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REGULAR ARTICLE

Design and Implementation of Wireless Multiple Agriculture Robot

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The primary source of food for the growing global population is agriculture, which is frequently referred to as the basis of human civilization. It includes a wide variety of tasks that are involved in growing crops, caring for animals, and creating different raw materials for food, clothing, and industrial uses. For thousands of years, agriculture has been the foundation of human societies, producing not just food and raw resources but also impacting cultures, economies, and environments. Consider a farm where robots work together as a team, with no cables connecting them. These robots make it easier for farmers to care for their crops. In this research paper, we will look at how wireless robots are transforming the way we farm. We also investigate how they conserve energy and improve farming efficiency. The research explains how these robots can do various farming tasks such as planting and harvesting. We also discuss various issues, such as what happens when they run out of power. Finally, we consider the future and how these robots might help farmers even more. It's like having a high-tech farm worker that assures our food grows better and our farms are more sustainable.

Keywords: Automation, Mobile Intelligence, Robots, Sensors

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1. INTRODUCTION

Agriculture, we see, has been around for thousands of years, but it has always been challenging work. Farmers must perform many tasks such as seeding, watering, and insect control on their crops [1]. It is not only difficult, but also time-consuming. Imagine how much of this work could be done by robots. Wireless agriculture robots can help with this. They are like smart devices that can travel around the farm without being limited by cables. Various forms of agriculture utilize automation more and more to increase productivity and cut labor expenses [2].

The high cost of agriculture is mostly caused by the significant effort and capital needs of farming. To raise crops and animals, farmers must purchase seeds, machinery, and tools. In addition, they must pay for things like land, fuel, and water. In addition, they need to hire workers for all the farm work, such as planting, harvesting, and caring for the animals [3]. These expenses can rapidly increase, making agriculture an expensive profession. Additionally, instability in the weather may delay crop growth, which can have an impact on costs. Therefore, the high cost of agriculture is caused by all these costs as well as the laborious method of growing our food [4].

The cost of labor makes up an important part of agriculture's overall expenses. It covers the cost of hiring and paying farmworkers who carry out essential tasks including planting, harvesting, and taking care of animals [5]. These labor costs include the workers' wages, perks, and sometimes housing. Due to factors including growing wages and a decreasing supply of available farm labor, labor costs have been rising recently. [6] Labor costs can represent an important part of a farmer's income and have an impact on the entire cost of agriculture since tasks that require labor require many workers, particularly during important farming seasons [7].

We can reduce the cost of farming in agriculture by using automation and robotics. Many of the laborious duties, such as planting and harvesting crops, may be completed by these machines without the need for large farm workers. This is helpful as a substantial portion of farming costs go into labor or paying workers. Robots can labor around the clock, which is an important benefit [8]. They are also intelligent enough to manage resources like fertilizer and water more effectively, which results in reduced expenses. In other words, we can reduce the cost of farming and increase its productivity by deploying automation and robotic [9].

Here are a few examples of automated agricultural techniques:

1. Precision agriculture increases agricultural output by carefully managing the use of water, fertilizer, and pesticides.

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2. Drones, sensors, and GPS are examples of technologies that are essential to precision agriculture methods.
3. Wireless, intelligent agricultural robots are progressively replacing human labor-intensive operations including planting, harvesting, and plowing.
4. The demand for manual labor during harvest seasons is decreased by robotic harvesting machines, which are made for fast and accurate crop harvesting.
5. Automated climate control systems in smart greenhouses enhance growing conditions, leading to higher yields and lower energy costs.
6. These robots are designed to help with crop irrigation, plant seeds in exact rows, and harvest crops.
7. The goal is to make farming chores easier and more efficient while providing a bright future for automated and productive agriculture. [10]

2. LITERATURE SURVEY OF WIRELESS MULTIPLE AGRICULTURE ROBOT

Wireless agriculture robots have a long history, as do the innovations created specifically for them. In order to increase their utility and efficiency, these robots went through tremendous evolution over time [10].

