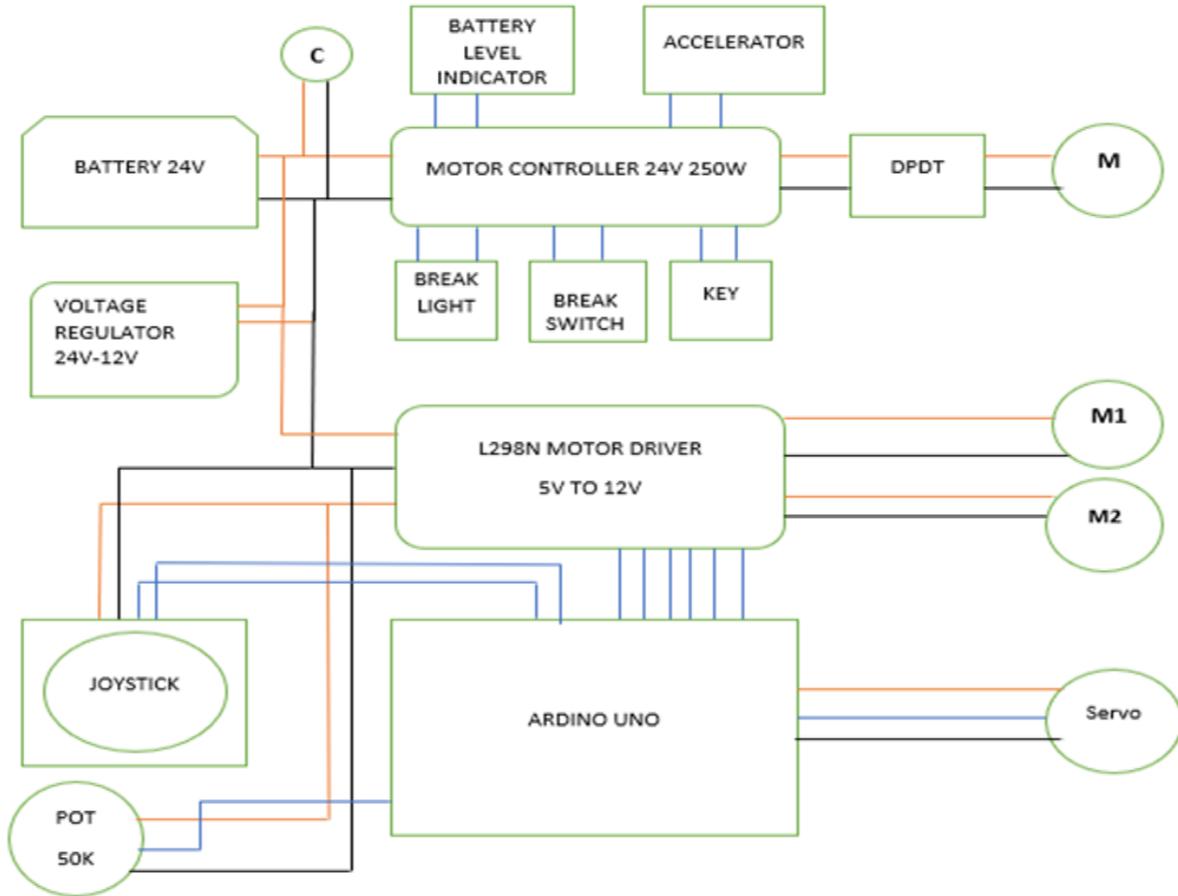


Fig 1: Robot Controller Block Diagram



Fig.2: Design of Agro Robot

The fig.2 represents the design of agro robot. The design is achieved on solid works. The design of agro robot consists of two rubber tyres, two aluminium frames namely left-hand frame and right-hand frame, nylon controller box and a long rod with cutter at its end. The distance between the two tyres is varied according to the diameter of the tree using the adjustable right-hand frame. The wheels are

rotated through the gear-chain mechanism. The driver gear has 32 teeth and driven gear has 8 teeth. The gear power ratio is 3. Aluminium frames are used to reduce the overall weight of the robot body. Frames are machined using CNC machine to obtain precise finishing. Nylon controller box consists of electronic systems required to control the operation of the robot. Fig 3 shows the working of agro robot rig.

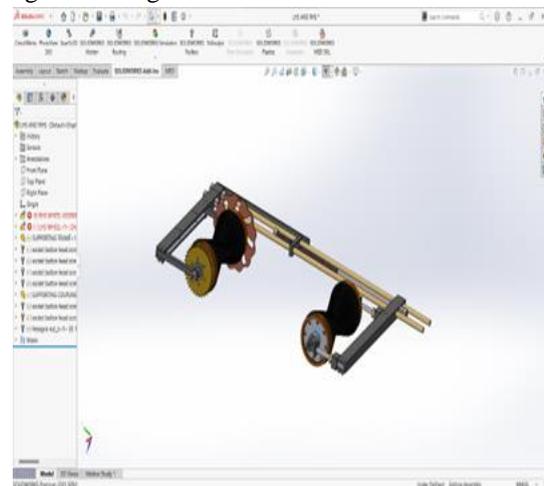


Fig.3: working of Agro robot rig

## V. CONCLUSIONS

We have designed and developed a robot which can climb both Arecanut tree and Coconut tree, to harvest and to spray pesticide; thereby it reduces the time and labor required for the same job. It is controlled using the controller, which is designed by us and now the robot is capable of climbing the tree and harvest areca nut and spray the pesticides. This robot is completely operated on the battery, which make our robot eco friendly.

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