

## Smart Pesticide Spraying Robot

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**Abstract** - The utility of insecticides and fungicides is one of the most important approaches in agricultural manufacturing and can have a good-sized impact on crop yield, fine, and in the long-run profitability. It is anticipated that approximately 30-35% of crop losses can be avoided whilst dangerous bugs and sicknesses are removed via making use of insecticides. At present, there are extraordinary sorts of pesticides sprayer but the approach for pesticide utility is a manually lever-operated backpack kind sprayer. Farmers who are spraying pesticides are tormented by it which makes them extra at risk of their health, eyes and they will also broaden lumbar ache because of the burden of the sprayer. This paper proposes a remotely operated spraying robot designed to lessen the time, reduce labour costs and prevent human hazards involved in spraying potentially toxic chemicals.

**Key Words:** Pesticide sprayer, Multipoint sprayer, human hazards, remote controlled, Agricultural use.

### 1. INTRODUCTION

Agriculture plays an essential position in the Indian financial system. For the rural population, agriculture is a vocation for their livelihood. All farmers use pesticides, including organic farmers. Whether from artificial or natural sources, insecticides are utilized by all farmers. The difference is organic farmers can best use insecticides from natural resources. But both synthetic and herbal insecticides have various stages of toxicity. Today solutions hugely rely upon heavy chemicals. A pesticide is a substance utilized for controlling, obviating, and ravaging pests. But when farmers spray the pest, it's far a very harmful procedure for them, they want to be very cautious like sporting proper clothes, gloves, masks, etc. Our purpose is to increment the crop yield and prevent human dangers due to poisonous chemicals. In conventional strategies, operated by hand low and high quantity hydraulic sprayer and electricity operated hydraulic sprayer with lengthy growth, lengthy lances or spray gun are used to hold fluid at different goals. In this approach, the time and labour required are extra. It is hard to spray the pesticide uniformly and effectively all through the tree with the aid of the conventional technique of spraying. The Hand operated sprayer's tank weighs 15-17 Kg. Farmers carry this for hours. Which may lead to Shoulder injuries, body pain, or Spinal Injuries. Long-term exposure to pesticides can motive loss of

reminiscence, tension, temper adjustments, and hassle concentrating. Tractor-operated sprayers are tough for adaption with the aid of the farmer because of present cropping styles, to be had subject size, area situation during the wet season. To overcome those hassle necessities for better adaptability. We introduce a remotely controlled 4 wheeled pesticide sprayer so that it will spray the insecticides and pesticides on the crops with a more expeditious speed and with minimal effort.

### 2. LITRATURE REVIEW

Leaf Disease Diagnosis and Pesticide Spraying Using Agricultural Robot (AGROBOT). It will identify the damaged leaf and its location and spray the pesticides and also it will identify the leaf disease and it will choose which pest should be used for that plant. The main problem in the agriculture field is detection of defected plants. With the help of these, the defected plants will be identified easily. [1]. The development of a smart sensor-based environment monitoring system is developed for that. In the low population areas and mainly in the farmlands etc., in that places the weather monitoring is not possible at all time so this project will help us to monitor the weather, temperature and all other climatic condition with the help of an IOT device [2]. Autonomous Pesticide Spraying Robot is the engineering solution by spraying the high toxic chemicals for the defected plants at exact location of the plant by taking all the health hazards and saves the farmer from the prevention of harm chemicals with in a confined space [3]. Application of intelligent control in spraying pesticide simulation system it is designed by using the Embedded system software, the main theme of this project is to spray the pesticides to the crops. This system is specially designed for wireless network system terminals that link to the upper device via a dedicated NC network [4]. A bionic electric spraying rod is created that performs two operations the first thing is spraying the water to the entire farm and at the same time it will sprinkle the pesticides, as it is in snake like structure it will easily undergo to entire farm. The snake bot having bone arm and muscles which is made up of multiple set of thin wires and it can be controlled by the driver module for pesticide spraying purpose a snake arm is used which is connected to the spray nozzle [5]. Nowadays the farmers are playing the crucial role by working hard in the agriculture lands and planting the

crops for the societies living in different regions for earning their minimum needs. In India the pesticide usage is higher which is 70% whereas the world-wide pesticide usage is 44% only.[6]. The main goal of this study was to design and develop software and hardware for an intelligent sprayer that can control variable-rate spray outputs through the nozzles based on availability of a target in sight and density level of the canopy sprayed. This has been accomplished to a large degree. However, there is still some ineffectiveness associated with the operation of this sprayer that can be addressed by future studies.[7]

### 3. PROPOSED METHOD

The Method that using is an Autonomous bot. This serves as helping hand to the farmers by replacing the manual farming technique with the modern farming technique. In our proposed method, the bot will control by using 2.4GHz Radio Frequency Wireless Controller. It reduces the workload of the farmers by sprinkling pesticides by its own. Automation as a part of solution.