These people and organizations come from a variety of backgrounds, including academia, business, and governmental organizations. Here are some prominent scientists, organizations, and businesses that have worked on wireless agriculture robot development and research. [11]

GPS navigational systems

Dr. Ivan Getting (who created GPS technology) is the inventor. Due to their ability to provide exact positioning and navigation for farm equipment, GPS guidance systems have transformed agriculture.

Robots that can autonomously weed

Weeding robots have been created by businesses like FarmWise and Carbon Robotics with the assistance of their own engineering teams.

IoT devices and smart sensors

With individual contributions to sensor technology, numerous businesses and researchers have developed smart sensors and IoT devices for agriculture [12].

Robots for sustainable agriculture

Sustainable agricultural robots have been developed by businesses like Small Robot Company, with help from their founders and engineers.

Following are the discoveries in the creation of wireless agricultural robots:

1. John Deere is a leader in autonomous farm equipment, using advanced automation and GPS technology.
2. Soft robotics is being pioneered by the Harvard Wyss Institute for delicate crop handling and soil traversal.
3. See & Spray, created by Blue River Technology, which is now a part of John Deere uses AI to identify weeds in real time and apply pesticides precisely.
4. The UK-based Small Robot Company uses small, AI-powered robots for agricultural monitoring, weeding, and planting.
5. Blue River Technology's See & Spray technology uses AI and computer vision to improve weed management while using less pesticide [13].

3. DESCRIPTION

Using wireless agriculture robots, this initiative seeks to increase farming's sustainability, efficiency, and productivity. By employing innovative technology to automate repetitive farming activities like harvesting and grass cutting, these robots remove the need for human labor. They collect crops and environmental data using sensors so they can make well-informed decisions [14]. By utilizing innovative technologies, the project seeks to lower labor costs, improve precision, and advance agricultural sustainability. Investigating the technology, real-world uses, difficulties, and prospects of wireless agriculture robots on big and small farms is one area that needs more research [15]. These robots represent more than just modern technology; they represent a more intelligent, productive, and sustainable farming environment in the future. Come along on this adventure to learn about the revolutionary technologies that are changing the face of agriculture [16].

4. BLOCK DIAGRAM

The focus in robots' area of an agricultural robot is on its essential components and functionalities. It includes a microprocessor for control and processing, an array of sensors and actuators for monitoring and performing activities, an energy supply system made of a battery and solar panels, and a dedicated component for battery management. This simplified model works to emphasize the robot's independent and localized capabilities in helping with agricultural operations such as sowing, pesticide and weed management, and grass cutting. Components used include motors, microprocessors, rechargeable batteries, solar panels sensors, seed Sower. Pesticide and grass cutter

