

Agricultural Pesticide Spraying Robot

Dr. A. Naga Jyothi

Department of Electronics and
Communication Engineering
Vignan's Institute of Information
Technology
Visakhapatnam, India.

P. Viswash

Department of Electronics and
Communication Engineering
Vignan's Institute of Information
Technology
Visakhapatnam, India.

Avinash Kanna

Department of Electronics and
Communication Engineering
Vignan's Institute of Information
Technology
Visakhapatnam, India.

Y. Lokesh Naga Sai Teja

Department of Electronics and
Communication Engineering
Vignan's Institute of Information
Technology
Visakhapatnam, India.

P. Kalyan Ram

Department of Electronics and
Communication Engineering
Vignan's Institute of Information
Technology
Visakhapatnam, India.

Abstract: One of the most crucial methods in agricultural production, the use of insecticides and fungicides can significantly affect crop output, quality, and long-term profitability. With the application of pesticides, it is predicted that 30–35% of crop losses can be prevented by eradicating harmful pests and diseases. Farmers who are applying pesticides are distressed by it, putting their health, eyes, and backs at additional risk. This is due to the strain of the sprayer. In order to shorten the time required to spray potentially harmful chemicals, lower labor costs, and eliminate human dangers, this paper suggests a remotely controlled spraying robot using IOT.

Keywords: Pesticide sprayer, human hazards, remote controlled, Agricultural use, IOT.

I. INTRODUCTION

The Indian financial system depends heavily on agriculture. Agriculture is a profession that provides a living for rural inhabitants. All farmers, even organic growers, use pesticides. Insecticides are used by all farmers, whether they come from artificial or natural sources. The advantage of using natural insecticides is available to organic producers. However, the toxicity of both synthetic and natural pesticides varies. Solutions nowadays heavily rely on powerful chemicals. A substance used to prevent, eliminate, or destroy pests is known as a pesticide. However, spraying pests is very risky practise for farmers, so they need to be very careful and use the appropriate clothing, gloves, masks, etc. Our goal is to increase crop productivity while reducing risks to humans from toxic pesticides. In traditional methods, long lances or spray guns with low and large-volume hydraulic sprayers with electricity operation and long growth are employed to retain fluid at various aims. The time and labor involved in this strategy are more. Using the traditional spraying method makes it difficult to evenly and properly apply the herbicide throughout the tree. The tank of a hand-operated sprayer weights 15–17 kg. This is a heavy load on farmers. It could result in spinal injury, bodily pain, or injuries to the shoulders. Long-term pesticide exposure can result in memory loss, stress, mood swings, and difficulty concentrating. Due to current cropping practises, available subject sizes, and region conditions during the wet season, farmers have a difficult time adapting to tractor-operated sprayers. To get beyond those difficult requirements for better flexibility. In order to spray insecticides and pesticides on crops more quickly and with less effort, we introduce a remotely controlled, four-wheeled pesticide sprayer.

II. Block Diagram

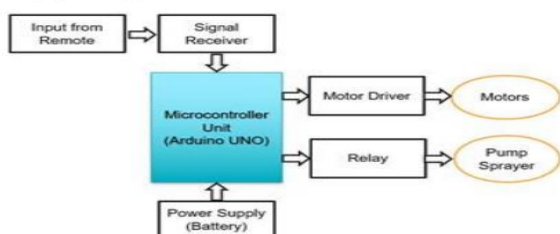


Fig. 1. Block Diagram

III. COMPONENTS USED

- 1) Aurdino NANO
- 2) Relay Module
- 3) DC Motors

- 4) NRF Module
- 5) Water Pump
- 6) Ribbon Wire
- 7) Battery
- 8) Joysticks
- 9) Acrylic Sheet
- 10) Water Sprayer
- 11) Silicon Pipe
- 12) SPST Switch

