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SMART ARECANUT PESTICIDE SPRAYER BOT

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Abstract: Agriculture is a critical sector for the Indian economy. Areca nut is one of the major commercial crops in India, and operations like spraying pesticides and fertilizers can be harmful and tedious for farmers. The scarcity of labour in agriculture has become a major concern in recent years, particularly for areca nut cultivation. Areca nut trees require frequent climbing for tasks such as preventive spraying against fungal diseases and nut harvesting. In addition to disease, farmers must also contend with the health risks associated with pesticide exposure. This paper aims to design a user-friendly agriculture robot that can assist farmers in risky tasks, such as pesticide/fertilizer spraying. The proposed system involves the automation of farm activities, which can be controlled by the farmer using a joystick. It uses MY1016ZL high torque motor and Cytron Smart Drive MDDS30 Dual 30A Motor Driver to control the motor. A FlySky FS i6 transmitter and receiver combination is employed for controlling the robot. The robot frame is equipped with a nozzle attached to a rubber pipe, which is employed to spray pesticide during operations. The proposed solution serves as a dependable means of resolving the issue of labour shortage, ultimately leading to an improved quality and yield of the produce.

***Index Terms* - Areca nut, motor driver, pesticide, FlySky FS i6, nozzle.**

I. INTRODUCTION

Agriculture is a critical sector for the Indian economy, with more than 50% of the population relying on its income[1]. Areca nut is one of the major commercial crops in India, and operations like spraying pesticides and fertilizers can be harmful and tedious for farmers. In this paper, we propose a solution to these problems by designing a user-friendly agriculture robot that can assist farmers in risky tasks, such as pesticide/fertilizer spraying. The main objective of this work is to provide precision farming and safety to the farmers, thereby increasing productivity and encouraging more people to take up agriculture as an occupation. The proposed system involves the automation of farm activities, which can be controlled by the farmer using equipment like motors and terminal equipment. We aim to overcome precision and safety challenges in the agriculture sector and reduce the tedious work involved in spraying pesticides/fertilizers. The agriculture robot is an association of all basic feasible technologies, bringing forth a new and much-needed solution for farmers in risk-involving tasks.

II. PROBLEM STATEMENT

The agricultural industry has been facing a major challenge due to the shortage of labour, especially in the context of areca nut farming. Climbing the areca nut trees at least five times a year for essential activities such as preventive spraying against fungal diseases and nut harvesting is a significant obstacle[1]. Moreover, the crop is highly susceptible to Koleroga disease in regions with high rainfall, causing severe damage. Various other diseases like bud-rot, food-rot, stem breaking, inflorescence die-back, and stem bleeding also affect areca nut yield to varying extents[2]. Yellow leaf disease is yet another critical issue characterized by yellowing of leaves and a decrease in leaf and nut size. Besides the aforementioned disease-related concerns, farmers must also cope with the adverse health effects of pesticide exposure, which range from mild skin irritation to severe consequences such as coma or death.

III. OBJECTIVES

This paper is to present the design and development of a low-cost robot that can climb areca nut trees and spray pesticides on the nuts. The robot is aimed at improving the efficiency and productivity of areca nut farmers by providing a safe and cost-effective alternative to manual labour.

IV. CHASSIS DESIGN

The chassis is L-Shaped with angular design built using metal as in Fig 1. At one end of the frame, driving motor is attached and the rotation of the wheels is facilitated through a chain drive and gearbox. A support wheel is attached at the lower end of chassis for firm grip[3]. Two hard nylon wheels with rubber grip are used to provide enough friction for climbing the tree[4]. The presence of substantial internal space within extrusions enables the creation of convenient configurations for wiring and circuitry. The driving, spraying, and control unit housings are constructed on top of this framework.

