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Revolutionising Agriculture with Remote-Controlled Automatic Sprayer Machines

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Abstract The agricultural sector is undergoing a rapid transformation with the integration of technology to improve efficiency, sustainability, and productivity. In this context, the development of a Remote-Controlled Pesticide Sprayer for agriculture offers a promising solution to address the challenges associated with traditional manual spraying methods. This abstract provides an overview of the concept, design, and benefits of such a system. The Remote-Controlled Pesticide Sprayer is designed to automate and optimize the process of pesticide application in agriculture. It consists of a self-propelled vehicle equipped with a pesticide spraying mechanism and remote-control capabilities.

Keywords*:* Pesticide Sprayer, Automation, Remote Monitoring, agriculture, harvesting,

1. Introduction

In recent years, the agriculture industry has witnessed a profound transformation due to advancements in technology. One such advancement that left an indelible mark on modern farming is the Automatic Sprayer Machine. This remarkable piece of agricultural equipment has revolutionized the way crops are cared for, making it possible to achieve higher yields, reduce resource consumption, and enhance overall productivity.

Gone are the days of manual spraying, which was not only labour-intensive but also prone to human error. With automatic sprayer machines, farmers now have access to a reliable and efficient tool that helps optimize the application of fertilizers, pesticides, and other agrochemicals while ensuring consistent coverage across fields. This review delves into the features, benefits, and implications of this technological marvel.

2. Literature Survey

Design and construction of a serious pesticide spraying device for various agricultural crops. The sprayer is a type of agricultural equipment used to apply insecticide and spray liquid on agricultural crops. The general spraying technique uses hand-operated and power sprayers that are backpack-style, which cover a very small area during application and necessitate a longer application period, increasing the labour cost of the sprayer and making it more important to have a 360-degree feature and adjustable pipe length during real-world testing on various agricultural crops [1]. Many attempts have been made to reduce the numerous tasks requiring human labour in agricultural processes. The most recent Modern technology can increase comfort, but the cost is a bigger worry. Control, output pressure and velocity, wheel rpm, field rolling resistance, mechanism, and weight on the wheels are the variables that affect pesticide and fertilizer quantity. The majority of designs rely on a slider crank mechanism, a belt and pulley, or a motor to move things. The versatile pesticide spraying device uses non-conventional energy sources, such as solar energy, to charge the batteries that power the pump. The machine has been powered by the same energy. Despite being a one-time expenditure that lowers operational and labour costs,

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it raises maintenance and part costs. This equipment is not preferred when there is limited room because it requires more space [2]. Additionally, the demand for agriculture robots raises awareness of their significance for both the present and the future. According to the survey, demand for drones and robots in agriculture is anticipated to increase between 2018 and 2038. As a result, it is anticipated that the use of autonomous robots would increase, reducing the need for present labourers. This detailed 20-year market forecast covers every aspect of agricultural robots and drones for 16 market categories, with the expectation that by the end of 2038, the market for these robots and drones will be close to 35 billion, given the viability of the technology and ongoing consumer demand [3]. Despite how heavily India depends on agriculture, it still falls far short of incorporating cutting-edge technologies to create high-quality farms. UAV application in remote sensing and photogrammetry for precision agriculture has already begun in developed nations [4]. Following this discovery in 1999, Van Blyenburgh P. focused on agricultural crops. He claims that it is extremely quick and could lessen a farmer's workload. UAVs typically come outfitted with cameras, sensors, and sprayers for applying pesticides to crops [5]. A device that would help farmers with weeding and spraying operations has been designed. This is accomplished utilising a reciprocating pump for the spraying mechanism and a wedding instrument. The machinery is specifically made for farmers with tiny farming plots, such as 5–6 acres. It can be used for both spraying and weeding at a low cost to the farmer, making it affordable [6]. Another spraying method that is advantageous to farmers with vast farms is aerial spraying. Farmers with small and medium farms cannot afford to use this farming practice. In aerial spraying, a miniature helicopter that is remote-controlled is used to apply the spray. A sprayer with many nozzles is attached to it, and it sprays the farm from a height. Hand-held, pressurised air sprayers are the smallest sprayers. They have a 1- to 5-gallon tank with an air pump on top, as well as a wand with a spray nozzle. Their best application is for small-area spot treatments. The tank must be periodically pumped up and agitated to maintain pressure while it is in use [7]. Therefore, it would be challenging to determine which robot design was now most successful. Designing and creating an autonomous pesticide sprayer for the chilli fertigation system is the goal of this project. The next step in this investigation is to use a flexible sprayer arm to spray the insecticide underneath the crop's leaves. The creation of an unmanned, self-moving pesticide sprayer is the subject of this study. The reason for this is that the pesticide contains a dangerous element that, if exposed during manual spraying, particularly in a closed space like a greenhouse, could have a negative impact on future human health.

