

## **REMOTE OPERATED PORTABLE SPRAYING DEVICE**

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### **ABSTRACT**

Despite the focus on industrialization, agriculture remains a dominant sector of the Indian economy both in terms of contribution to gross domestic product (GDP) as well as a source of employment to millions across the country. Agriculture plays a vital role in the Indian economy. Over 70 per cent of the rural households depend on agriculture as their principal means of livelihood. But an attack of pest in crops is one of the major problems to reduce the production growth in agriculture field. This paper presents an engineering solution to tackle this kind of problem in which a remote operated portable robotic spraying device is used.

Chemical application of nutrients and pesticides is one of the most important processes in agricultural production, but also one of the most dangerous agricultural operations. To improve the chemical efficacy, reduce chemical and labour cost, minimize labour hazards and reduce the harmful environmental damage provided the motivation behind the development of a remote operated portable robotic spraying device.

A four wheel remote operated vehicle was designed and built to act as a sprayer. Power is transmitted from the DC motors to all the wheels through a reduction Gear mechanism. It is expected to have a successful pesticide management system in the fertigation based farm by using the remote operated portable robotic spraying device.

### **1. INTRODUCTION**

In India agriculture is the main source of income for Indian population which include almost 60 percent of Indian population. Agriculture where farmers work in their field to cultivate different kind of crops according to climate and resources. To deal with this kind of food demand for such huge population, farmers has to use large quantity of pesticides for increasing the food production. The productivity of crop is affected by other major biological parameter such as pest, disease and this parameter can be control by human being for improving production of crop. But it is very harmful procedure for farmers when they spray pesticide, they have to take too many precautions like wearing suitable outfit, gloves and masks etc. For getting best solutions in such cases use of robots is very imminent technological solution which improves productivity and efficiency. It becomes cost effective technological solution.

The Economic Survey says that there is a need to improve farm mechanization in the nation. Increasing Pest infestation productivity control plays a significant role. The farmers are facing significant issues in managing pest infestation. Pests are undesirable insects or germs that interfere with human activity and can bite, ruin food plants or make life more hard for farmers. A key point in crop management is early detection and avoidance of pests. Effective control of pests needs some understanding of pests and their habitats. Farmers are currently spraying pesticides around their fields. The main disadvantages with regard to this method are: the pesticide may come into contact with the farmer during spraying, which may trigger skin cancer and asthma illnesses. Increased pesticide spraying can impact consumer health as it enters the food chain. Pesticides are also sometimes sprayed on non-affected crops resulting in the same waste. We have therefore created an automated robotic system that can spray pesticides to solve the above-mentioned problems. Not only does this save the farmer from life threatening illnesses and physical issues, but it also saves his cash because of restricted pesticide use. That is why it helps farmers, in turn the nation, to develop

economically. Using this form of robots Time consumption is decreased in spraying the pesticide liquid and it will also assist farmers to decrease the workload and in any season and conditions to do job.

## **2. OBJECTIVES**

In method irrigation wings fixed but sprinkler are movable. For reducing expenses, big sprinkler is used that numbers of fixed Sprinkler irrigation wings are reduced significantly. This method has easier utilization, lower expense and alternative moving compared with other method. Useful life of equipment and pipes are suitable, if pipes are put inside of earth, there is no danger of theft, and also the long leg plants can be irrigated. Because, there is possibility of installation of long stand for sprinklers, for the sake of these advantages' farmers welcome to this method so much and the method has developed in recent years. In this system of irrigation riser is fixed while sprinklers are connecting on riser during irrigation. Likewise, irrigation riser is separated and transferred to the next one, after each period. The main disadvantage of this method is that, the pipes are fixed during the irrigation season but irrigation risers are moved by human labour with the sprinkles which are installed on each riser.

## **3. LITERATURE REVIEW**

[1] Aishwarya.B.V, Archana.G, IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural Development 2015.This paper deals with the exposition of how robotics can be applied to various fields of agriculture. One of the most important occupations in a developing country like India is agriculture. It is very important to improve the efficiency and productivity of agriculture by replacing laborers with intelligent machines like robots using latest technologies. The paper proposes a new strategy to replace humans in various agricultural operations like detection of presence of pests, spraying of pesticides, spraying of fertilizers, etc there by providing safety to the farmers and precision agriculture. The developed system involves designing a prototype which uses simple cost effective equipment's like microprocessors, wireless camera, various motors and terminal equipment's which is an aid to the farmers in various crop field activities.

