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"DESIGN AND FABRICATION OF PESTICIDES SPRAY ROBOT"

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Abstract - *This paper represents the idea of automation in agriculture particularly in the pesticide spraying operation on crops. Pest control of crops is very important step in agriculture and most of developing economies like in India, these practices are done Manually which can cause hazardous effects to farmers health. This study aims to design and fabricate an automatic pesticide spray robot system that will help reduce pesticide consumption, labour intensity, and preserve farmer's health. The robot will be developed, including control mode, movement, spraying, and sensor integration. This idea offers a pesticide spraying system to assist farmers in the agricultural sector. A mechanized framework is created using RGB Colour sensor which will recognize the colour and will spray liquid according to requirement. A Bluetooth control module used to control the motion of robot. As a prototype, Robot is restricted only for To-and-Fro motion. To cover front and side area for spraying, The rotating arm is designed which can rotate 180 degrees mounted with nozzle which will spray pesticide. Thus, this project vigorously describes the design and construction of a robot featuring plant spraying mechanism for pesticide. compact, portable and a well-founded platform that can help farmers for pest control of crops with precision. This approach will help farmers using fundamental principles of Sensor's and robotics technology.*

***Key Words*: Automation, Robotics, Pest-control, Agriculture, RGB colour sensor, Colour sensing, Mechanism.**

1. INTRODUCTION

Healthy, sustainable and inclusive food systems are critical to achieve the world's development goals. Agricultural development is one of the most powerful tools to end extreme poverty, boost shared prosperity, and feed a projected 9.7 billion people by 2050[5]. Growth in the agriculture sector is two to four times more effective in raising incomes among the poorest compared to other sectors. 60 percent of the Indian population works in the industry, contributing about 18 percent to India's GDP [6].

To cultivate crops, the farmer performs various agricultural activities such as tillage, sowing, fertilizing, irrigation, spraying pesticides, harvesting, etc. Most of these methods are done manually by farmers. Pest control is one of the activities farmers do to protect crops from diseases and insects. One of the most common forms of pesticide application, especially in conventional agriculture, is the use of mechanical sprayers. In conventional methods, hand operated low and high-volume electric sprayers with long rods, long lances or spray guns are used to transport liquids to different targets. Tractor operated sprayers are difficult for adaption by the farmer due to existing cropping patterns, available field size, field condition during the rainy season. The spraying operation done by backpack manual sprayer which consumes more time and energy [1]. It is the standard methods of applying pest control chemicals and other compounds. Nearly 35% of crops have been safeguarded from the insects` using pesticides [4]. Although this method provides good pest control, it consumes a large amount of liquid per plant, which is time- and labour-intensive It is difficult to evenly and effectively spray the entire plant with conventional spraying methods. Owing to concern towards protecting environment from pollution by excessive use of pesticide and to economies the spraying method suitable alternative should be identified. Automation can be used on large scale to overcome the problems faced during various agricultural practices so as in pest control [3]. By surveying farm land size, crop types, available resources many kinds of automatic or robotic systems can be designed and implemented. As per necessities of farmers spraying mechanisms can be design which can spray pesticides evenly over crops, also reduce pollution of soil and maintain quality of crops.

we therefore created a robotic system which will going to spray pesticides according to requirement of plant to solve this problem.so it will reduce the labour dependency of farmers also reduce pollution by controlling extra amount of pesticide solution. using this type of systems helps farmers to decrease their workload.

2. METHODOLOGY

The first step to design the Agri-robots is to conduct the field survey to know the requirements, which helps to decide upto what level we have to design and automate the robot. Literature survey helps to learn more about the existing technology. The two important parts in Agri-robots specially the pest controlling robot are the chassis i.e., mechanical frame design and electronics that is sensors, processor, different controlling module, etc. From field survey we can design the chassis according to the pattern of Agri-land. IT also helps to decide what components and materials we should consider, how we can automate the motion of robot, of what power electric motors we should use, etc.

From surveys, we got to know about the different disease present on plant, how we can identify and differentiate them; which chemicals to use to eliminate disease and their quantity. Diseases on plants are depends on various factors like ph., temp, color. One of the major factor considered while checking diseases on plants is colour.

As mentioned above we conducted the surveys and decided to design a prototype of pest controlling robot based on RGB colour sensor suitable for environments like polyhouse, small to medium size plant nurseries.

2.1 Prototype CAD model

We used CATIA software to design the chassis. The CAD model and the specifications are listed below.

Table 1-Frame Specifications

Sr.No.	Feature	Data
1.	Material	Mild Steel
2.	Length	450 mm
3.	Breadth	300 mm
4.	Height	155 mm
5.	Thickness	1 mm
6.	Unloaded Weight of frame	4.45 Kg
7.	Loaded frame of frame	9.7 Kg