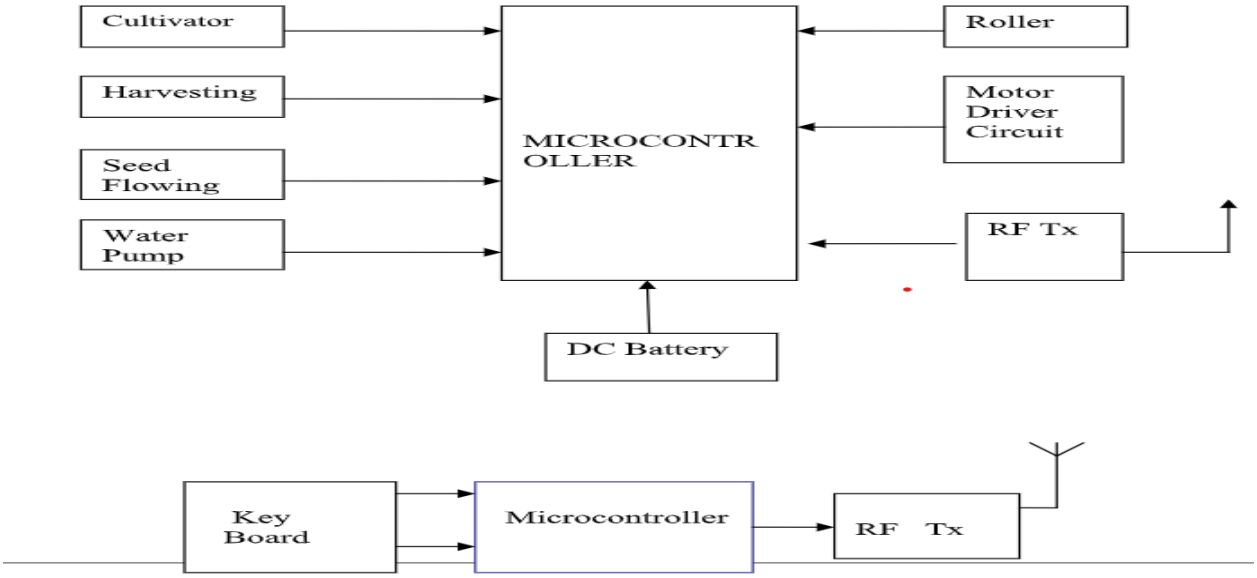
The flexible sprayer boom can also be managed in a greenhouse or an outdoor setting like an open field. To address the current risks to human health, an engineering approach may involve misting potentially dangerous compounds in a stuffy, steamy glasshouse. To do this, a self-contained mobile robot that may be utilized as a tool for disease prevention and insect control in industrial greenhouses is conceived and constructed. The effectiveness of this strategy is demonstrated by the platforms' capacity to move smoothly through greenhouse rows and the pesticide spraying system's ability to evenly cover the plants with the required dosages of spray. The outcomes demonstrated that the robot could pass the physical requirements established by the National Greenhouse Horticulture Centre in order to operate in those greenhouses. The robot was on schedule but faced financial limitations. The robot was able to move around the tracks inside the greenhouse. The induction proximity sensors work well and correctly detect the rails. When moving along tracks, the spraying system created by another thesis candidate was able to selectively spray certain plant groups in the greenhouse. The crops received a sufficient and reliable dosage of the spray protection [8].

3. Methodology

This methodology provides a structured approach to revolutionizing agriculture with automatic sprayer machines. It involves a systematic progression from research and development to field testing, manufacturing, and market adoption. Adjust and tailor this methodology according to the specific needs and constraints of our project.