[2] S. Singh, T. F. Burks, and W. S. Lee Trans. ASAE, vol. 48, no. 6, The road of a greenhouse is both damp and narrow, and there are both ground obstacles and space obstacles in a greenhouse, which easily cause the instability problem for a four- wheel independent driving greenhouse spraying mobile robot turning in the greenhouse. The control response curves of the yaw velocity and the sideslip angle of the robot's mass centre in a step input and in a sinusoidal input are obtained, respectively. It is shown from the simulation results that compared with the feedforward–feedback control method, the proposed dynamic sliding mode control strategy based on the established dynamic model is effective to improve the turning control stability of the mobile robot for greenhouse spraying. The experiment results further verify the feasibility of the proposed turning control strategy.

[3] N. Dai, Agricultural Research, vol. 31, no. 2. In order to reduce pesticides in agricultural production caused by direct contact with the human body injury, and improve the efficiency of agricultural spraying operations, this paper proposes the design of intelligent Wi-Fi wireless controlled spraying pesticides robots. For monitoring the microcontroller core, a wireless router for the network connection point is employed. Test results show that the design realizes spraying pesticides by robot to replace staff job, and achieves good results.

[4] P.Rajesh Kannal R.Vikram<sup>2</sup> 12Assistant professor, Department of Computer Science and Engineering 12M. A pesticide spraying ramble is the device for exact pesticide spraying equipped for managing nebulous shapes and variable article targets. The gadget incorporates a solitary splash siphon engine with a consequently separate flexible spraying utilizing ultrasonic sensors, all mounted on a pan tilt unit. The site- explicit spraying gadget plans to splash explicit targets while diminishing the utilization of pesticides. The proposed framework includes the advancement of an article explicit sprayer arrangement. The created gadget intends to diminish

pesticide application by spraying singular targets explicitly by setting the item separation of the spraying as per the objective. The spraying device is equipped for decreasing the measure of pesticides connected. Real reserve funds rely upon the spraying lengths, target size, and appropriation. We trust that such a device can be utilized in present day farming and can be joined with an automated sprayer exploring independently along yield fields. Such a gadget will add to decreased pesticide application.

[5] S N Deshmukh, S Gengaje, In agriculture robots are deployed for agricultural purposes. The main use of robots in agriculture is for harvesting , Fruit picking , driverless tractor or sprayer are design to supersede human labour. Main aim is to avoid manual spraying of pesticides at actual farm. It will achieve by replacing human by a robot, through transmission of video of crop to central station. Then central station will control movements of the robot and spraying of the pesticides, using processor in real time. This will reduce the excessive use of pesticide for plant.

#### **4. PROPOSED METHOD**

In the proposed system robotics model provides a facility to control the movement of agriculture vehicle. The quality and quantity of agricultural products can reduce by Plant diseases which have produced an enormous post effect scenario.

An automatic pesticide sprayer is involved to spray the pesticide on the crops. This system is based on the sprayer that is filled with pesticide. This provides a continuous flow of pesticide and an accuracy that is not affected by varying fluid properties and flow conditions and also sprays pesticide on affected area of plant by adjusting the height of pesticide sprayer. The motion and direction of the robot can be controlled by using software through mobile remotely.

