e-ISSN:2582-7219

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 7, Issue 3, March 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.521

International Journal Of Multidisciplinary Research In Science, Engineering and Technology (IJMRSET)

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly Peer Reviewed & Referred Journal |

| Volume 7, Issue 3, March 2024 |

| DOI:10.15680/IJMRSET.2024.0703053 |

Design and Development of Smart Agriculture Spraying System

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ABSTRACT: The Problem of modern agriculture is to reduce crop yield and quality while increasing resource efficiency. The "Design and Development of Smart Agriculture Spraying System,"the project's main focus, uses cutting-edge technology to increase the sustainability and efficiency of fertilizer and pesticide application in agriculture. The spraying process is precisely targeted and controlled by the system through the integration of modern sensors, data analytics, and automation. Our strategy entails building a hardware platform made up of cars fitted with sensors to track crop health, insect infestation, and metrological variable in real-time. With precise nozzles and actuators that alows for on-the-fly adjustments to spraying parameters, the system ensures exact application while reducing waste. A central control system processes these data inputs and applies artificial intelligence algorithms to determine the kind and volume of spraying that is necessary.

KEYWORDS: Agriculture Spraying Vehicle, Fertilization, Insects, Precision Spraying.

I. INTRODUCTION

Agriculture has been at the heart of human civilization for millennia, providing the sustanance required for our survival. As the global population continues to grow, so does the demand for food, which places increasing pressure on the agriculture sector to boost crop production and efficiency. However, the traditional method of pesticide and fertilizer application in agriculture has often been associated with issues such as overuse of chemicals, environmental degradations, and resource inefficiency. In response to these challenges, there is a growing need for innovative and sustainable agricultural practices. The "Design and Development of Smart Agriculture Spraying system" represent a significant step forward in addressing these issues. This research project focuses on the creation of an intelligent and precision-based agriculture spraying system that harnesses the power of emerging technologies to revolutionize the way pesticides and fertilizers are applied in farming.

India is primarily an agricultural nation, with around 75% of its people depending heavily on farming on a direct or indirect basis. The nation as a whole depends on this industry for food, thus the government is always working to grow it. we have been engaged in agriculture for thousands of years, but it strayed undeveloped for a very long period. In addition, we used to important food grains from other nations to meet our demand after gaining independence. Following the green revolution, we achieved self-sufficiency and began exporting our excess to other nations. For years, farmers have been carrying out tasks like seeding, spraying, weeding, and other similar tasks using the same tools and methods. Traditional agriculture spraying Methods, which rely on fixture schedules and uniform distribution, often lead to over-application or insufficient coverage, resulting in reduced crop yield and environmental harm. Smart agriculture, however, leverages advancement in sensor technology, data analytics, and automation to optimize the entire spraying process. The smart agriculture spraying system allows for remote monitoring and control, enabling farmers to manage spraying operations with greater precision and efficiency. The system's adaptability and responsiveness to changing conditions make it a promising solution for modern agriculture's needs, aligning with the broader goals of sustainability and environmental conversation.

II. LITERATURE REVIEW

India's population is growing daily, thus it's critical to modernize the agricultural sectors to meet the country's growing demand for food. The soil's fertility is declining as a result of chemical fertilizers. The farmers are therrefore committed to organic farming. Mechanization of spraying equipment allows for the uniform distribution of insecticides and fertilizers over the farm while lowering waste output. This prevents losses and waste of the input used on the farm. It will ;lower the production costs. With less input, the mechanism yeilds more production. In India, the industrial sector

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has developed significantly more than the agriculture sector, while farmers still apply pesticides and fertilizer using the sane conventional techniques. Fertilizer is sprayed manually by laborers usinng backpack sprayers in the past, small farmers benefit more from the required efforts when they farm smaller areas. [1]

Traditionally ,labor-intensive backpack sprayers have been used for the task of spraying requiring greater human effort. For small land farmers, bulls help with the weeding process most of the time. In a smillar vein,applying seeds requires the assistance of a bull and takes a lot of time and effort in the modern era. In order to solve the aforementioned issues, a machine that will help farmers with seed sowing as well as weeding and spraying has been designed. It will be helful to have a multipurpose tool that can be used a various farming stages based on needs. The issues of farmers health related concerns is the main topic of the essay. Most of them work in close proximity to toxic chemicals without taking any saftey measurs, such as wearing gloves or face masks , to protect themselves. This is detrimental to the farmer because the traditional methods spray hits the face directly. Due the elimination of the necessity to solder and carry the tank on the backbone, the recommended model has solved the issue of back pain.[2]

