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MULTIPURPOSE AGRICULTURE ROBOT

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ABSTRACT

An agricultural robot is a robot deployed for agriculture purpose. The main area of application of robots in agriculture today is at the harvesting stage. Emerging applications of robots or drones in agriculture include weed control, cloud seeding, planting seeds, harvesting, environmental monitoring and soil analysis. According to Verified Market Research, the agricultural robots market is expected to reach $11.58 billion by 2025.Fruit picking robots, driverless tractor / sprayers, and sheep shearing robots are designed to replace human labor. In most cases, a lot of factors have to be considered (e.g., the size and color of the fruit to be picked) before the commencement of a task. Robots can be used for other horticultural tasks such as pruning, weeding, spraying and monitoring.

INTRODUCTION

India, with its vast agricultural sector, is increasingly adopting innovative technologies to address the challenges faced by farmers. The introduction of multipurpose agriculture robots in India is revolutionizing the way farming is done and offering significant benefits to farmers across the country. Multipurpose agriculture robots in India are designed to cater to the diverse needs of Indian farmers and the specific demands of Indian agricultural practices. These robots are equipped with advanced features and capabilities to handle the unique challenges faced by Indian agriculture, such as labor shortage, fragmented land holdings, and the need for sustainable farming practices.

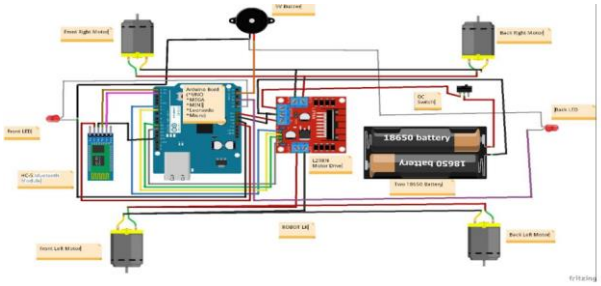

Fig 1 proposed circuit configuration

These robots are capable of performing a wide range of tasks, including seeding, planting, crop monitoring, weed control, and crop maintenance. By automating these labor-intensive activities, multipurpose agriculture robots are reducing the dependency on manual labor, which has become a growing concern in India's agriculture sector due to rural-urban migration and changing demographics. Additionally, these robots integrate cutting-edge technologies like artificial intelligence, machine learning, and computer vision, allowing them to gather real-time data about crop health, pests, diseases, and nutrient deficiencies. This data-driven approach enables farmers to make informed decisions and take timely action, leading to increased yields and improved crop quality.

Furthermore, the use of multipurpose agriculture robots promotes sustainable farming practices in India. With precise application of resources such as water, fertilizers, and pesticides, these robots minimize wastage and reduce the

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environmental impact. They also support organic farming methods by selectively removing weeds and minimizing the use of chemical herbicides. The introduction of multipurpose agriculture robots in India is empowering farmers by enhancing productivity, reducing manual labor, improving resource management, and enabling precision farming. These robots have the potential to revolutionize Indian agriculture and contribute to the country's goal of achieving food security, sustainable farming, and increased farm incomes.

An agricultural robot is a robot deployed for agricultural purposes. The main area of application of robots in agriculture today is at the harvesting stage. Emerging applications of robots or drones in agriculture include weed control, cloud seeding, planting seeds, harvesting, environmental monitoring and soil analysis. According to Verified Market Research, the agricultural robots market is expected to reach $11.58 billion by 2025. Engineering research in field of agriculture holds a key for sustainable future of Mankind. Technological advancements in farming, referred to as Agtech as grabbed a massive attention among researchers, investors and end users. It focuses on every aspect of farming, starting from Crop selection, Land Preparation, Seed Selection and sowing till the crop is harvested. In past half decade the trends in Agtech have been promising with countries like USA,Canada.

Agtech is automation of conventional farming techniques using modern day robots and drones. Initially,the main use of Agricultural robots had been in harvesting of crops. However, the Drones revolutionized the orthodox laborious techniques to easy, quick and more precise methods which help in maintaining the nutritional values of soil and improving crop quality thereby, increasing the overall yield. Fruit picking robots, driverless tractor / sprayers, and sheep shearing robots are designed to replace human labor. In most cases, a lot of factors have to be considered (e.g., the size and color of the fruit to be picked) before the commencement of a task. Robots can be used for other horticultural tasks such as pruning, weeding, spraying and monitoring. Robots can also be used in livestock applications (livestock robotics) such as automatic milking, washing and castrating. Robots like these have many benefits for the agricultural industry, including a higher quality of fresh produce, lower production costs, and a decreased need for manual labor. They can also be used to automate manual tasks, such as weed or bracken spraying, where the use of tractors and other human-operated vehicles is too dangerous for the operators.

LITERATURE SURVEY

Title: "Agricultural Robots for Field Operations: Concepts and Components" Authors: Hemming et al. Published in: Computers and Electronics in Agriculture (2011) Summary: This paper provides an overview of agricultural robots, including their concept, components, and applications. It discusses the development of autonomous systems for field operations, including seeding, spraying, and harvesting.

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Title: "Vision-Based Weed Detection for Selective Herbicide Application: A Review" Authors: Piron et al. Published in: Weed Research (2018) Summary: This review paper focuses on vision-based weed detection techniques used in agriculture robots. It discusses the use of various imaging technologies, machine learning algorithms, and robotic platforms for weed detection and selective herbicide application.