Component Specifications

1. Aurdino NANO

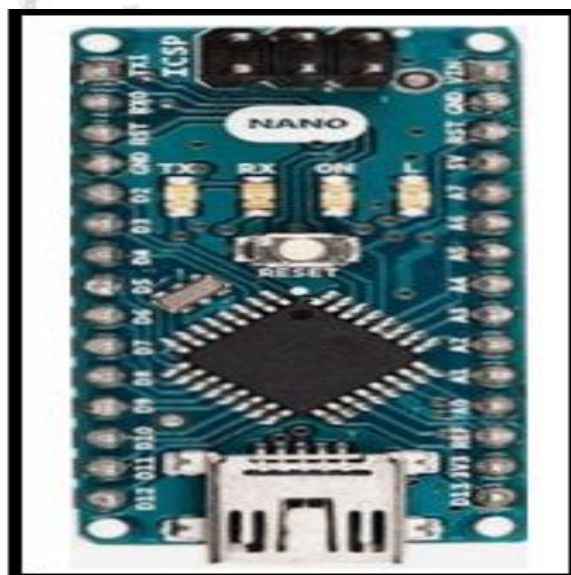


Fig. 2. Aurdino NANO

Arduino Nano is one type of microcontroller board, and it is designed by Arduino.cc. It can be built with a microcontroller like Atmega328. This microcontroller is also used in Arduino UNO. It is a small size board and also flexible with a wide variety of applications. Other Arduino boards mainly include Arduino Mega, Arduino Pro Mini, Arduino UNO, Arduino YUN, Arduino Lilypad, Arduino Leonardo, and Arduino Due. And other development boards are AVR Development Board, PIC Development Board, Raspberry Pi, Intel Edison, MSP430 Launchpad, and ESP32 board. These are mainly used to build electronic projects, embedded systems, robotics, etc. But the nano boards are mainly introduced for the beginners who are not from the technical background.

2. Relay Module



Fig. 3. Relay Module

5. Water Pump

A power relay module is an electrical switch that is operated by an electromagnet. The electromagnet is activated by a separate low-power signal from a micro controller. When activated, the electromagnet pulls to either open or close an electrical circuit. A simple relay consists of wire coil wrapped around a soft iron core, or solenoid, an iron yoke that delivers a low reluctance path for magnetic flux, a movable iron armature and one or more sets of contacts. The movable armature is hinged to the yoke and linked to one or more set of the moving contacts. Held in place by a spring, the armature leaves a gap in the magnetic circuit when the relay is de-energized. While in this position, one of the two sets of contacts is closed while the other set remains open.

3. DC Motors

Any of a group of rotating electric motors that use direct current (DC) electricity to create mechanical energy is referred to as a DC motor. The most prevalent kinds depend on the forces created by induced magnetic fields brought on by current flowing through the coil. For a portion of the motor's current to occasionally shift direction, almost all types of DC motors contain an internal mechanism that is either electromechanical or electronic



Fig.6. Water Pump

A water pump is a machine used to move, compressing, or transfer water. Water pumps are used to provide high irrigation efficiency by supplying proper amount of water to every area of the field to gain speed in cultivation. Low maintenance is required as it they come with less moving parts which eases the work.

6. Ribbon Wire



Fig. 4. DC Motors



Fig. 7. Ribbon Wire

A ribbon wire (also known as multi-wire planar cable) is a cable with many conducting wires running parallel to each other on the same flat plane. As a result, the cable is wide and flat. Its name comes from its resemblance to a piece of ribbon. Ribbon cables are usually seen for internal peripherals in computers, such as hard drives, CD drives and floppy drives. On some older computer systems (such as the BBC Micro and Apple II series) they were used for external connections as well. The ribbon-like shape interferes with computer cooling by disrupting airflow within the case and also makes the cables awkward to handle, especially when there are a lot of them; as a result, round cables have almost entirely replaced ribbon cables for external connections and are increasingly being used internally as well.

4. NRF Module

The NRF module is commonly used in Internet of Things (IoT) applications, This allows for wireless communication using the NRF protocol. It is known for its low power consumption and long-range capabilities. Essential while working with this circuit.

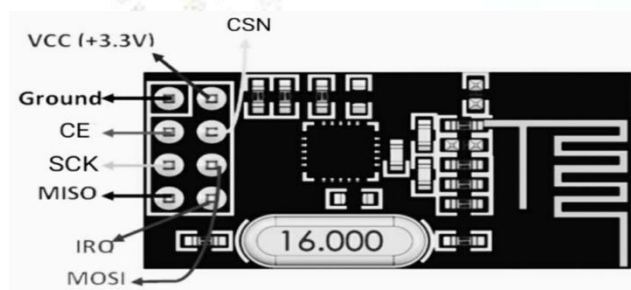


Fig. 5. NRF Module

7. Battery

IoT gadgets, particularly smartphones and smartwatches, are very popular with rechargeable lithium-ion batteries. Lithium-ion batteries typically have a high energy density and a minimal rate of self-discharge. They are the most reliable kind of rechargeable battery and may be used repeatedly without losing

power. These are the most common batteries on the market, and IoT devices in particular benefit greatly from their dependability and even customizability.

8. Joysticks



Fig. 8. Joystick

A joystick is an input device that can be used for controlling the movement of the cursor or a pointer in a computer device. The pointer/cursor movement is controlled by maneuvering a lever on the joystick. The input device is mostly used for gaming applications and, sometimes, in graphics applications.