The main concept of this bot is to make an autonomous robot with the help of an Arduino controller to reduce the health issues of the farmers. In our proposed system it consists of three parts, they are: -

1. Input unit.
2. Spray and Control Processing unit.
3. Output unit.

#### Input Unit:

The purpose of the input unit is to give the power supply for all over the circuit and it will act as a storage device too for saving the pesticide liquid.

#### Spray and Control Processing:

The main component of the circuit is Arduino uno controller and it is also known as Heart of the robot. A driver circuit is connected to Arduino, which is used for the movement of the robot. A pesticide pump is also used for transferring of liquid pesticide to the sprayer head from the storage tank.

#### Output Unit:

The output unit consists of direction control unit which is used for controlling the directions via wirelessly. As per our directions, the spraying unit will spray the fertilizers to the plants.

In this system consists of Arduino uno board, power supply, driver module, prototype car module and RF controller and receiver. The main component of the whole system is Arduino uno and it is also called as heart of the whole system, the Arduino microcontroller coordinates the sensor

and other components automatically. In the fig.4.1.the power supplies with +12v&-12. A sprayer is used for spraying the pesticides, where sprayers are commonly used for projection of water, weed killers, pest maintenance chemicals etc. Here L293D module is used. It is a driver motor 16 pin IC it is used for driving the robot on specific directions as per our instructions. The aim of the project is to design a pesticide spraying bot with a view of spraying pesticides all over the crop.

#### BLOCK DIAGRAM:

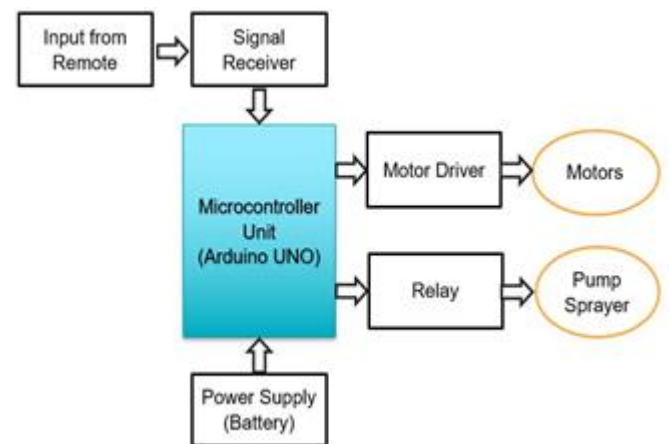


Fig -1: Block Diagram

#### 1.Power supply:

The power supply (12v,1.3Ah battery) will give the power to the input circuit, the circuit will take the power how much it is required.

#### 2.Arduino uno:

The main component of the circuit is Arduino Uno controller and it is also known as Heart of the robot. A driver circuit is connected to Arduino, which is used for the movement of the robot.

#### 3. Wireless Controller:

The 2.4Ghz PS2 DualShock wireless controller (Radio Frequency controller) is used for controlling the operations and it will send the instructions to its receiver which is interfaced with the Arduino.

#### 4. Spraying Arm:

The spraying arm with multiple nozzles is used for spraying the pesticides in the farm and it is connected to the bot.

#### 5.Driver module:

The driver module is used to control the directions of robot, it is connected to the prototype of the bot.