It is impossible to avoid modernizing agriculture in order to meet the food needs of the expanding population and the fast-paced industry. High population densities and low land productivity relative to developed countries are problems shared by the majority of Asia's developing countries. The lack of power on farms and the low degree of farm mechanization are two major causes of low productivity. In particular, this applies to india. Mansukhbhai jagani invented a motorcycle attachment in 1994 that provided a multifunctional toolbar. The lack of laborers and bullocks, which are the two main issues facing saurashtra's farmers, are addressed. There are several farming tasks that can be completed with this motorcycle-driven plow, including sowing, inter-culturing, furrow opening, and spraying. The agricuture sector has not developed as much as the industrial and service sectors in our country, despite farming being parcticed traditionally. It takes more human effort to spray a surface when it is done by laborers carrying a backpack-style sprayer. Farming with small farms often incur additional costs when using bull to help with the weeding process. Therefore, in order to solve the aforementioned two issues, we made an effort to do away with them and created equipment that will help farmers with their weeding and spraying.[3]

The World's population is growing at an expanential rate. In recent years, automation in agriculture and other fields has garnered increasing attention . one domain where automation is neccesary is weed control methods. Herbicides will be wasted in large quantities bacause only a portion of the field will be covered in weeds, in addition to the detrimetal effects on plants, soil,and subtreeanean aquifers. Recent studies have employed various characterstics to identify weeds spectral reflectance properties or color are among these attributes.[4]

In order to effectively handle issues like overdosage and product losses, variable rate technologies and optimised sprayer that rely on cutting edge sensing system are required for the efficient administration of phytochemical product in agriculture. These effort created a system that can analysing various tree canopy characteristics to promote environmentally conscious and precise fruit farming employing clever spraying technologies. These device operates using 2 dimensional light detection and ranging. Integrated sensor and global navigation satellite system receive into a tractor driven sprayer[5]

III. PROPOSED DESIGN

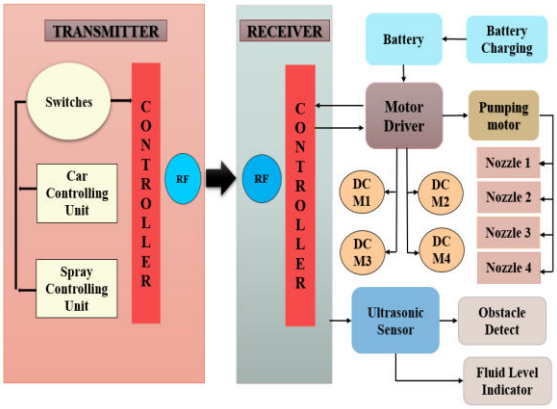

Fig .1 Block diagram of the proposed system

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly Peer Reviewed & Referred Journal |

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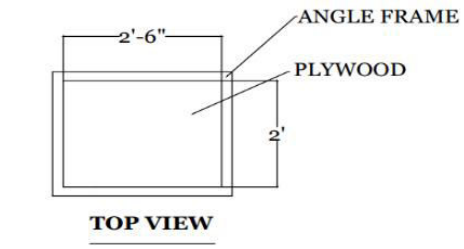
In this Block Diagram, Various blocks include main two sections are transmittter, receiver, In transmitter including controller switches, car controlling unit, and spray controlling unit, and In receiver including blocks RF and Controller. Then the battery , motor driver, pumping motor, dc motor, and ultrasonic sensor obstacle detect Fluid level indicator. In the transmitter we are going to install buttons to operate the car and spray.