9. Acrylic Sheet

Acrylic sheet is used in everything from windows and wall partitions to lighting fixtures and canopies. Acrylic for Transportation Applications– Acrylic is used throughout the transportation industry in instrument panels, windows, windshields, and mirrors.

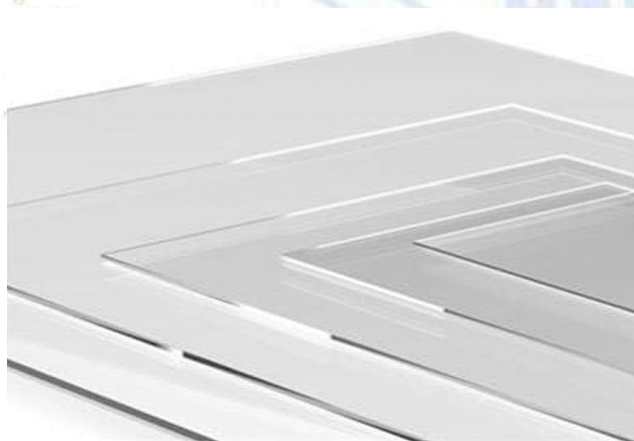


Fig.9. Acrylic Sheet

10. Water Sprayer

A sprayer is a device used to spray a liquid, where sprayers are commonly used for projection of water, weed killers, crop performance materials, pest maintenance chemicals, as well as manufacturing and production line ingredients. In agriculture, a sprayer is a piece of equipment that is used to apply herbicides, pesticides, and fertilizers on agricultural crops.



Fig. 10. Water sprayer

11. Silicon Pipes



Fig. 11. Silicon pipes

Silicon pipes can be a good choice for pesticide sprayers because they are resistant to many chemicals commonly used in pesticides and are also flexible and durable. However, it is important to make sure that the specific type of silicone being used is compatible with the chemicals being sprayed, as some types of silicone may not be suitable for certain pesticides. Additionally, it is important to properly clean and maintain the silicone pipes to prevent contamination and ensure their longevity. Regular inspection and replacement of damaged or worn out parts is also recommended to avoid any leaks or malfunctions during use. Overall, using silicone pipes for pesticide sprayers can be a good choice, but it is important to do proper research and ensure compatibility with the chemicals being used, as well as proper maintenance and replacement as needed.

12. SPST Switch



Fig. 12.SPST Switch

An SPST (Single Pole Single Throw) switch can be used in a pesticide sprayer to control the flow of electricity to a pump or other electrical component. However, it is important to choose a switch that is rated for the appropriate voltage and current for your specific application. When selecting a switch for a pesticide sprayer, it is also important to consider the environment in which it will be used. The switch should be constructed of materials that are resistant to chemicals commonly used in pesticides, and should be sealed to prevent moisture and other contaminants from entering the switch and causing damage or malfunction. It is also important to properly wire and install the switch according to the manufacturer's instructions and any applicable safety regulations to ensure safe and reliable operation. Overall, an SPST switch can be a useful component in a pesticide sprayer, but it is important

to choose a switch that is rated for the specific requirements of your application and to properly install and maintain the switch for safe and reliable operation.