### HARDWARE REQUIREMENTS

- Arduino Uno board
- Vehicle construction
- RF Controller
- DC motor
- Battery
- Spraying motor
- L298n module
- Switch
- RO tube

### SOFTWARE REQUIREMENTS

- Arduino IDE

### FLOWCHART:

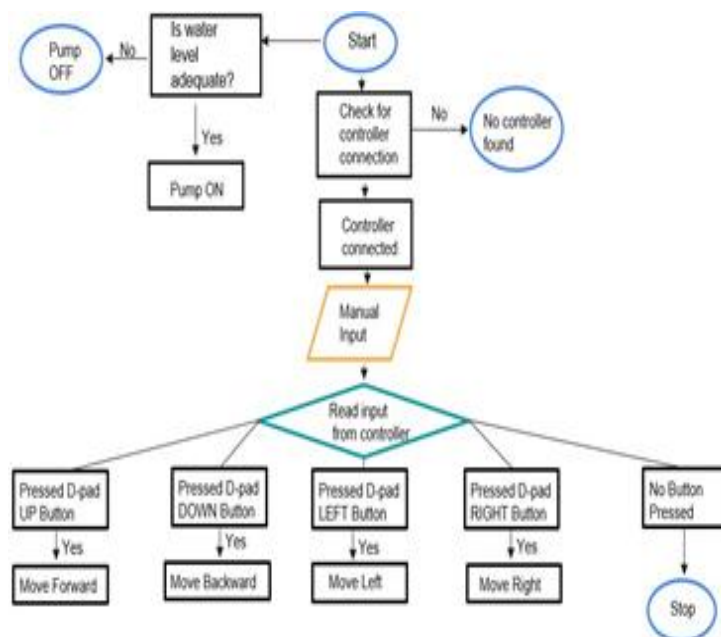


Fig -2: Flowchart

### 4. CONSTRUCTION AND WORKING PRINCIPLE

The construction of Pesticide spraying machine consists of a frame which is used for mounting the components such as D.C encoder motor, Battery. Fig. shows the pesticide spraying machine. The base is used to carry the whole machine. The movement of the robot is controlled by the commands given to the Arduino wirelessly from a safe distance via a radio frequency controller Now it is only left with the spraying mechanism and the storage device for

pesticide with the spraying mechanism that uses DC motor for spraying the pesticides, it consists of an arm and a multipoint spray rod is placed on. We can rotate and adjust the nozzle cap by which we can control the fineness of spraying of pesticide. The motor pump that is used in the robot is submersible. That means one part of pump is used to insert the pipe and other part is kept outside. A 12v DC supply is used for the supply and it is connected to the battery. The complete mechanism works on battery. In Figure-4. shown the complete picture of our robot mounted with each and every component. This total arrangement is useful in movement of the robotic sprayer from initial to the final position. This would help you to understand the working and its mechanism. The work performed here has extended the growth of the agriculture and improvement of advanced technology in the agriculture field.



Fig -3: 2.4Ghz RF Controller and receiver



Fig -4: Arduino interfaced with RF Receiver



**Fig -5:** Snapshot of Vehicle prototype

## 5. RESULTS AND DISCUSSION

When current(I) is passed through the source in 30RPM DC geared motor, the bot initializes. In that instant, dc enabled pump comes into motion in which it sprays insecticides with its five nozzles. The machine is being controlled remotely with maintaining much distance as a result humans will be much less vulnerable to the insecticides. As it covers big vicinity in brief succession of time which leads to time efficiency as it takes less time and additionally the labour workforce will be reduced. Moreover, various materials selected for the entire mechanism will be easily available at a considerably affordable price. The main problem being faced by the farmer was to carry the entire load of the pests on his shoulder and this problem can be solved by adopting this method.

Thus, the DC motor pump also gives very powerful spray for the height plants up to 2-3 ft. In this way, the remotely controlled multi-nozzle pest sprayer is going to be a very handy and viable product for farmers. The suggested model has a greater number of nozzles, the sprayer will cover most places of spraying in minimal time & at the most rate. Proper adjustment facility within the model helps to avoid excessive use of pesticides which results in less pollution. Muscular problems are removed and there is no need to operate the lever. This pump alone can be used for multiple crops.

## REFERENCES

[1] , "Effect s of chemical pesticides on human health" Shanghai Journal of Preventive Medicine, vol. 15, no. 8, pp 383-384, 2013.

[2] S. H. Deng, Z. Cai, D. D. Fang, H. Liao, G. Mont Avon, "Application of robot offline programming in thermal

spraying original research article", Surface Coatings Technology, vol. 206, no. 19, pp. 3875-3882,2012.

