JSRT JOURNAL
JOURNAL OF SCIENTIFIC RESEARCH AND TECHNOLOGY
PAGES: 91-99
02/07/25
VOLUME-3 ISSUE-7 JULY

Agricultural Pesticides Spraying Remote Control Robot

Asst. Prof. Nandini[1], Nirmala[2], Pooja.W[3], Reshma Rathod[4], Swarali[5]

[1]*Professor, Department Of Electronics and communication engineering, Godutai Engineering College, Kalaburagi, India.*

[2,3,4,5]*Students, Department Of Electronics and communication engineering, Godutai Engineering, Kalaburagi, India.*

ABSTRACT

Automatic pesticide sprayers offer several significant advantages in modern agriculture. They enhance efficiency by covering larger areas quickly and reducing labor costs. These machines also improve precision in pesticide application, minimizing wastage and environmental impact. Furthermore, they enhance safety foe farmers by reducing exposure to harmful chemicals. By optimizing resource use and minimizing risks, automatic sprayers contribute to sustainable and productive agricultural practices. In conclusion, agriculture pesticides spraying smart remote-control robots offer a range of benefits, including increased efficiency, improved safety, enhanced accuracy, cost-effectiveness, and environmental benefits. These robots can help farmers optimize pesticide application, reduce waste, and promote healthier crops. As technology continues to evolve, we can expect to see further advancements in this field, leading to more sustainable and productive agriculture practices.

Keywords: Pesticide, Sprayer remote control, Regulator, Potentiometer.

I.INTRODUCTION

The aim of this project is to create an agricultural pesticide spraying robot that will decrease pesticide use and human health damage, allowing farmers to be protected and labor intensity can be reduced. The robot will have full route planning and navigation systems, as well as driving control, spraying mechanism and system construction and obstacle avoidance with multi -sensor module integration. The spray robot will be designed including obstacle avoidance spraying, and sensor integration simulations and analysis. It is used not only to track motion and monitor orientation, but also to compensate for path errors in order to achieve good stability and reliability. The "Smart Pesticide Sprayer" combines modern technologies like sensors, automation, and precise control mechanism to improve farming practices. Our goal is to create a sustainable and innovative solution that supports farmers in protecting their crops while reducing the harmful effects of pesticide usage.

Agriculture robot performs crop maintenance tasks such as harvesting, applying pesticides, weeding, and other tasks. Agriculture robots are a type of field robot; however, they also add value indoors by operating in greenhouse. The development of automatic pesticide sprayers can be traced back to the early 19th century when manual sprayers were first introduced. These models were labor – intensive, requiring significant manual effort to operate. However, the advent of the industrial revolution and advancement in engineering led to the development of more efficient and automated sprayers. One of the earliest notable advancements was the invention of the knapsack sprayer in the mid-19th century. The portable sprayer, carried on the operator's back, significantly reduced the physical strain associated with manual spraying. However, it still required manual operation and was limited in its capacity.

Automatic pesticide sprayers offer several significant advantages in modern agriculture. They enhance efficiency by covering larger areas quickly and reducing labor costs. These machines also improve precision in pesticide application, minimizing wastage and environmental impact. Furthermore, they enhance safety foe farmers by reducing exposure to harmful chemicals. By optimizing resource use and minimizing risks, automatic sprayers contribute to sustainable and productive agricultural practices.

II. LITERATURE SURVEY

1) Nitin Das, Namit Maske, Vinayak Khawams, Dr. SK Chaudhury, Er. RD Shete "Agricultural Fertilizers and Pesticides Sprayers - A Review", *International Journal for Innovative Research in Science & Technology* | Volume 1, Issue 11, April 2015.

For agriculture based country like India control of pest in filed is an important factor. In order to increase the efficiency and effectiveness and to reduce the manual involvement of spraying mechanism, an automated sprayer is needed. Considering the unavailability of electricity in remote areas of agricultural field this paper proposes a remotely controlled pesticides sprayer which utilizes solar energy as source.

2) Dhiraj N. Kumbhare, Vishal Singh, PR ashik Waghmare, Altaf Ansari, Vikas Tiwari, "Fabrication of Automatic Pesticides Spraying Machine", *International Research Journal of Engineering and Technology (IRJET)*, vol 3, issue 4. Apr- 2016.

