



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 5, May 2022

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.118

9940 572 462

6381 907 438

[ijirset@gmail.com](mailto:ijirset@gmail.com)

[www.ijirset.com](http://www.ijirset.com)



# Design and Fabrication of Colour Decoding Pesticides Spray Robot

**Tejas Babasaheb Bankar, Nikhil Nitin Dangade, Rushikesh Sachin Darandale,**

**Sopan Kashinath Dugane, Prof.Sarang Joshi**

Student, Dept. of Mechanical Engineering, JSPM's Imperial College of Engineering & Research, Pune,  
Maharashtra, India

Assistant Professor, Dept. of Mechanical Engineering, JSPM's Imperial College of Engineering & Research, Pune,  
Maharashtra, India

**ABSTRACT:** There are many types of pesticides sprayer are available in India. But mostly used sprayer is backpack type sprayer which is used by farmers because it is cheaper, easy to use but it requires lot of time. Also, the farmer which is spraying pesticides is affected by it as it is harmful to human health and human also affect by the lumbar pain due to weight of equipment. Thus, this project vigorously describes the design and construction of a robot featuring plant spraying mechanism for pesticide with varying spray. To realize this work we provide a compact, portable and a well-founded platform that can survey the farmland automatically. This approach will help farmers using fundamental principles of Sensor's technology. The main aim of our project is to design and develop pesticide spray with varying the timing machine. The 3 D model is drawn. All the parts are manufactured and then assembled together and then the testing of model is carried out.

**KEYWORDS:** RF transmitter & receiver, solar panel, remote, DC motor, AT mega 16.

## I. INTRODUCTION

The main business of Indian people is agriculture and the economy of the nation is decided by agriculture. The essential nutrients for plant growth are commonly generates in its surroundings. The plant development process depends on the conditions of the environment, where plant grows. The plant development process depends on the conditions of the environment, where plant grows. The necessary parameters like, humidity, light, moisture, ambient temperature and CO<sub>2</sub> etc. are consists in the environment. Deep understanding of all these factors and their relationships can help the farmer to get much familiar with any of the potential problems that will affect the health of the plants and thereby more appropriate and accurate measures can be taken to get rid of these problems.

In conventional methods, manually operated low and high volume hydraulic sprayer and power operated hydraulic sprayer with long boom, long lances or spray gun are used to carry fluid at different targets. In this method, the time and labour required is more. It is difficult to spray the pesticide uniformly and effectively throughout the tree by conventional method of spraying. Though this method gives good pest control, it consumes large volume of liquid per plant, great amount of time and labour are required. Also drip losses are more. Owing to concern towards protecting environment from pollution by excessive use of pesticide and to economies the spraying method suitable alternative should be identified. In India, diverse farm mechanization scenario in country due to varied size of the farm holdings and socio-economic disparities. Most of farmer in India are small and marginal land holder. The spraying operation done by Knapsack sprayer which consumes more time and energy. Tractor operated sprayers are difficult for adaption by the farmer due to existing cropping patterns, available field size, field condition during the rainy season. In order to reduce the harm to the environment and people the research and development of plant protecting machine focus.

## II. LITERATURE SURVEY

This journal represents the, developments and innovation in agricultural robots for field operations, and the associated concepts, principles, limitations and gaps. Robots are highly complex, consisting of different sub-systems that need to be integrated and correctly synchronised to perform tasks perfectly as a whole and successfully transfer the



required information. Extensive research has been conducted on the application of robots and automation to a variety of field operations, and technical feasibility has been widely demonstrated. Agricultural robots for field operations must be able to operate in unstructured agricultural environments with the same quality of work achieved by current methods and means. To assimilate robotic systems, technologies must be developed to overcome continuously changing conditions and variability in produce and environments. Intelligent systems are needed for successful task performance in such environments.

The robotic system must be cost-effective, while being inherently safe and reliable human safety, and preservation of the environment, the crop and the machinery are mandatory. Despite much progress in recent years, in most cases the technology is not yet commercially available. Information-acquisition systems, including sensors, fusion algorithms and data analysis, need to be adjusted to the dynamic conditions of unstructured agricultural environments. Intensive research is needed on integrating human operators into the system control loop for increased system performance and reliability. System sizes should be reduced while improving the integration of all parts and components. For robots to perform in agricultural environments and execute agricultural tasks, research must focus on: fusing complementary sensors for adequate localisation and sensing abilities, developing simple manipulators for each agricultural task, developing path planning, navigation and guidance algorithms suited to environments besides open fields and known a-priori, and integrating human operators in this complex and highly dynamic situation.