- [3] N. Dai, "Development and application of Agricultural Robot," Agricultural Research, vol. 31, no. 2, pp. 241-243, 2009.
- [4] X. Zhao, "The main application of intelligent robot in the field of agriculture automation", Chinese Agricultural Science Bulletin, vol. 26, no. 10, pp. 360-364, 2010.
- [5] G. Gao, H. Zhou, and X. Niu, "An intelligent variable spraying decision-making system based on fuzzy neural network for greenhouse mobile robot", Intelligent Computing for Sustainable Energy and Environment, vol. 355, pp. 257-265, 2013.
- [6] R. Gadow, A. Candel, and M. Floristán, "Optimized robot trajectory generation for thermal spraying operations and high-quality coatings on freeform surfaces", Surface Coatings Technology., vol. 205, no.4, pp. 1074-1079, 2010.
- [7] Linz, A. Ruckelshausen and E. Wunder, "Autonomous Service Robots for Orchards and Vineyards: 3d Simulation Environment of Multi Sensor Based Navigation and Applications"
- [8] "Design and Fabrication of Organic Fertilizer and Pesticides Sprayer" Dr.S K Choudhary, published in "International Journal for Scientific Research & Development", Vol.03, ISSN: 2321-0613(2015)
- [9] "Fabrication of Automatic Pesticides Spraying Machine" Dhiraj N. Kumbhare, published in "International Research Journal of Engineering and Technology", Vol.03, ISSN: 2395-0056(2016)
- [10] "Mechanically Operated Cart for Pesticide Sprayer for Agriculture" Faijubhai Malek, published in "International Journal of Innovative Research in Science, Engineering and Technology", Vol.05, ISSN: 2319-8753(2016)
- [11] "Design and Fabrication of Mechanical Pest Sprayer" Sanjay S, published in "International Journal of Innovative Research in Science, Engineering and Technology", Vol.04, ISSN: 2319-8753(2015).
- [12] Design and Operation of Agriculture Based Pesticide Spraying Robot, International Journal of Science and Research (IJSR), 2013.
- [13] Agriculture Robot for Seeding and Forming, ISAR - International Journal of Electronics and Communication Ethics – 1(2), 2018, 7-12.
- [14] Design and Fabrication of Solar Powered Semi-Automatic Pesticide Sprayer, International Research

Journal of Engineering and Technology (IRJET), 2073-2077.

- [15] Sammons, P.J., Tomonari, F. & Bulgin, A., Autonomous Pesticide spraying robot for use in a greenhouse, Australian Conference on Robotics and Automation, pp. 1-9, Sydney, Australia, December 2005.
- [16] Sanchez-Gimeno, A., Sanchez-Hermosilla, J., Rodriguez, F., Berenguer, M. and Guzman, J.L., Self-propelled vehicle for agricultural tasks in greenhouses. Proceedings of the World Congress - Agricultural Engineering for A Better World, Germany, 2006.
- [17] G. Belforte<sup>1</sup>, R. Deboli, P. Gay; P. Piccarolo, D. Ricauda Aimonino., Robot Design and Testing for Greenhouse Applications, Bio-systems Engineering, 95(3), page 309–321,2006.
- [18] Giles D K, Downey D, Slaughter D C. Herbicide micro-dosing for weed control in field-grown processing tomatoes, J. Applied Engineering in Agriculture, 2004.
- [19] Hague T, Marchant J A, Tillett N. D., Ground based sensing systems for autonomous agricultural vehicles, J. Computers and Electronics in Agriculture, vol.25,11-28.,2000. [8] Zhang Junxiong, Cao Zhengyong, Geng Changxing, Li Wei, Research on precision target spray robot in greenhouse, Transactions of the CSAE, Vol.25 Supp.2, Oct., 2009.
- [20] Cao Zhengyong, Zhang Junxiong, Geng Changxing, Li Wei, Control system of target spraying robot in greenhouse, Transactions of the CSAE, Vol.26 Supp.2, Dec. 2010.
- [21] Prakash M. Manikar, Shreekant Ghorpade, Mayur Adawadkar, "Plant Leaf Disease Detection and Classification Using Image Processing Techniques," International Engineering Journal, Volume 2, Issue 4, 2015.
- [22] Prof. Bhavana Patil, Mr. Hemant Panchal, Mr. SHUBHAM Yadav, Mr. Arvind Singh, Mr. Dinesh Patil, "Plant Monitoring Using Image Processing, Raspberry PI and IOT," Journal of Engineering and Technology, Volume 4, Issue 10, 2017.