The primary issue with existing pesticide sprayer systems is the inability to adapt to the dynamic agricultural environment. Farmers struggle with precise targeting, leading to wasted resources and potential harm to non-targeted areas. Additionally, the presence of unwanted weeds further complicates the situation, requiring separate intervention methods. The proposed solution aims to address both aspects by introducing a robotic system equipped with a remote-control mechanism, allowing operators to navigate the robot within a 5-meter range, ensuring precision application and targeted weed cutting.

3) Shalini D V, "Automatic Pesticide Sprayer for Agriculture Purpose", *International Journal for Science and Research in Technology*, vol 2, issue 7, Jul 2016.

The remote-control aspect is critical to this solution, as it provides farmers with the ability to oversee and direct the robot's movements in real-time. The 5-meter range allows operators to maintain a safe distance from potential pesticide exposure while still ensuring close supervision. The integration of sensors, cameras, and advanced algorithms enables the robot to identify crops and distinguish them from weeds, ensuring accurate pesticide application only where necessary. This not only optimizes pesticide usage but also reduces the environmental impact associated with excessive chemical dispersal.

4) Abhishek Khanna; Priya Ranjan, "Agricultural pesticides sprayer remote control", 2015 *Fifth International Conference on Communication Systems and Network Technologies*, Year: 2015, Pages: 1244–1249.

Furthermore, the inclusion of a weed cutter motor in the front of the robot adds an extra layer of efficiency to the system. Once the robot identifies unwanted weeds, the operator can activate the cutting mechanism to precisely remove the intruders, eliminating the need for separate manual weeding efforts. This dual-functionality – targeted pesticide application and weed cutting – enhances the overall effectiveness of the robotic system, providing farmers with a comprehensive solution crop management challenges.

5) A. Krithik Raj, M. Arul Kumar, S. Savanna, and V. Muthukumar: Proposed an artificial intelligence-based autonomous pesticide spraying drone management system for sustainable agriculture, leveraging precision agriculture, drone technology, and AI to minimize environmental impact.

.

6) Kshetrimayum Lochan, Asim Khan, Islam Elsayed, Bhivraj Suthar, Lakmal Seneviratne, and Iran Husain: Conducted a comprehensive review of advancements in precision spraying of agricultural robots, highlighting the potential of AI and machine learning in improving crop yields and reducing pesticide usage.

These researchers have made significant contributions to the development of agricultural pesticide spraying robots, emphasizing the importance of precision agriculture, AI, and machine learning in enhancing farming efficiency and sustainability.

III. METHODOLOGY

A methodology for agriculture pesticide spraying using a remote-controlled robot involves using a mobile platform equipped with a sprayer system, a control system (e.g., wireless controller or mobile app), and potentially sensors for monitoring and optimization. The robot can be remotely

guided to navigate through the field, and a sprayer system, often with adjustable nozzles, can be activated. The robot needs a robust and maneuverable base for navigating different terrains. this can include wheels, tracks, or other suitable locomotion systems. DC motors are often used for their high torque and speed, allowing for efficient movement of the robot. The chassis should be designed to securely hold all components including the motor, battery, and pesticide tank. A tank is needed to store the pesticide solution. A pump is required to deliver the solution to the nozzles. The nozzle arrangement should be designed to provide efficient coverage of the target area, and the nozzle can be adjusted to accommodate different crop heights. The robot can be programmed to spray at different pressures and flow rates depending on the crop and pesticide requirements.

IV. COMPONENTS

4.1 CAPACITOR

A capacitor is a device that stores electrical energy by accumulating electric charge on two closely spaced surfaces that are insulated from each other. The capacitor was originally known as the condenser, a term still encountered in a few compound names, such as the condenser microphone. It is a passive electronic component with two terminals.

Fig 4.1 Capacitor

4.2 SWITCH ON\OFF BUTTON:

An exchange or a swap, especially one done secretly. A transf erence or shift, as of opinion or attention.. A device used to break or open an electric circuit or to divert current from one conductor to another. A device consisting of two sections of railroa d track and accompanying apparatus used to transfer rolling stock from one track to another.. A slender flexible rod, stick, or twig, especially one used for whipping. The bushy tip of the ta il of certain animals: *a cow's switch.* A thick strand of real or synthetic hair used as part of a c oiffure. A flailing or lashing, as with a slender rod: *gave the ox a switch.*

Fig 4.2 Switch on\off button

4.3 NOZZLE

A nozzle is a device designed to control the direction or characteristics of a fluid flow (specially to increase velocity) as it exits (or enters) an enclosed hamper or pipe. A nozzle is often a pipe or tube of varying cross sectional area, and it can be used to direct or modify the flow of a fluid (liquid or gas). Nozzles are frequently used to control the rate of flow, speed, direction, mass, shape, and/or the pressure of the stream that emerges from them. In a nozzle, the velocity of fluid increases at the expense of its pressure energy.