In this article present design agricultural robot which is based on electronic and mechanical (Mechatronics) platform that perform advance agriculture process. This paper strives to develop a robot capable of performing operation like automatic ploughing and seed dispensing. We have developed an electromechanical vehicle which is steered by DC motor to drive wheels. The farm is cultivated by the automated system, depending on the crop considering particular row and specific columns. This project controlled by remotely and solar panel is used to charge DC battery. In this journal author tried to present related work of agricultural robot as labour problem can be reduced as compared to the manual and tractor based sowing time, energy required for this robot machine is less. At the same time by using solar energy environment pollution can also be reduced. Development and Automation of Robot with Spraying Mechanism for Agricultural Applications. This is achieved by the design and construction of an autonomous mobile robot for use in pest control and disease prevention applications in commercial Farm.

The effectiveness of this platform is shown by the ability to successfully navigate itself down rows of a Farm, spray the pesticides effectively while the farmer controls it from a far distance. And this pesticide spraying system efficiently covers the plants evenly with spray in the set dosages. To reduce the human effort and increase the yield. The ploughing of firm and plantation of seeds is automatically done by using dc motor. The distance between the two seeds are controlled and varied by using microcontroller. When the robot reaches the end of the field, we can change the direction with the help of remote switches. The whole process is controlled by microcontroller. Ploughing of firm and seed plantation is our day to day life is done by tractor in farms. But it requires more time & the man power shortage is faced continuously. The main requirement of automation is to reduce man power in our country; the buzzword in all industrial firms generally involves electrical, electronic component as well as mechanical part. Automation saves a lot of tedious manual work and speeds up the production processes.

### III. METHODOLOGY

Step 1: - We started the work of this project with literature survey. We gathered many research papers which are relevant to this topic. After going through these papers, we learnt about grass cutter and pesticide spray machine.

Step2: - After that the components which are required for my project are decided.

Step 3: - After deciding the components, the 3 D Model and drafting will be done with the help of CATIA software.

Step 4: - The components will be manufactured and then assembled together.

Step 5: - The testing will be carried out and then the result and conclusion will be drawn.



## DESIGN OF THE SYSTEM:

### DESIGN:

CAD: -

Computer-aided design (CAD) is the use of computer systems (or workstations) to aid in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing. CAD output is often in the form of electronic files for print, machining, or other manufacturing operations. The term CADD (for Computer Aided Design and Drafting) is also used.

Its use in designing electronic systems is known as electronic design automation (EDA). In mechanical design it is known as mechanical design automation (MDA) or computer-aided drafting (CAD), which includes the process of creating a technical drawing with the use of computer software.

CAD software for mechanical design uses either vector-based graphics to depict the objects of traditional drafting, or may also produce raster graphics showing the overall appearance of designed objects. However, it involves more than just shapes. As in the manual drafting of technical and engineering drawings, the output of CAD must convey information, such as materials, processes, dimensions, and tolerances, according to application-specific conventions.

CAD may be used to design curves and figures in two-dimensional (2D) space; or curves, surfaces, and solids in three-dimensional (3D) space.

CAD is an important industrial art extensively used in many applications, including automotive, shipbuilding, and aerospace industries, industrial and architectural design, prosthetics, and many more. CAD is also widely used to produce computer animation for special effects in movies, advertising and technical manuals, often called DCC digital content creation. The modern ubiquity and power of computers means that even perfume bottles and shampoo dispensers are designed using techniques unheard of by engineers of the 1960s. Because of its enormous economic importance, CAD has been a major driving force for research in computational geometry, computer graphics (both hardware and software), and discrete differential geometry.

### BASIC DESIGN CALCULATIONS AND FRAME DESIGN:

Total water storing capacity approximately of water tank- 5-10 litres.

Hence weight of the tank is given by,

Density= Mass/Volume.

For ten litre of water tank mass of the tank =1000\*0.01

=10kg.

Total mass of the framework=4kg.

So, Total weight =16 kg.