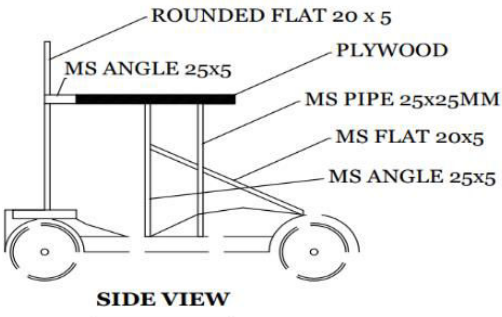
- **Controller**- The controller the control the speed and control the direction of vehicle simultaneously
- **RF**- Radio frequencies are used in communication devices such as transmitters, receivers, computers, television, and mobile phones.
- **Battery input** of the motor driver.
- **Motor Driver**- We use Motor Driver L2N93D to provide the motor with high power by utillizing a small voltage signal from a microcontroller or a control system
- **A pumping motor**-pump motor is an electrical induction unit that converts electrical energy into mechanical energy.
- **Nozzle**- Low pressure agriculture sprayers with nozzle types like flat-fan, flood, raindrop,hollow cone, and fullcone are frequently utilized. Flatfan is widely used for spraying herbicides.
- **Ultrasonic Senor-** The ultrasonic sensor act as a microphone to receive and send the ultrasonic sound and it detects objects regardless of the color, surface, or material.
- **Obstacle detector**-It is the process of finding and detecting barriers in the path of a moving object
- **Fluid level indicator-** It is used for checking the fluid levels in the tank and hydraulic system.

IV. LAYOUT OF AGRICULTURE SPRAYING VEHICLE

Above fig. shows design layout of agriculture spraying vehicle. According to this layout we have develop our project smart agriculture spraying system by considering all aspect regarding dimensions as well as calculations required for battery and motor



TOP VIEW



SIDE VIEW

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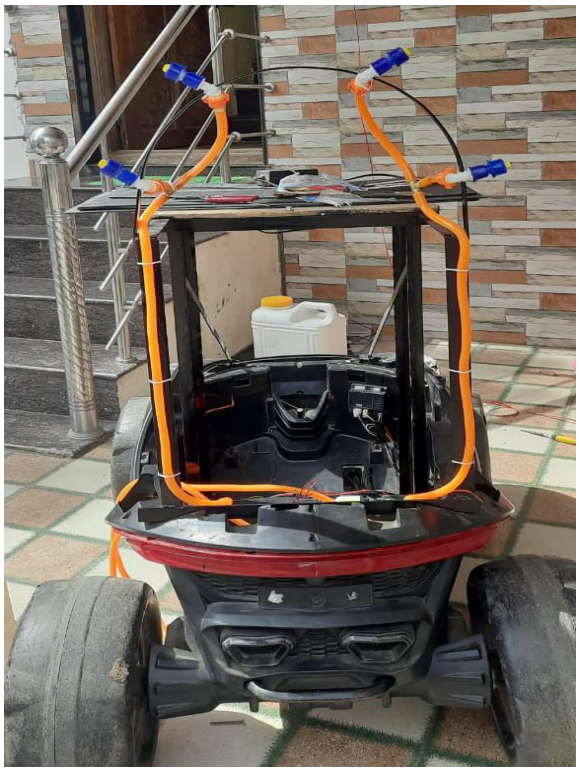
V. HARDWARE IMPLEMENTATION

Here the proposed model is made up of hardware which was previously explained in the description of the system design hardware.



Pic.1

Pic 2

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| Volume 7, Issue 3, March 2024 |

| DOI:10.15680/IJMRSET.2024.0703053 |

Pic. 3

Pic.4

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VI. APPLICATIONS

- Its Primary application in agriculture is for **fertilizer spraying**.
- In city and urban areas, it can be used for **watering lawns.**
- It is used for **transferring agricultural stuff** from one place to its nearer place.
- For the use of fungicides and bactericides to treat plant illnesses.
- To kill the weeds in preparation for applying the herbicide.
- It might be used as exercise equipment in the morning on the lawn.
- For any other purpose, including applying the powdered formulation of toxic substances to crops.
- For the application of plant nutrients as foliar spray.
- In industries, it's utilized for spray painting.
- For the application of harmony sprays to promote fruit set or stop premature fruit falling.

VII. FUTURE SCOPE

As smart agricultural spraying systems continue to develop, we can expect to see even more advanced features, such as:

- The ability to identify and spray specific pests and diseases, rather than relying on broad-spectrum pesticides.
- The ability to adjust the spray pattern and droplet size based on the crop and the environmental conditions.
- The ability to integrate with other agricultural robots and machines to create a fully autonomous spraying system.
- Smart agricultural spraying systems have the potential to make a significant contribution to sustainable agriculture by reducing the use of pesticides, improving the efficacy of treatments, and saving farmers money.
- More numbers of nozzles can be used.
- Stronger but lightweight material can be used for the frame.

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Impact Factor
7.521

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

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