Fig 4.3 Nozzel

4.4 MOTOR DRIVE

Explore our wide range of DC Motor Drivers designed to suit a variety of motor control needs. Whether you're working with stepper motors, servo motors, or brushed and brushless DC motors, we've got you covered. Our collection includes high-performance drivers from top-rated brands like Citron, Palolo, Dimension Engineering, Pro-Range, and more—ensuring quality, reliability, and ease of integration for hobbyists and professionals alike. From compact modules to powerful multi-channel drivers, our inventory supports everything from basic DIY projects to advanced robotics and automation systems.

Fig. 4.4 Motor Drive

4.5 LI-ION BATTERY

Explore our Single Cell category, offering a comprehensive selection including the advanced LifeP04 and Li-ion battery cells. Whether you require superior performance for your electronic devices or power systems, we have you covered. Our range encompasses a variety of single cell options, ensuring compatibility with various applications. With a focus on quality and reliability, we provide products sourced directly from trusted manufacturers

Fig 4.5 LI-Ion battery

4.6 POTENTIOMETER

An instrument for measuring an electromotive force by balancing it against the potential difference produced by passing a known current through a known variable resistance. A variable resistor with a third adjustable terminal. The potential at the third terminal can be adjusted to give any fraction of the potential across the ends of the resistor.

Fig 4.6 Potentiometer

4.7 ARDUINO NANO:

The Arduino Nano is an open-source breadboard-friendly microcontroller the Microchip ATmega328P microcontroller (MCU) and developed by Arduino.cc and initially released in 2008. It offers the same connectivity and specs of the Arduino Uno board in a smaller form factor. The Arduino Nano is equipped with 30 male I/O headers, in a DIP-30-like configuration, which can be programmed using the Arduino Software integrated development environment (IDE)

Fig 4.7 Arduino Nano

4.8 HT7333 VOLTAGE REGULATOR

The HT7333 is a high efficiency 3.3V linear voltage regulator. It provides a regulated voltage of 3.3V with very low losses because of its low quiescent current and low drop-out voltage. Quiescent current is the current that gets leaked out through our regulator even when no load is connected this current is only of 8uA for HT7333.

Fig 4.8 HT7333 Voltage Regulator

4.9 MPU6050

The MPU6050 is a Micro Electro-Mechanical Systems (MEMS) which consists of a 3-axis Accelerometer and 3-axis Gyroscope inside it. This helps us to measure acceleration, velocity, orientation, displacement and many other motion related parameter of a system or object. This module also has a (DMP) Digital Motion Processor inside it which is powerful enough to perform complex calculation and thus free up the work for Microcontroller.

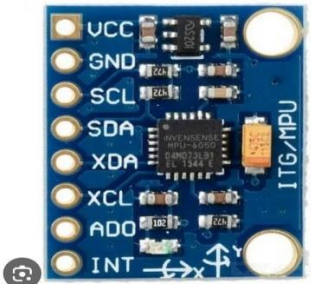

Fig 4.9 MPU6050

4.10 NRF24L01

The module can use 125 different channels which gives a possibility to have a network of 125 independently working modems in one place. Each channel can have up to 6 addresses, or each unit can communicate with up to 6 other units at the same time. The power consumption of this module is just around 12mA during transmission, which is even lower than a single LED. The operating voltage of the module is from 1.9 to 3.6V, but the good thing is that the other pins tolerate 5V logic, so we can easily connect it to an Arduino without using any logic level converters.