Total force is calculated by,

$F=m*a$

$= (16*9.81)$

$=157N$

So, on each wheel load is equals to  $(157/2) =78.5N$

We are using four-inch diameter (101.6mm) wheels hence the total required torque is calculated as,

$T=F*R$

$= (78.5*0.0508)$



$$=3.9878 \text{ N-m} \text{-----A}$$

For 12V and 12A DC battery motor,

$$P=V*I$$

$$= (12*2)$$

$$=24\text{Watt.}$$

Now each motor generated torque for 30 r.p.m.is given by,

$$P=2*3.141*(30) *T/60$$

Hence calculated torque is,

$$T=7.693 \text{ N-m} \text{-----B}$$

From the above Calculations  $B>A$ , hence the design is safe.

Material selected for body Mild steel or low carbon steel, Square hollow pipe

Size of section: 25x25 mm

Thickness of section: 2 mm

Total weight of acted is considered as: 15 kg

$$= 15 \times 9.81 \text{ N}$$

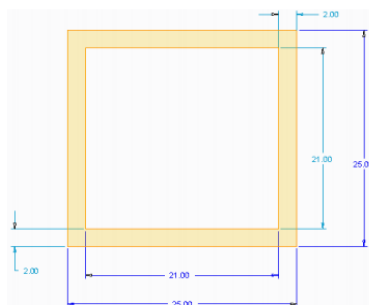
$$= 147.15 \text{ N}$$

Weight on one hollow Square bar = 7.5 kg

$$= 7.5 \times 9.81 \text{ N} = 73.58 \text{ N}$$

$$x = y = 12.5\text{mm}$$

Area of cross-section is = 174mm<sup>2</sup>



As the load is distributed on the pipe which is subjected to the load as simply supported beam with uniformly distributed load the bending moment on the pipe is calculated as

$$M / I = \sigma b / Y$$

$$I = BH^3/12 - bh^3/12$$

$$I = 32552 - 16206 = 16346 \text{ mm}^4$$

$$M_b = WL^2 / 8 = 147.15 \times 1 / 8 = 18.3937 \text{ N-m}$$

$$M_b = 18393 \text{ N-mm}$$



$$18393 / 16346 = \sigma_b / 12.5$$

$$\sigma_b = 14.06 \text{ N/mm}^2$$

**PUMP:**

Power spent directly on transmission of pumped fluid energy is calculated by the formula:

$$N_{II} = \rho \cdot g \cdot Q \cdot H$$

$N_{II}$  – useful power, W

$\rho$  – density of the pumped medium, kg/m<sup>3</sup>

$g$  – gravity acceleration, m/s<sup>2</sup>

$Q$  – flow rate, m<sup>3</sup>/s

$H$  – total head, m

$$N_B = N_{II} / \eta_H$$

$N_B$  – power on pump shaft, W

$N_{II}$  – useful power, W

$\eta_H$  – pump efficiency

In its turn, power developed by motor exceeds the shaft power, which is necessary to compensate for energy losses in its transmission from motor to pump. Electric motor power and shaft power are linked by efficiencies of transmission and motor.

$$N_{II} = N_B / (\eta_{II} \cdot \eta_H)$$

$N_{II}$  – motor power consumption, W

$N_B$  – shaft power, W

$\eta_{II}$  – transmission efficiency

$\eta_H$  – motor efficiency

Final motor generating capacity is calculated from motor power with regard to potential overload during start up.

$$N_Y = \beta \cdot N_{II}$$

$N_Y$  – motor generating capacity, W

$N_{II}$  – motor power consumption, W

$\beta$  – power safety margin

We calculate useful power consumed directly for medium pumping:

$$N_{II} = \rho \cdot g \cdot Q \cdot H =$$

$$Q = \text{Area} \times \text{Velocity}$$

$$\text{Velocity} = 2\pi N / 60$$

$$= 2 \times 3.142 \times 100 / 60$$

$$= 10.47 \text{ m/s}$$

$$A = \pi r^2 - \pi r^2$$

$$= 2.8274 \times 10^{-5} \text{ m}^2$$

$$Q = 2.8274 \times 10^{-5} \times 10.47 = 0.00029603 \text{ m}^3/\text{s}$$

$$N_n = 1000 \times 9.81 \times 0.00029603 \times 0.1 = 0.290 \text{ Watt}$$

Shaft calculations:

We select M.S material for shaft,



$$\rho = 7860 \text{ kg/ m}^3$$

$$L = 0.765 \text{ m}$$

Mt = torsional moment

$$\text{Maximum bending stress} = (M \cdot r) / I$$

$$M = WL^2/8 = 14071 \text{ Nmm}$$

$$I = \pi r^4 / 4 = \pi \times r^4 \times 0.25 = 0.785 \times r^4$$

Allowable bending stress of Mild steel is 155 N/mm<sup>2</sup>

$$155 = (14071 \cdot r) / 0.785 \cdot r^4$$

So  $r = 10.75 \text{ mm}$  but we are taking the diameter of shaft as 20 mm by considering the factor of safety as 2.

### Bearing:

Dynamic load acting on bearing,  $P = 10 \text{ N}$

$L_{10h} = 12000 \text{ hr}$  --- (Rated bearing life)- (used in machines to work with high operational reliability during short periods) — (V.B. Bhandari)

Load life equation,

$$L_{10} = (C/P)^p,$$

$$L_{10} = (60nL_{10h})/10^6 \text{ --- (Life in hours)}$$

$$= (60 \times 1500 \times 12,000) / 10^6$$

$$= 36 \text{ million revolution}$$

$$[L_{10} = (C/P)^p] \text{ take } P = (10/3)$$

$$36 = (C/10)^{10/3}$$

Dynamic Load Capacity

$$C = 29.3 \text{ N}$$

So, we are selecting bearing 6204.

## IV. CONCLUSION

The accurate and efficient classification and detection of a plant diseases is vital task for the successful farming of a crops and is the key to prevent the agriculture loss. The modern agricultural technology towards plant production, protection, health and sustainable agriculture. This can be done using image processing technique, which is used for the detection of plant leaf diseases. This paper discussed the various techniques to segment the disease part of a plant and spraying the pesticide on the diseased plant efficiently and effectively. We can say that proposed system is efficient enough for detection of the leaf diseases.

## V. FUTURE SCOPE

- As this is prototype when we go for large scale production it will increase atomization of agriculture.
- Robots can be used for other horticultural tasks such as pruning, weeding, spraying and monitoring.
- Robots can also be used in livestock applications (livestock robotics) such as automatic milking, washing and castrating.
- They can also be used to automate manual tasks, such as weed or bracken spraying, where the use of tractors and other manned vehicles is too dangerous for the operators.



- Another goal being set by agricultural companies involves the collection of data.

#### REFERENCES

1. “Agricultural robots for field operations: Concepts and components” Avital Bechar, Clement Vigneault Institute of Agricultural Engineering, Agricultural Research Organization, The Volcani Center, Bet-Dagan, Israel
2. “AGRICULTURAL ROBOT” Kavita Zole<sup>1</sup>, Sanghasevak Gedam<sup>2</sup>, Aditya Dawale<sup>3</sup>, Kiran Nikose<sup>4</sup>, Jayant Hande Research Student, Dept. of ETC, Priyadarshini J L College of Engineering Nagpur, Maharashtra, India
3. “HRI usability evaluation of interaction modes for a teleoperated agricultural robotic sprayer” George Adamidis, Christos Katsanos, Yisrael Parmet, Georgios Christou, Michalis Xeons, Thanasis Hadzilacos, Yael Edan
4. “Development of Smart Pesticide Spraying Robot” by Pvr Chaitanya, Dileep Kotte, A. Srinath, K. B. Kalyan
5. “Application of systematic methods in the electromechanical design of an agricultural mobile robot” Rubens Andre Tabile, Eduardo Paciencia Godoy, Giovana Tripoloni Tangerino, Arthur José Vieira Porto, Ricardo Yassushi. Inamasu, Rafael Vieira de Sousa
6. “Autonomous Pesticide Spraying Robot for use in a Greenhouse by Philip J. Sammons, Tomonari Furukawa and Andrew Bulgin
7. “Colour sensors and their applications based on real-time colour image segmentation for cyber physical systems” by Neal N. Xiong, Yang Shen, Kangye Yang, Changhoon Lee and Chunxue Wu





**INNO SPACE**  
SJIF Scientific Journal Impact Factor  
**Impact Factor: 8.118**



**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details