Methodology is a systematic analysis of methods to be carried out to design the final product. The well-implemented project needs a plan of action and specified steps for its completion. This project's work began with a need study to gather data regarding current issues and identify the project's problem statement. On the basis of the morphological chart, various design options were discovered. Based on the best alternative, on the evaluation

matrix. The main aim is to design and develop a system which enables remote control the agriculture functions



such as water spraying and measure the moisture level of soil by using soil moisture sensor. The system consists of Node much which will act as the heart of the system.

4. System Design .Implementation

Mechanical Design Description:

We tried to make the basic design for our reference purpose only. with all measurements being 2 x 4 ft. Once you power on the bot the steps followed by the agriculture boater as follows. We decided to design a remotely controllable system various operation. This project has huge scope in agriculture operations like automatic seed sowing, grass cutting, water, and pesticides spraying. It reduces human effort as well as saves time. We can further add several operations to reduce human efforts even more.

Pesticide and fertiliser spraying:

It consists of a tank, dc motor, dc gear motor, sprayer Circuit, ultrasonic sensor. Dimensions for tanks are (in feet): 1.96 x 1.14 x 1.96. When spraying pesticides and fertilisers, it is important to follow the instructions on the label carefully. This will help to ensure that the chemicals are applied safely and effectively. It is also important to wear personal protective equipment (PPE) when spraying, such as gloves, goggles, and a respirator. Pesticide and fertiliser spraying is a common practice in agriculture. It is used to control pests and weeds, and to provide nutrients to crops. There is a a range of methods for spraying pesticides and fertilisers, including:

Hand-held sprayers: These are by far basic type of sprayer, and are frequently employed for modest areas.

Backpack sprayers: These are larger and more powerful than hand-held sprayers, and are usually employed for medium-sized areas.

Tractor-mounted sprayers: These are the largest and most powerful type of sprayer, and commonly employed for large areas.

Table No: 1

Manual Pesticide Sprayer	Remote Control Pesticide Sprayer
Method of Operation: A manual sprayer is operated by a person who carries the sprayer and manually applies the pesticide by pumping or triggering the spray nozzle. It relies entirely on human labour for operation [9]	**Method of Operation:** This type of sprayer is automated and operated remotely, typically using a remote-control device or a computer interface. It can be controlled from a distance by a user, reducing the need for direct human labour during the spraying process [9]
Precision and Accuracy: Manual sprayers are more reliant on the operator's skill and experience. Achieving consistent and precise application is more challenging, and there is a higher risk of uneven coverage or overapplication, leading to potential crop damage and environmental issues [10].	**Precision and Accuracy:** Remote-controlled sprayers can provide a higher degree of precision and accuracy in pesticide application. They often use advanced technology, such as GPS and sensors, to adjust the spray rate, pattern, and dosage based on crop type, growth stage, and environmental conditions. This leads to more consistent and efficient pesticide distribution, reducing chemical wastage and potential overuse [10].
Efficiency and Productivity: Manual sprayers are less efficient and may have limitations in terms of coverage and speed. They can be time-consuming and may require multiple passes to ensure even coverage [12].	**Efficiency and Productivity**: Remote-controlled sprayers are generally more efficient and productive. They may encircle bigger areas. in a shorter time, reduce operator fatigue, and ensure a consistent application of pesticides. This can result in increased productivity and reduced time and labour costs [12].
Safety and Health: Manual spraying can expose operators to pesticide chemicals, potentially leading to health risks. Operators must put on personal defense gear and follow safety guidelines to mitigate these risks [11].	**Safety and Health:** These systems reduce direct exposure to pesticides for operators since they do not should be in close proximity to the chemicals during application. This can enhance operator safety and reduce the risk of pesticide exposure and related health issues [11].

5. Results

Remote-controlled agriculture with automatic sprayer machines can provide various advantages for farmers and agriculture. These systems are designed to make the farming process more efficient, cost-effective, and environmentally friendly. Here are some potential results and advantages of using remote-controlled agriculture with automatic sprayer machines:

1. Precision Farming: Remote-controlled sprayer machines can be programmed to apply fertilisers, pesticides, and herbicides with precision. This reduces wastage and ensures that the right amount is applied to each section of the field, leading to improved crop health and yield.