IV. Flow Chart

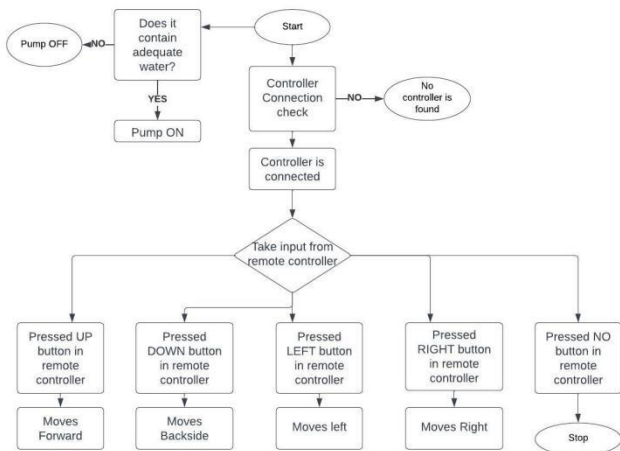


Fig. 13. Flow Chart

V. CIRCUIT DIAGRAM

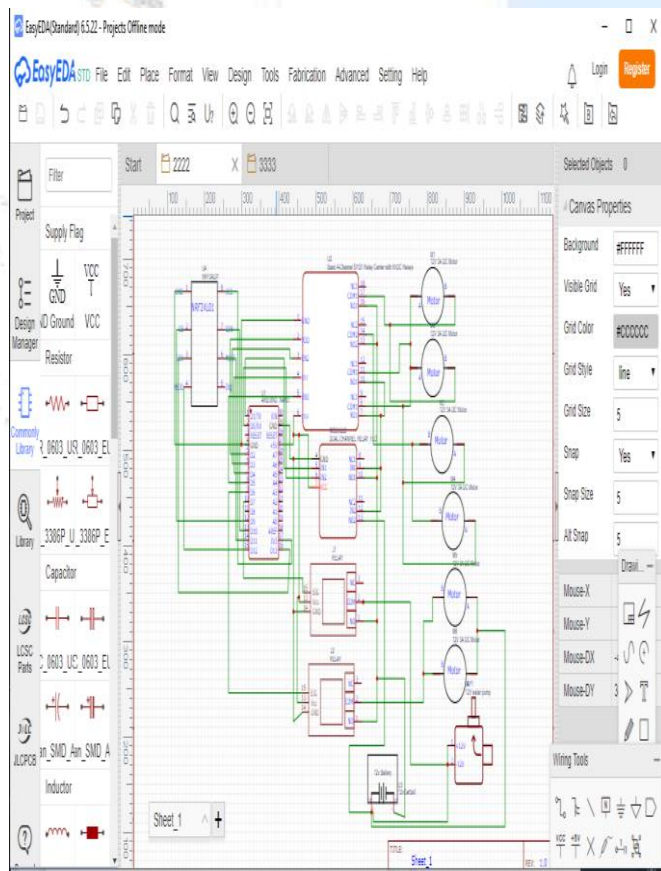


Fig. 14. Circuit Diagram of proposed system

VI. CONSTRUCTION AND WORKING

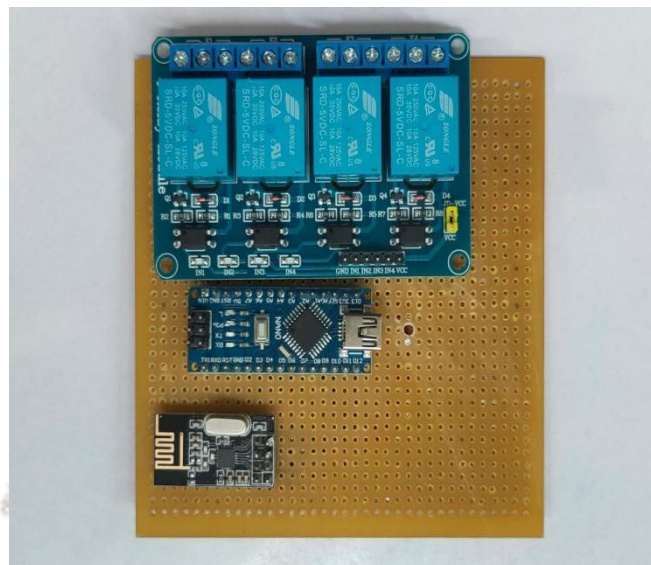


Fig. 15. Receiver Section

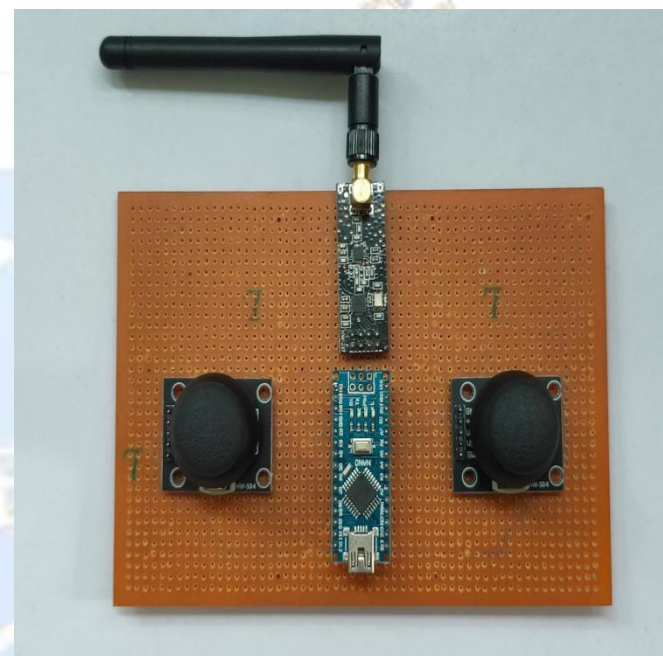


Fig. 15. Transmission Section

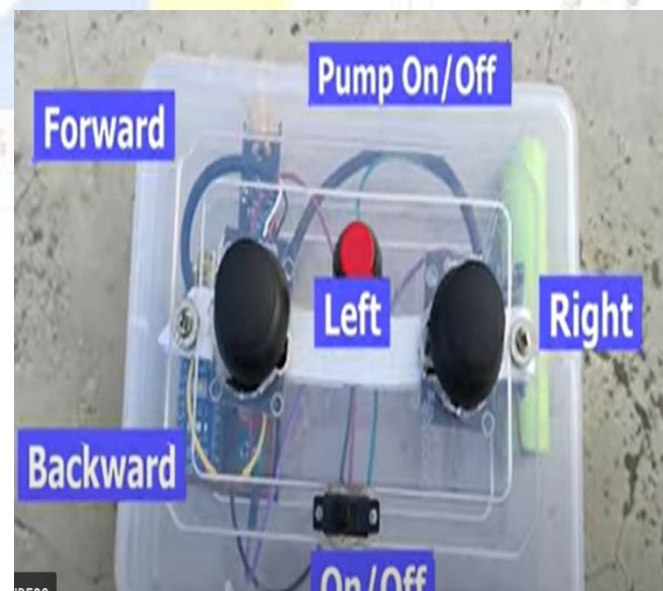


Fig. 16. Remote Controller



Fig. 17. Snapshot of vehicle Prototype

Agricultural pesticide spraying robots can also be controlled using remote controllers, which can provide real-time control of the robot's movements and spraying mechanism. One proposed method for such a robot using a remote controller is as follows:

Design and build the robot: First, the robot would need to be designed and built with the necessary components, such as motors, a spraying mechanism, and a microcontroller.

Pair the remote controller with the robot: The remote controller would need to be paired with the robot's wireless communication module. This would allow the controller to send commands to the robot in real-time.

Control the robot: The user would then control the robot using the remote controller, driving it to the desired locations and activating the spraying mechanism as needed.

Monitor the results: The user would monitor the effectiveness of the pesticide application, adjusting the spraying pattern and amount as needed based on the results.

Overall, using a remote controller to control an agricultural pesticide spraying robot can provide flexibility and real-time control, allowing the user to respond to changing conditions and adjust the spraying strategy as needed. However, it may require more manual intervention than an IoT-based solution and may not be as automated.

VI . FUTURE SCOPE

There are several potential future developments for agricultural pesticide spraying robots that use a remote controller, including:

- **Autonomous navigation:** Currently, the user has to manually navigate the robot to the desired locations in the field. In the future, the robot could be equipped with autonomous navigation capabilities, such as obstacle detection and avoidance, to allow it to navigate the field on its own.

- **Integration with smart farming systems:** The remote-controlled robot could be integrated with other smart farming systems, such as crop monitoring and yield estimation, to provide a more comprehensive solution for precision agriculture.