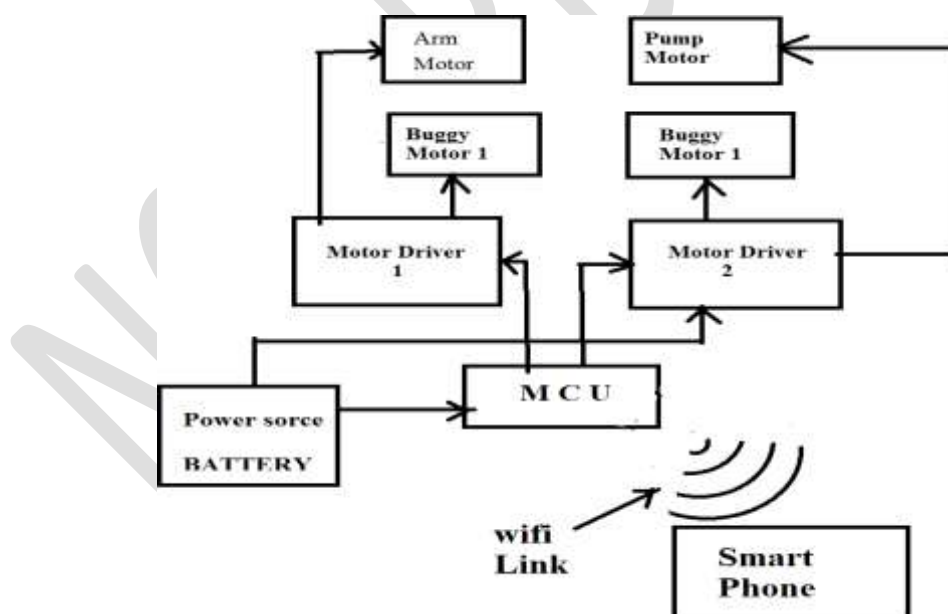


Fig 3.1. Layout of Remotely Operated Spraying Robot

#### **5. FABRICATION OF PROPOSE SYSTEM**

##### **5.1 Chassis Frame**

Chassis is the main support structure of our project which is also known as ‘Frame’. Material used for chassis is square iron pipe of dimension 1.25” x 1.25”. The length of chassis frame is 24” and width is adjustable from 8” to 12” and it can carry weight of approximately 20 kgs. Its structure is like ladder type

chassis frame, this width adjustment is done using 10 mm dia. & 12” long bolts, to this ladder frame 9” long vertical downward 1” sq. pipe are welded.

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1.25”

*Fig 5.1 Chassis Frame*

### 5.2 Components Required

#### 5.2.1 PMDC Motor with Reduction Gear Box:



Photograph 4.3.1 PMDC Motor

#### 5.2.2 Sprocket and Chain

The sprocket and chain together use to transfer power generated by PMDC Motor and reduction gear box to the wheels of the robot which gives robot ability to move in various direction.



*Photograph 4.3.2 Sprocket and Chain*

### 5.2.3 Spur Gear

Spur gears are a type of cylindrical gear, with shafts that are parallel and coplanar, and teeth that are straight and oriented parallel to the shafts. They're arguably the simplest and most common type of gear – easy



to manufacture and suitable for a wide range of applications.

*Photograph 4.3.3 Spur Gear*

### 5.2.4 Pump

The battery provides power to the pump. One end of the pump is connected to the water and fertilizer reservoir, the pump sucks water and fertilizer from the reservoir and pushes it to the multipoint nozzle which sprays the fertilizer.



*Photograph 4.3.5 Pump*

### 5.2.5 Control Unit

At the first stage the signal send by mobile WIFI is catch by WIFI modulator. This WIFI modulator catches the mobile signal and sends it to the micro controller system. According to the command given by the mobile signal the micro controller use command to motor pump, etc. to operate accordingly.



*Photograph 4.3.6: - Control Unit*

## **6. FABRICATED PROPOSED MODEL**



Photograph 6.1 Fabricated Model of Remote Operated Portable Spraying Device.

## **7. MODEL OPERATED TECHNIQUE**

The model is constructed in three parts, the first part is about the base buggy, and the second part is the manipulator arm, which is fixed on the buggy, and the third part is the controller unit (that controls the entire robot.) The first part i.e. the buggy is fabricated using an adjustable ladder frame which is 24" long and center-adjusted for its width from 8" to 12", this width adjustment is done using 10mm dia. & 12" long bolts, to this ladder frame 9" long vertical downward 1" sq. pipe are welded. These are frame pipes in all to the end, 1 each pipe a wheel is fixed using bush bearing, each wheel in 2" wide section 6" dia. PVC pipe with 1" dia. disc of 18mm wide plywood, behind each wheel & sprockets of 28 teeth are affixed using 3/16 nut and bolt. Between each sidewise set of front & rear wheel at the middle part a PMDC motor is affixed. This motor is 17W DC and is motor connected with gearbox, sporting one set of reduction gear where in the input gear is worm type and the output gear is spur or roller type. The output shaft of this gearbox 16" teeth sprocket is affixed to the ladder frame using a 7" long vertically downward 1" sq. section iron pipe. The second sprocket works on an idler sprocket, a chain runs on all those sprockets and thus the front & rear wheel of any side run in synchronism with the help of the controlling fitted PMDC motor. Thus running the motor in clockwise direction too. The entire conduction is for the other side of the buggy. Thus running both the motor in the same direction, the motor running front direction and vice versa. When one motor runs and the other is not, then the buggy turns in the respective direction, to turn the buggy in the other direction, the other motor runs and the first is made off, thus

the buggy in all wheel drive buggy. This buggy supports three platforms the front and rear platform supports 5 liters. Tanks each that carrier liquid for spraying the permanent magnet DC motor by using the power of dry cell battery runs the output shaft of motor has a sprocket mounted on it. As the motor starts the output shaft of motor starts rotating and so the sprocket rotates. This sprocket is connect to other sprocket mounted on shaft of the wheel with the help of chain so as the motor starts the wheels will run.. The middle platform supported mechanical manipulator arm.