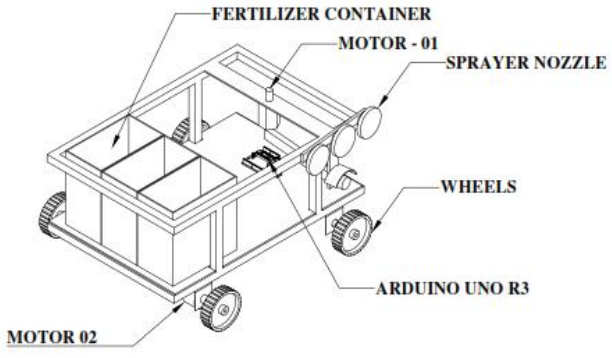

Figure 1- Prototype Parts

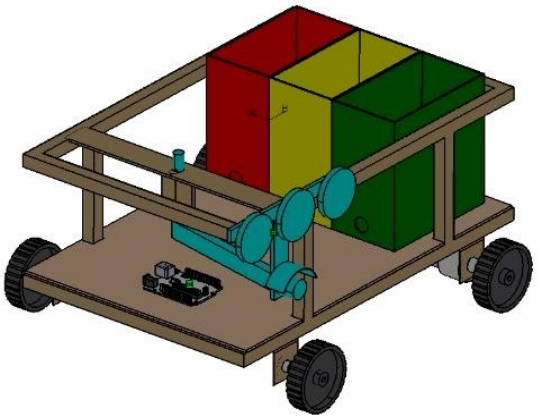

Figure 2- Prototype CAD Model

2.2 Proposed system working

First step is understanding requirement of plant by checking color of leaves with color sensor TCS 3200. Here sensor will scan the color by throwing white light on leaves. After scanning sensor will pass its output to Arduino. Here Arduino is programmed for green yellow and brown intensity as green color indicates healthy, yellow and brown shade indicates plant is diseased. So, the output from TCS3200 will be processed by the microcontroller and resultant processed data will pass to the pump. pump will spray the pressurize pesticide liquid through nozzle according to plant requirement. For spraying 180-degree rotating arm carrying nozzle is made which is able to spray on plants which are on front side as well on both left and right side of robot.

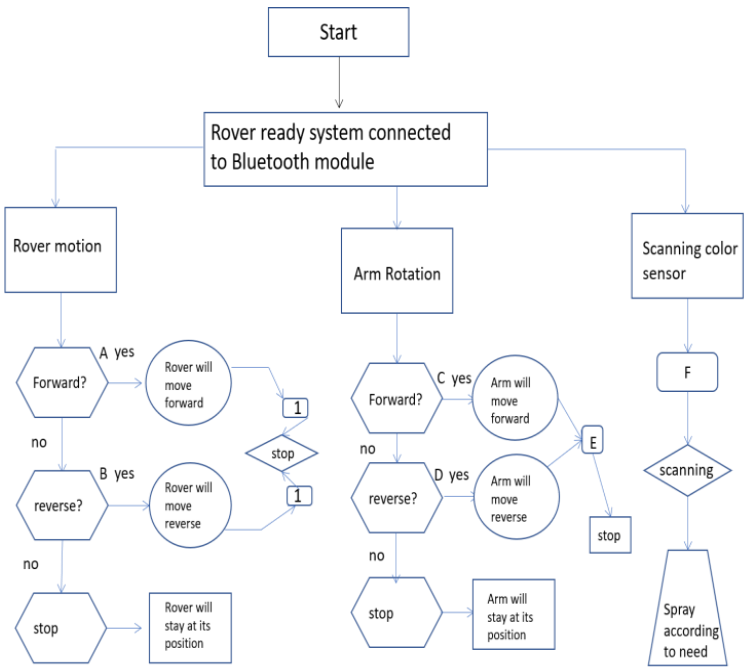

Chart 1- Flowchart of System

For motion controlling Bluetooth module HC05 is used with Arduino for connecting smartphone. The operator will control the motion using smartphone by passing motion commands to the Arduino through Bluetooth module. The rotation arm which carries nozzle is also controlled by smartphone.

3. Components and Specifications

After market survey and market research below components finalized according to requirements.

Table 2 - Components and Specifications

Sr.No.	Component Name	Component Specifications
1.	Electric Motor	Base RPM: 3000 , Rated Torque: 46.7 N-cm.
2.	Arduino Microcontroller UNO R3	Microcontroller: ATmega328, Pins: 14.
3.	Colour sensor TCS3200	Power: 2.7V to 5.5V, High-resolution conversion of light intensity to frequency, Programmable color and full-scale output frequency.
4.	Relay Module- 5v 2 Channel	AC voltage 250V, AC current 10A, maximum DC voltage 30V DC current maximum 10A.
5.	Bluetooth module	Name: HC-05
6.	Motor Driver Module	Driver Model: L298N 2A, Driver Chip: Double H Bridge L298N.
7.	Lead-Acid Battery	Voltage: 12V , Current rating: 1.3 A-h
8.	Pump	1.Used Pump Type: Wiper Pump, 2. Flow Output: 20ml/sec, 3. Operating Voltage: 12V, 4. Current: DC, 5. Moderate Pressure.

3.1. Colour Sensor TCS3200:

A color sensor is a photoelectric sensor that emits light from a transmitter and detects light reflected off an object to be detected. The color sensor based on the TCS3200 is a complete color detector capable of detecting static colors. The sensor output is a square wave with a frequency directly proportional to the intensity of the incident light. It also supports fill light with built-in LED. It contains a TAOS TCS3200 RGB sensor chip and 4 white LEDs. The TCS3200 can detect and measure an almost infinite range of visible colors. Applications include strip reading, color classification, ambient light detection and calibration, and color matching.

Figure 3: TCS3200 Colour Sensor

Here's the sensor specifications:

- Power: 2.7V to 5.5V and Size: 28.4 x 28.4mm (1.12 x 1.12")
- Interface: digital TTL
- High-resolution conversion of light intensity to frequency
- Programmable color and full-scale output frequency
- Communicates directly to microcontroller
- Tcs 3200 uses photodies with 4 different colours.

4. CONCLUSION

Now a day's agriculture is shifting towards different robotic machinery for the value, reducing labour dependency and for getting best accuracy purpose. One among the key challenges in agricultural operations like spraying insecticide is knowing and processing real time data, The programming and interfacing. By understanding these limitations project is successfully completed. For perfect performance one should check the battery activities in the designed circuit properly. The project is implemented using the metal chassis with enough powerful motors to provide robust operations in all terrain. The project can profit little scale farmers and can offer a cheap solution and facilitate them financially. If we lot of advance technologies like AI, ML, Advance sensors robots have more scope of correct and economical operations.

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