- **Improved spraying accuracy:** Future developments in spraying technology, such as advanced spraying mechanisms and precision nozzle systems, could improve the accuracy and efficiency of pesticide application.
- **Data analytics:** The data collected by the robot could be analyzed using machine learning algorithms to provide more accurate and targeted spraying plans. This could result in reduced pesticide use and increased efficiency.
- **Use of drones:** Drones are increasingly being used in agriculture for crop monitoring and other applications. In the future, drones could be used for pesticide spraying, providing a more flexible and agile solution for precision agriculture.

Overall, while the remote controller-based system provides real-time control and flexibility, there is still room for improvement in terms of automation, precision, and integration with other smart farming systems. These future developments could further enhance the capabilities and effectiveness of agricultural pesticide spraying robots.

VIII. Conclusion

In conclusion, agricultural pesticide spraying robots using a remote controller provide a flexible and efficient solution for precision agriculture. The remote controller allows the user to control the movement and operation of the robot in real-time, providing flexibility to respond to changing conditions in the field. The use of sensors and data analysis can help optimize the spraying plan and reduce pesticide use, minimizing the environmental impact of pesticide application.

While the remote controller-based system may not provide the same level of automation and optimization as an IoT-based solution, it still has a significant impact on the efficiency and effectiveness of pesticide application in agriculture. With potential future developments, such as autonomous navigation, improved spraying accuracy, and integration with other smart farming systems, the capabilities of agricultural pesticide spraying robots will continue to evolve and enhance.

Overall, agricultural pesticide spraying robots using a remote controller offer a promising solution for sustainable and efficient pesticide application in agriculture, helping to meet the growing demand for food while minimizing the impact on the environment.

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