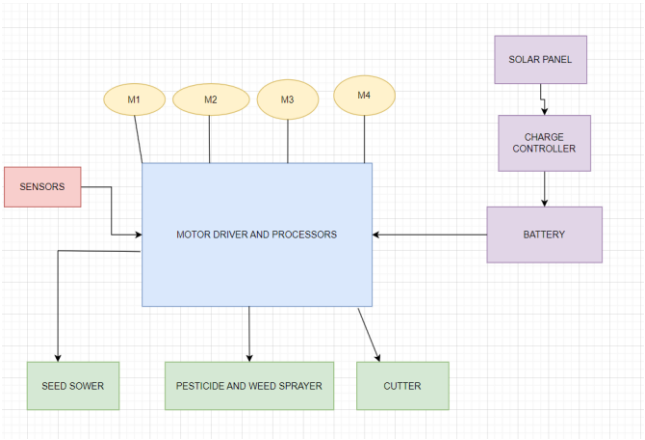


Fig. 1 – Block Diagram

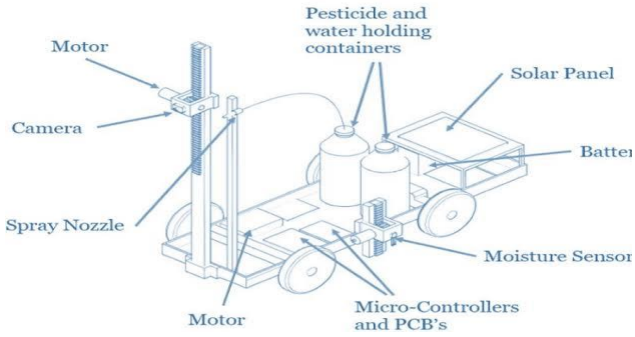


Fig. 2 – The general appearance of model

5. WORKING

Wireless agriculture robots are like smart farm workers. They move around with the help of complex motors and wheels. A smart computer inside the robot controls these motors. Special sensors, such as tiny eyes and sensing, are also used by robots. These sensors help the robot in seeing and understanding.

What is going on in the field? They can detect if the soil is dry or moist, whether the sky is clear or foggy, and even where the robot is in the field [17].

Robots, like humans, require energy to function. They have special batteries that store energy, and some of them have solar panels on their backs to absorb solar energy. This allows them to work for a longer duration of time without taking a break. One of the coolest things these robots can do is cut grass or oversee crops [18,19]. They move with motors and use sensors to determine when to cut or plant. It is like having a super-smart lawn that does not need moving. So, these robots assist farmers by doing essential duties in the field, and they do so completely on their own, owing to their motors, sensors, batteries, and sometimes solar assistance [20].

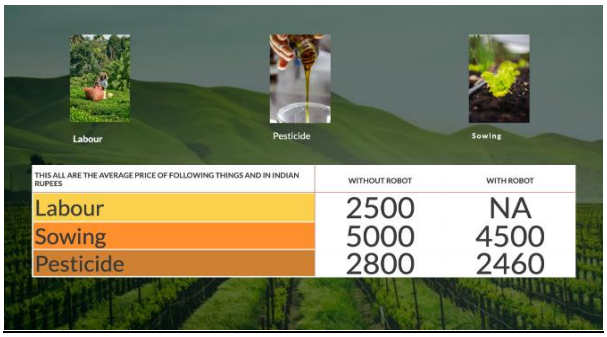


Fig. 3 – Shows the average price of different items with and without robot

6. RESULT

In our research, wireless agriculture robots with electric motors, solar panels, rechargeable batteries, and innovative sensors were incorporated into actual agricultural operations. These robots successfully completed several activities, including mowing grass, applying pesticides, planting seeds, and checking crop health.

Our wireless farm robot concept has several advantages, chief among them being a major decrease in the requirement for human labor, which raises crop yields and improves operational efficiency. Our emphasis on resource efficiency through the application of contemporary technology also reduces input costs and its negative effects on the environment, especially when it comes to the overuse of pesticides.

The main objective of our initiative is sustainability, in line with the growing demand for ecologically friendly agriculture. The robots completed tasks with accuracy and regularity, guaranteeing that grass was trimmed, seeds were planted, and pesticides were applied uniformly.