Title: "A Survey of Agricultural Robotics" Authors: Nandal et al. Published in: International Journal of Agricultural and Biological Engineering (2015) Summary: This comprehensive survey provides an overview of the latest developments and applications of agricultural robots. It covers various aspects, including robot platforms, sensing technologies, control systems, and applications in precision agriculture.

Title: "Robotics in Agriculture and Forestry" Authors: Griepentrog et al. Published in: Precision Agriculture Technology for Crop Farming (2015) Summary: This book chapter explores the use of robotics in agriculture and forestry. It covers topics such as field robots, sensing and perception technologies, robotic manipulation, and autonomous navigation systems.

Title: "Robotic Agriculture—A Review" Authors: Das et al. Published in: Precision Farming and Sustainable Agriculture (2016) Summary: This review article provides an overview of robotic agriculture systems and their applications. It discusses various aspects of robotic farming, including sensing and perception technologies, crop monitoring, harvesting, and post-harvest handling. These references should provide you with a good starting point for your literature survey on multipurpose agriculture robots. They cover a range of topics related to robotics, automation, sensing, and their applications in agriculture

PROPOSED SYSTEM CONFIGURATION

The objective of agricultural robotics is to help the sector in its efficiency and in the profitability of the processes. In other words, mobile robotics works in the agricultural sector to improve productivity, specialization and environmental sustainability. The agriculture has always been the backbone of India's sustained growth. As the population of India continues to grow, the demand for production will also grows. Hence, there is a great need for multiple cropping in the farms and this in turn requires efficient and time saving machines. The paper discusses the modern way agriculture which will be helpful for the agriculture industry to move towards mechanization. The Objectives are: • To build a battery operated smart agricultural robot for multipurpose farm activities. • It should check the moisture content in soil, humidity of surroundings and temperature of seed. • The ground should be dug to the specified depth and the adequate amount of seeds has to be dispensed then it should level the mud after seeding operation. • It should be easy to operate and safe handling.

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FIG 2: OUTPUT OF THE AGRICULTURE ROBOT

Agriculture is a very important sector in Indian economy. Most of the livelihood in India depends on agriculture. As the knowledge based farm labours are less, the requirement for them is high and their wages are increasing. Traditionally farming is done by human being with the help of bullock carts, tractors and tillers etc. The main problem in agricultural field include lack of labor availability, lack of knowledge regarding soil testing, increase in labor wages, wastage of seeds and more wastage in water. The idea of applying robotics technology in the field of agriculture is very new. In agriculture, the opportunity for robot-enhanced productivity is more and the robots are appearing on farms in various guises and in increasing numbers. In recent years there are many agricultural robots which can perform only single or dual tasks. We are improving the robot by designing a agricultural robot for spraying water, seeding, mulching and cutting operation. More than 42% of the total population in the world has chosen agriculture as their primary occupation. In recent years, the development of autonomous vehicles in agriculture rational and adaptable vehicles. In the field of agricultural autonomous vehicles, a concept is being developed to investigate if multiple small autonomous machines are more efficient than traditional large tractors and human force. These vehicles should be capable of working round the clock all year round, in most weather conditions and have the intelligence embedded within them to behave sensibly in a semi-natural environment over long periods of time, unattended, while carrying out the useful task. There are a number of field operations that can be executed by autonomous vehicles, giving more benefits than conventional machines.

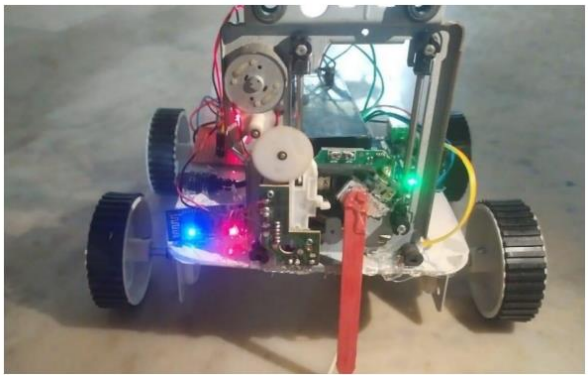

FIG 3: SOWING AND SEEDING

ADVANTAGES

¬ The robots are not getting sick or tired, and the time off is not needed.

¬ With higher speeds and closer tolerances, they can operate with fewer errors.

¬ They make fewer errors and operate at higher velocities and higher quality.

¬ The robots can reduce the use of pesticides by up to 80% of the farm.

¬ For technicians, the robots can create jobs that can fix the robots.

¬ The robots can deliver products of high quality and lower the cost of production.

¬ Happier Employees

¬ Productivity

CONCLUSION

A multipurpose robot was designed for several field operations in this work. Once a new task is needed, the corresponding operation can be realized by adding or removing sensing components, replacing the actuating unit and switching the control software, with little or no change of the mobile platform. The SMC method was applied to control motion of the designed robot with differential speed driving. Taking two operations of spraying water

and weeding by machine as examples, vision-based guidance and operations were conducted to assess the performance of two tasks in a vegetable greenhouse. The preliminary tests showed that the robot traveled well with a maximum lateral error of 47 mm for two tasks, it sprayed with productivity of 16-20 plants/min, and the weeding action was taken in time. The designed robot was found to have adaptability and versatility because the different operations can be achieved on the same mobile platform. The test environment and the operation algorithms employed were all simple in the preliminary tests. Therefore, future research will focus on the control algorithm with autonomous turning and target recognition algorithm to improve the guidance accuracy and operating performance in a more complex environment.

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