The second part of the model is manipulator arm having adjustable height up to 38” and can be rotated using PMDC motor using reduction gear box , The 38” height manipulator arm in constructed using a compos the link i.e. base fixed link and upper rotating arm this link are actually pipe and co axially fitted . The motor makes the upper pipe rotate as per controlling device, the base pipe is 1.50” dia. and the upper pipe in 1” is dia. At the top of this pipe swinging wide made of aluminium rails and 35” long in fixed using nut bolt. This link can manually be rotates from angle, the height of the arm is adjusted by disassembling it & then assembling it to already drilled holes with help of nut and bolts. The end of tanks are link to two multipoint sprayer attach to the both side of manipulator arm with help of PVC pipes, a PMDC motor pump pushes the liquid from the two reservoirs through PVC pipe to this two spraying nozzle thus the liquid can be sprayed. The manipulator arm is adjusted to the reversed position using the motor and manual inputs.

The third part of the construction part is controller unit this is done using Wi-Fi micro controlled unit (MCU ) . This is connected with two motor drive unit each motor drive which is capable of running two motors. This for motor are controlled (two for motion of buggy, one for rotating are and one PMDC pump thus for motor) are controlled using MCU and motor driver unit. Each of these motor expect the pump motor is mode to run in clockwise and anticlockwise direction. Signal to the MCU is given from the connected smartphone. The smartphone is connected to MCU using Wi-Fi and the html// code that is send signal the MCU is executed and displayed on the smartphone, this html// code have various buttons to operate various motor . When a button is clicked the C language program send in the MCU is executed and relevant motor is made to run an driver, thus all the motor are controlled. This is how the project is construct, thus works of the project is quite good and can be handled by how so semiskilled operator, who can fill the tank with the liquid desired for spraying, and then manipulating the button on the smartphone html// page the works can move and control the spraying robot.

## **8. EXPERIMENTAL RESULT**

Working test carried out in the farm, the robot installed sprayed with water & pesticides, connected to the robot Android phone wireless router Wi-Fi network, using a mobile phone to control the robot into the farm in one filling of tank the robot covers area of 76.5 sq.m. and takes about 25 min till the reservoir is empty. There are some problems faced during testing like as the size of wheel small, at some point they get stuck in soil and because of these problem it become difficult to operate these robot. And because that time period is also increases.

Working test carried out in the ground, the robot installed sprayed with water & pesticides, connected to the robot Android phone wireless router Wi-Fi network, using a mobile phone to control the robot into the ground in one filling of tank the robot covers area of 102 sq.m. and takes about 23 min till the reservoir is empty. Problems occur during this process are less as compared to farm.

Robot needs a dry cell battery to the buggy during the work group and the both motor supplies power, dry cell battery to provide the core of the system board and the pump power, the experiment the robot can

continue to work in one. By the time the test experimental robot, the robot power supply system to ensure the robot has relatively long working hours, to guarantee the completion of certain spray robot workload. However, if you want to get a longer working time, you can improve the motor-driven mechanical structure, reducing the friction loss, the use of more efficient pumps and other ways to work longer hours.

## **9. CONCLUSION**

We conclude that this robot can be controlled from around 15-20 m range without being exposed to pesticides; it will be a profit for the farmer. He will stay unaffected by his health condition. Apart from that, it does not require any supervision for operating. It only needs pesticide level refilling, recharging the battery. Solar technology for self-recharge can also be imported in future. This paper suggests the effective use of technology to meet the agricultural growth. This cost effective and one time investment project. It saves labour cost which also saves total cost for a farmer. By the removal of the disease from crop, a farmer gets more productive output which results in wealth maximization of the farmer. This can be said as an advanced step in the agricultural sector, which avoid food crisis, attract the youngsters, and shows the fragrance of agriculture.

Robot device can be used in different terrain, different heights crops by spraying operation tests show that a certain protective, practical, mobile robot, better spray effect at the right working environment, ease of handling and easy maintenance and other characteristics of individuals with a broad market in agricultural production.

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