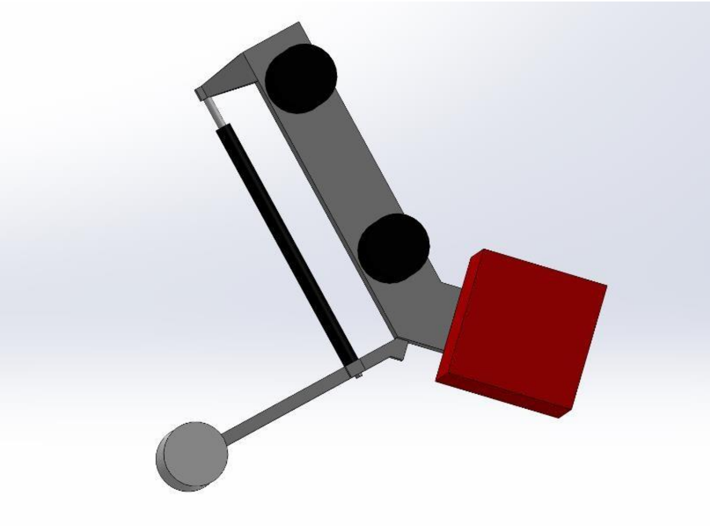

Fig 1 3D view of robot design

V. METHODOLOGY

The robot is equipped with a 24V LiPo battery that powers the motor used to drive the system. A Cytron Smart Drive MDDS30 Dual 30A motor driver is used to control the operation of the motor[5]. The wheels of the robot are rotated with the help of a gearbox and a chain drive. The gearbox aids in reducing the speed of the motor and converting the high-speed rotation into low-speed torque, which is required for the efficient rotation of the wheels. One of the wheels rotates clockwise, while the other rotates counter clockwise[6]. This allows the robot to move smoothly and maintain balance when moving up and down the tree. To provide additional stability, a third support wheel is integrated into the robot design. This support wheel helps to securely attach the robot to the arecanut tree while it is in operation. The wheel is positioned in such a way that it does not hinder the movement of the robot on the tree. The final designed robot in shown in Fig 2.

Fig 2 Robot prototype

The robot's ascent and descent functions are controlled by a transmitter-receiver system[7]. The receiver is attached to the motor driver, which regulates the motor's speed and direction. The FlySky FS i6 transmitter allows the user to control the robot's movement and is used to send signals to the receiver, which in turn controls the motor. To spray pesticide on the areca nuts, the robot is equipped with a nozzle attached to the robot frame. Pesticide solution is pumped through the nozzle with the help of a pump, ensuring even distribution on the areca nuts. The system is designed to deliver the right amount of pesticide solution, ensuring that the areca nuts are not over-sprayed or under-sprayed. Fig 3 shows the block diagram of the robot. Overall, the system is designed to provide efficient, reliable and precise pesticide spraying while also minimizing the need for human labour.

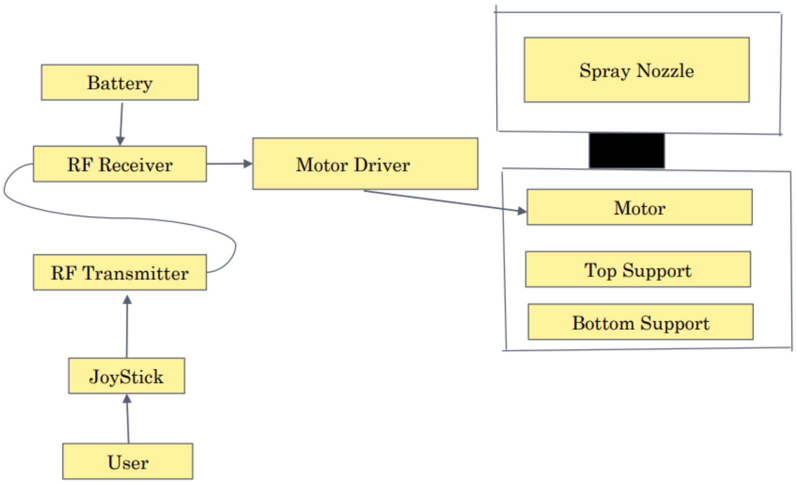

Fig 3 Block diagram of designed robot

VI. RESULT AND DISCUSSION

The robot described in this study was successfully able to climb the arecanut tree and spray the pesticide as per the controller's instructions as shown in Fig 4 and 5. The operator controls the movement of the robot using a transmitter-receiver system. Once the robot has reached the desired location on the tree, the pesticide solution is sprayed onto the arecanuts through a nozzle attached to the robot's frame. A pump delivers the correct amount of pesticide solution to the nozzle, ensuring that the arecanuts receive the appropriate amount of pesticide solution.