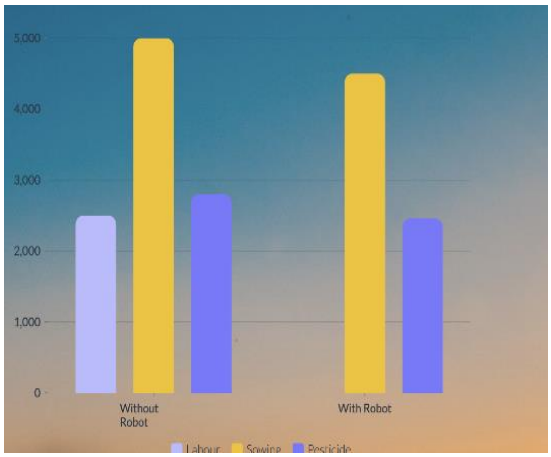


Fig. 4 – Analysis of average price of different items with and without robot

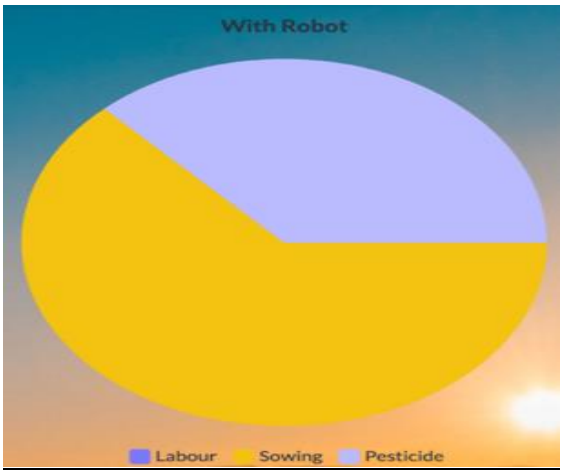
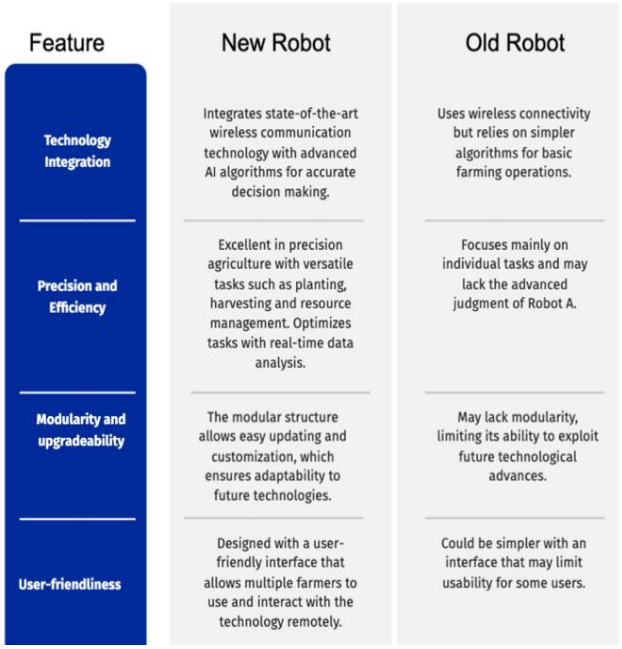


Fig. 5 – Shows comparison price of different items without robot and shows comparison price of different items with robot

7. COMPARISON

This is a comparison analysis of wireless agricultural robots that emphasizes crucial factors including impact, usefulness, and technology:



Robot A: With its precision farming techniques, anti-collision devices, and optimal systems for continuous operation, Robot A excels in energy efficiency, sustainability, and safety. For independent jobs, it depends on well-informed decision-making and thorough information collecting. Its cutting-edge technology promises long-term increases in productivity and efficiency despite greater initial expenses.

Robot B: There may be differences in Robot B's energy efficiency, environmental effect, and safety characteristics, which could cause problems with operation and sustainability. It might process data more simply, which would limit how deeply decisions can be made. Robot B might not have as many sophisticated features as Robot A, so which one to choose will depend on your needs in terms of space, money, and desired technological advancement. Robot B may also be less expensive initially.

8. CONCLUSION

Utilizing their innovative technologies, wireless agriculture robots are revolutionizing farming methods by completing chores autonomously, lowering labor costs, and improving crop quality. This invention optimizes resource management by utilizing AI and sensors to drastically reduce costs throughout the farming process. The "Wireless Agriculture Robots for Sustainable Farming" program represents how data analytics and technological integration are modernizing the sector. The project reduces operating expenses, gives farmers more authority, and moves the agriculture industry closer to sustainability through knowledge sharing. These robots, which are in line with the UN Sustainable Development Goals, have a profound effect on people's lives, enhancing rural economies, decreasing reliance on distant food supplies, and generating long-term job prospects.

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