Fig 4.10 NRF24L01

V. CIRCUIT DIAGRAM

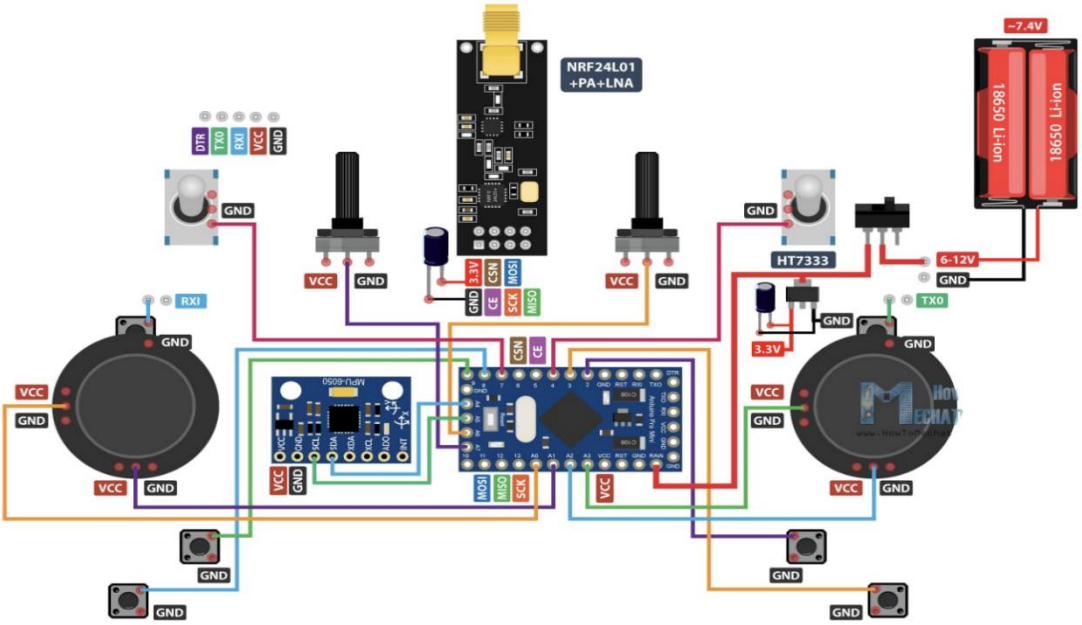

Fig 5.0 Circuit diagram on agricultural pesticides spraying remote control robot

VI. WORKING

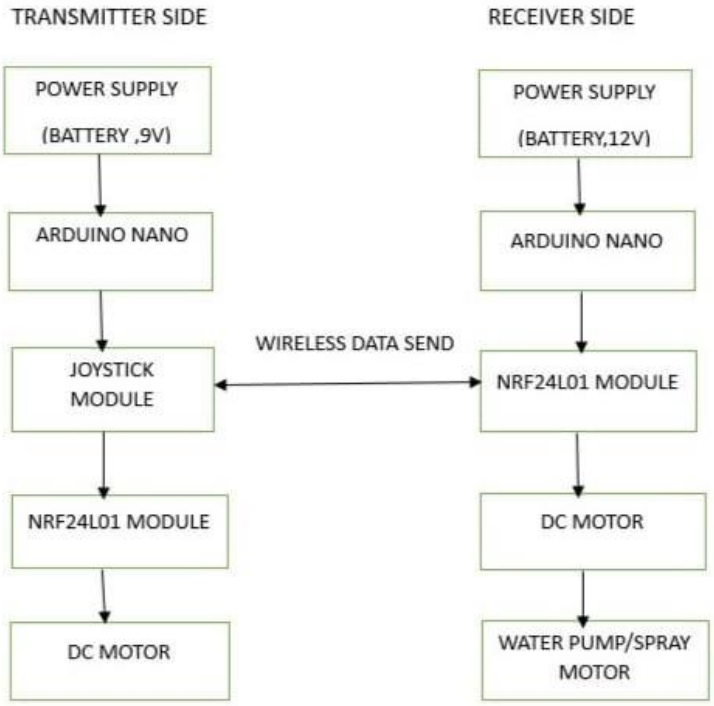

Fig-6 Working

This system is a wireless-controlled agricultural pesticide spraying robot designed to reduce manual labor and increase efficiency in farming. The robot operates with two main sections: the transmitter side and the receiver side. On the transmitter side, a 9V battery powers an Arduino Nano, which reads input from a joystick module. The joystick is used to control the movement and spraying functions of the robot. The position data from the joystick is processed by the Arduino and sent wirelessly through an NRF24L01

module.

On the receiver side, a 12V battery powers another Arduino Nano, which receives the joystick commands via its own NRF24L01 module. Based on the received instructions, the Arduino controls a DC motor that drives the robot's wheels for movement, and a water pump or spray motor for pesticide spraying. The entire system allows the user to wirelessly control the robot's navigation and spraying actions in real time, making it ideal for agricultural applications where safe and efficient pesticide application is needed.