Fig 4 Testing of designed robot

The successful performance of the robot has several significant implications. Firstly, it eliminates the need for human labour to climb trees and spray pesticides manually, thereby reducing labour costs and the risk of accidents. Finally, the use of the robot ensures that the pesticide is applied in a timely and efficient manner, leading to better pest control and improved yield of the crop. Overall, the results of this study demonstrate that the use of this robot for pesticide spraying in arecanut cultivation is a viable and effective solution that has significant potential to improve the efficiency and sustainability of crop production.

Fig 5 Pesticide spraying robot in action

VII. Conclusion and Future Scope

In conclusion, the utilization of automation and robotics has been identified as a crucial milestone in the field of agriculture. The design presented in this paper offers an economical, user-friendly, and effective solution for pesticide spraying, which has the potential to increase crop yield and decrease labour requirements. By implementing this technology, farmers can significantly reduce the workload associated with manual labour while improving the accuracy and precision of pesticide application. Overall, this design serves as a promising step towards achieving sustainable and efficient agricultural practices.

Additionally, aluminium can be utilized as a material for designing the frame to reduce the overall weight of the robot. This would not only increase the efficiency and agility of the robot, but it would also enable it to cover larger areas with greater ease. Furthermore, the mounting of a camera onto the robot, which transmits real-time video data to the operator could be incorporated. With the addition of image processing features, AI could be employed to automatically spray pesticides on affected areas when detected minimising the amount of time required for manual inspection and increase the precision and accuracy of pesticide application. Also, the robot could be developed to be controlled via a smartphone, connected through Bluetooth or Wi-Fi, thereby eliminating the need for an expensive RC remote controller. This would make the robot more accessible to farmers with limited resources while also enhancing the overall user experience.

References

[1] B. Shwetha and B. Bhaskar, “Smart Pesticide Sprayer for Arecanut,” in *Proceedings - 2017 International Conference on Recent Advances in Electronics and Communication Technology, ICRAECT 2017*, Oct. 2017, pp. 196–200. doi: 10.1109/ICRAECT.2017.44.

[2] B. B. Aishwarya, G. Archana, and C. Umayal, “Agriculture robotic vehicle-based pesticide sprayer with efficiency optimization,” *Proceedings - 2015 IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural Development, TIAR 2015*, pp. 59–65, Dec. 2015, doi: 10.1109/TIAR.2015.7358532.

[3] R. K. Megalingam et al., "Amaran:An Unmanned Robotic Coconut Tree Climber and Harvester," in IEEE/ASME Transactions on Mechatronics, vol. 26, no. 1, pp. 288-299, Feb. 2021, doi: 10.1109/TMECH.2020.3014293.

[4] A. G. Bhat, "Arecanut Tree-Climbing and Pesticide Spraying Robot using Servo Controlled Nozzle," 2019 Global Conference for Advancement in Technology (GCAT), Bangalore, India, 2019, pp. 1-4, doi: 10.1109/GCAT47503.2019.8978452.

[5] Sri Krishna Shastri C, Megha B, 2021, Automated System for Climbing and Spraying Pesticides on Areca Nut Trees, *International Journal of Engineering Research & Technology (IJERT)* Volume 10, Issue 11 (November 2021).

[6] Pallavi H G, Sushma N, Vinay V, Sharath Kumar A J, 2019, Automated Arecanut Tree Climbing Machine, *International Journal of Engineering Research & Technology (IJERT)* NCRACES – 2019 (Volume 7, Issue 10).

[7] S. K. Gowda, K. R. Prathima, L. Yashaswini, M. D. Rakesh, and T. R. Sateesh Kumar, “Pneumatic Controlled Smart Arecanut Plucking Robot with Raspberry Pi,” *Proceedings of the 4th International Conference on Communication and Electronics Systems, ICCES 2019*, pp. 527–532, Jul. 2019, doi: 10.1109/ICCES45898.2019.9002228.