2. Labour Savings: Automating spraying tasks reduces the need for manual labour. Farmers can remotely control these machines, reducing the physical strain on workers and potentially cutting down on labour costs.

3. Reduced Chemical Use: Precise application of chemicals reduces overuse and minimises the environmental impact of farming. This can result in fewer chemicals entering the ecosystem and less harm to non-target species.

4. Time Efficiency: Remote-controlled sprayer machines can quickly cover a vast area and efficiently. This can expedite things. farmers, allowing them the goal of other essential farming tasks.

5. Data Collection: Some modern automatic sprayer machines come equipped with sensors and data collection capabilities. These details may used for monitoring crop health, assessing the effectiveness of treatments, and making informed decisions about crop management.

6. Consistent Application: Automation ensures a consistent and even application of chemicals across the entire field, reducing the risk of under- or over-application.

7. Cost Savings: While the initial investment in automatic sprayer machines can be significant, the long-term cost savings can be substantial. Reduced chemical use, labour costs, and increased crop yields can contribute to a positive return on investment.

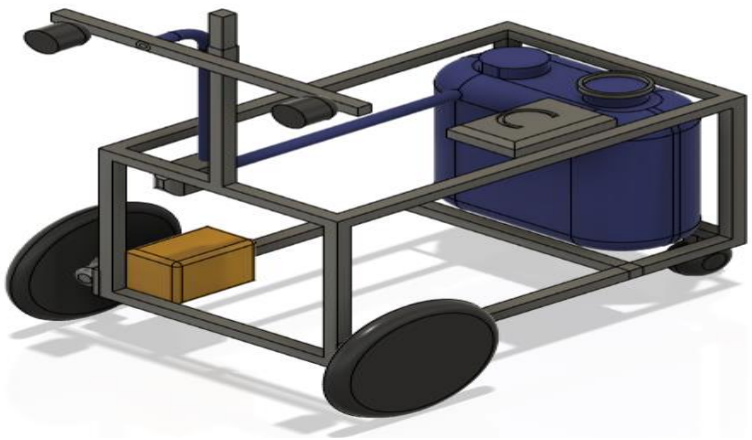
8. Environmental Benefits: By using remote-controlled sprayer machines to minimise chemical usage and reduce environmental impact, agriculture can become more sustainable and eco-friendlier.

9. Improved Safety: Reducing need face-to-face interaction with chemicals and minimising human involvement in spraying operations can enhance the safety of farm workers.

10. Adaptability: Remote-controlled agriculture systems may adjust to respond to changing weather conditions, specific crop requirements, or pest threats, making sure that the farm's operations remain flexible and adaptable.

It's important to note that the results of implementing remote-controlled agriculture with automatic sprayer machines may vary depending on factors like the specific equipment used, the crops being cultivated, and the expertise of the farmer or farm manager. Proper training, maintenance, and monitoring are essential to realising the full potential of these systems.

Fig: 3D Model



Conclusion

In conclusion, remote-controlled agriculture with automatic sprayer machines holds significant promise for modernising farming practices and improving overall efficiency, sustainability, and productivity. As technology continues to advance and become more accessible, it is likely that additional farmers adopt these methods to meet the growing demands of the agriculture industry. However, careful planning, ongoing maintenance, and a

commitment to responsible and long-term farming Practices are important. for realising the full potential of this technology.

This multipurpose system gives an advanced method to sow, plough and cut the crops with minimum manpower and labour making it an efficient vehicle. Depending on the crop, the machine will cultivate the farm by taking specified rows and specific columns into account at a given distance.

Future Scope

The specific future potential of this project will depend on the goals and objectives of the project, in addition the resources and capabilities of the team working on the project. However, the possibilities are endless, and the project could have a significant impact on the company, the industry, or even the world. Following are some examples of how this project could accustomed to create new products or services:

1) The project could accustom to create a new using a software program that aids companies manage their finances.

2) The project could be used to create a new medical innovation that aids doctors diagnose and treat diseases.

3) The project could be used to create a new educational tool that benefits learners learn new subjects.

4) The project might be utilized create a new marketing campaign that helps businesses reach new customers.

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