VII. ADVANTAGES, DISADVANTAGES & APPLICATION

7.1 ADVANTAGES

1. **Increased efficiency and productivity:** Robots can work faster and with greater accuracy than the humans, allowing for more efficient pest control and potentially increasing crop yields.

2.**Reduced cost labor**: Automating pesticide spraying reduces the need for manual labor, saving time and resources for farmers.

3.**Improved accuracy and precision**: Remote-controlled robots can apply pesticide more precisely, minimizing waste and ensuring that only the necessary amount is used.

4.**Enhanced safety for farmers**: Remote operation minimize exposure to pesticides, reducing the risk of health problems and improving the safety of farm workers.

5.**Reduced environmental impact**: By optimizing pesticide application, robots can reduce the amount of pesticide used, minimizing environmental pollution and protecting ecosystems.

6.**Potential for cost savings**: Reduced pesticide uses and labor costs can lead to overall financial savings for farmers.

7. **Real-time monitoring and data collection**: Some robots can be equipped with sensors to monitor crop health, soil conditions, and weather patterns, allowing for data-driven decision-making and more efficient pest management.

7.2 DISADVANTAGES

1**. High initial investment**: The cost of developing or purchasing agriculture robots is substantial. This high initial investment can be barrier for many farmers, especially those with limited financial resources. Additionally, the cost of ongoing maintenance and repairs can add to the financial burden.

2.**Technical complexity**: Agriculture robots require sophisticated algorithms and advanced technology to perform their tasks. Moreover, the development and testing of these robots require significant research and development efforts.

3.**Dependence on electricity**: Agricultural robots rely on a stable electricity supply to function. In, rural areas where power outages are common, this dependence can limit the robots' usability and effectiveness. Ensuring a reliable power source is crucial for the consistent operation of agricultural robots.

4.**Potential job losses**: The introduction of robot in agriculture can lead to job displacement for farm workers. As robots take over tasks traditionally performed by humans.

7.3 APPLICATION

1. **Remote control**: robots can be controlled remotely via wireless devices like controllers or mobile applications, allowing farmers to operate the robot from a distance.

2.**Efficiency and accuracy**: robots can spray pesticides more precisely and efficiently than manual methods, potentially reducing pesticide waste and improving crop health.

3.**Safety**: By automating pesticide application, robots can minimize human exposure to harmful chemicals.

4. **Technology**: Robots may utilize various technologies like Bluetooth communication, mobile applications, and microcontrollers to controllers to control movement and spraying.

5.**Benefits**: Robotics in agriculture can lead to increased efficiency, reduced labor costs, and potentially higher crop yields.

VIII. CONLUSION

In conclusion, agriculture pesticides spraying smart remote-control robots offer a range of benefits, including increased efficiency, improved safety, enhanced accuracy, cost-effectiveness, and environmental benefits. These robots can help farmers optimize pesticide application, reduce waste, and promote healthier crops. As technology continues to evolve, we can expect to see further advancements in this field, leading to more sustainable and productive agriculture practices.

REFERENCES

1. The agriculture sector robotic vehicle driven pesticide sprayer”2015 IEEE International conference on technological innovations in ICT for rural development and agriculture, B. V Aishwarya, G. Arc Hana and C. Umayal.
2. The agriculture sector robot for automatic harvesting and planting “, 2015 IEEE international conference on technological innovations in ICT for agriculture and rural development Amrita Sneha A, Abi ramie, Ankita A, Mrs. R. Praveen, Mrs. R. Sri Meena.
3. Pvr Chaitanya, Dileep Kotte, A. Srinath, and K. B. Kalyan, "Development of a Smart Pesticide Spraying Robot, " International Journal of Recent Technology and Engineering (IJRTE), Volume 8, Issue 5, January 2020, ISSN: 2277-3878.
4. Peng Jian-sheng, "Spraying Pesticides with an Intelligent Robot System, " The Open Electrical & Electronic Engineering Journal, 8, 435–444, 2014.
5. In the 5th International Conference on Electrical and Electronics Engineering in 2018, Ege Ozgur and Ugur Celik presented their work, \"Design and implementation of Semi-Autonomous Anti-Pesticide Spraying and Insect Repellent Mobile Robot for Agricultural Applications.\"
6. Autonomous Agricultural Robot for Planting Seeds The following people work at the Department of Electronics and Communication Engineering at Amrita School of Engineering, Amrita Vishwa Vidyapeetham, India: Jayakrishna P V S Surya Vamsi Reddy, Jaswanth Sai, Susheel N, and Peeyush K P.