



A Review: 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” 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 allows for on-the-fly adjustments to spraying parameters, the system ensures exact application while reducing waste. Precision agriculture that is data-driven and sustainable has made great progress with the “Design and Development of Smart Agriculture Spraying System.” It has the power to completely transform farming methods, advancing the agriculture industry’s ecological and financial viability.

Keywords: Motor Drive, Battery, Controller, Sensor etc.

INTRODUCTION:

Agriculture has been at the heart of human civilization for millennia, providing the sustenance 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.

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 import 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.

LITERATURE REVIEW:

Day by Day the population of India is increasing and to fulfill the need for food modernization in agriculture sectors is important. Due to chemical fertilizers, the fertility of the soil is decreasing. Hence the farmers are attached towards organic farming. By mechanization in spraying devices fertilizers and pesticides are distributed equally on the farm and reduce the quantity of waste. Which results in prevention of losses and wastage of input applied to the farm? It will reduce the cost of production. The mechanism gives higher productivity in minimum input. Farmers are using the same traditional methods for spraying fertilizers and pesticides, in India there is a large development in industrial sectors compared to agricultural sectors. Conventionally the spraying is done by labors carrying backpack sprayers and fertilizers are sprayed manually. The efforts required are more beneficial by farmers having small farming land. [1]

The spraying is traditionally done by labor labor-carrying backpack type sprayer which requires more human

Effort. The weeding is generally done with the help of bulls for small land farmers. Similarly the seed sowing application is also done with the help of bull, which is the present age is time-consuming and laborious. So to overcome these above problems a machine is developed which will be beneficial to the farmers for the spraying and weeding operation along with the seed sowing application. A multifunction device will come in handy that can be put to use in different stages of farming as per requirement. This paper focuses on the problem of health-related issues of the farmers. Majority of them don't use any precautions like face masks and hand gloves against hazardous chemicals and work in direct contact with them. Consequently, this harms the farmer as the spray in the conventional method directly hits the face. The suggested model has removed the problem of back pain since there is no need to carry the tank on the backbone and solder. [2]

To meet the food requirements of the growing population and rapid industrialization, the modernization of agriculture is inescapable. Most of the developing countries of Asia have the problem of high population and low levels of land productivity as compared to the developed nations. One of the main reasons for low productivity is insufficient power availability on the farms and a low level of farm mechanization. This is especially true for India. In 1994, Mansukhbhai Jagani developed an attachment for a motorbike to get a multipurpose toolbar. It addresses the twin problems of farmers in Saurashtra namely the paucity of laborers and shortage of bullocks. This motorcycle-driven plow can be used to carry out various farming operations like furrow opening, sowing, inter-culturing, and spraying operations. In our country farming is done the traditionally, besides that there is a large development of the industrial and service sector as compared to that of agriculture. The spraying is traditionally done by labor carrying a backpack-type sprayer which requires more human effort. The weeding is generally done with the help of bulls which becomes costly for farmers having small farming land. So to overcome these above two problems, we tried to eliminate these problems and designed the equipment that will be beneficial to the farmer for the spraying and weeding operation. [3]

The population of the world is increasing rapidly. Over the past few years, there has been a rising interest in using automation in agriculture as well as other fields. Weed control is one of the areas that demand automation. In conventional weed control systems, herbicides are sprayed uniformly all over the fields. Apart from the damaging consequences like negative impacts on plants, soil, and underground aquifers, large amounts of herbicides will be wasted, as only some parts of fields are covered with weeds. To identify weeds, different attributes have been used in recent papers. One of these attributes is color or spectral reflectance properties. [4]

In order to effectively handle issues like over dosage and product losses, variable rate technologies and optimized 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 analyzing 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. The algorithm recognizes the borders of the canopy, permitting spraying only when there is vegetation represent. The system performance is assigned by using volume saved in comparisons to the crew volume technique. The over dosage of the system substance spread was reduced by 28%, according to the data. These work second stage involved figuring out how much liquid to apply and modifying it according to their trees volume stop taking these parameter into account, the average for the left and right row was 78%. The amount of tree volume was also Joe referenced by the development of an occupation grid map. This chart showcased the sprayer's path and the identified trees based on their volume. [5]

BLOCK DIAGRAM AND METHODOLOGY:

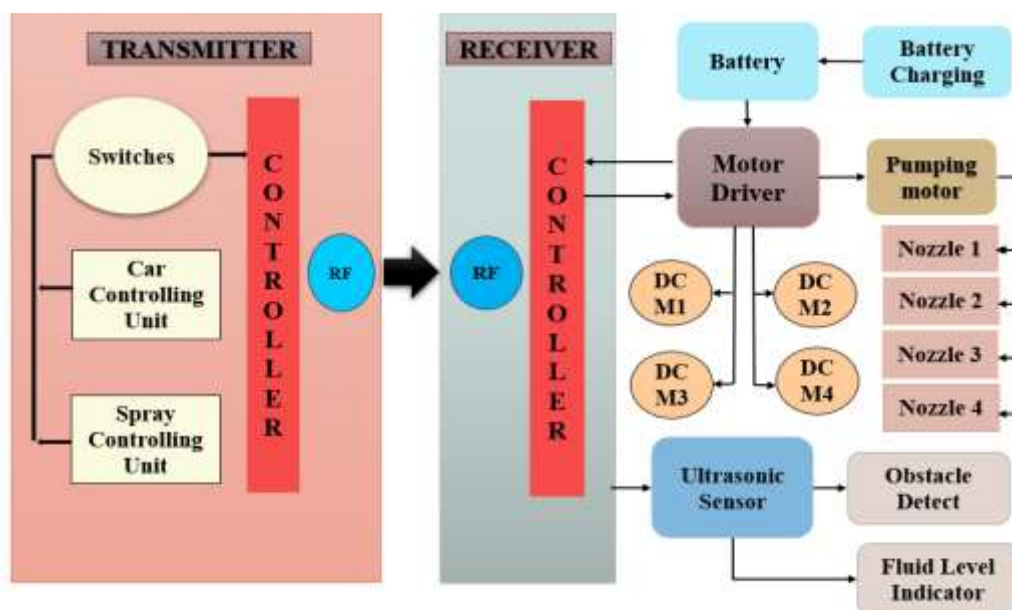


Figure 2: Block diagram and methodology

In this Block Diagram, Various blocks include main two sections are transmitter, 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.

Motor Driver-We use Motor Driver L2N93D to give high power to the motor by using 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- nozzle types commonly used is low pressure agriculture sprayers include flat-fan, flood, raindrop, hollow cone, full cone, Flat fan is widely used for spraying herbicides.

Ultrasonic Sensor- The ultrasonic sensor act as a microphone to receive and send the ultrasonic sound and it detects objects regardless of the colour, 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.

WORKING PRINCIPLE:

Here in this project, we are going to make Spraying Vehicle. Which powered by Lead acid battery. The vehicle used in the project can be controlled by the operator. It help to control the vehicle from distance. We also used sensor to detect obstacle and fluid level in the tank. Sensors will give signal to controller when water level in tank is low. Motor drive give high power to the motor by using small voltage from a microcontroller. Pump motor is an electrical induction unit that convert electrical energy into mechanical energy.

In future work we expect even more advanced feature, the ability to create a fully autonomous spraying system.

COMPONENTS REQUIRED:

1) Motor Controller-



A motor controller is an electronic device that is used to control the speed of the motor and control the vehicle's directions. Motor controllers play a role in various apps. Motor controllers play a role in various applications including industrial automation, robotics, and automotive systems. They are designed to provide control over speed, direction, and other parameter of the motor operation. A motor controller has both automatic and manual ways to turn on and off the motor, as well as options for forward and backward rotation.

Specification-

Type of controller- DC motor controller

Model Number -JR-1816RXS-12 V

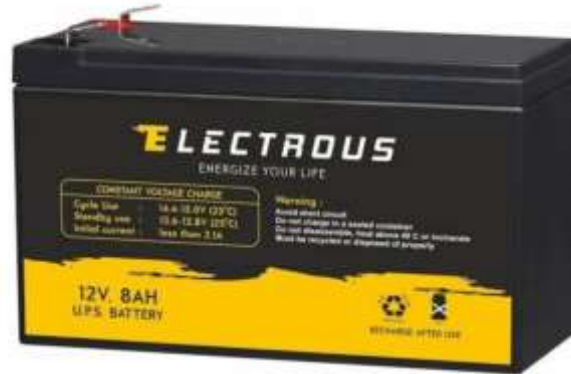
Rated voltage- 12 V

Rated current- 15 A

Frequency- 2.405GHz- 2,485GHz

Manufacturing- Made in China.

2) *Battery-*



Lead acid is a rechargeable type of battery first invented in 1859 by French physicist Gaston Plantae that operates on lead and sulphuric acid is the first rechargeable battery compared to modern rechargeable batteries. To allow for a Controlled chemical reaction, the lead is submerged in sulphuric acid. The chemical process is what enables batteries to produce power. At the same a period they are incredibly sturdy, dependable, and low maintenance. These properties provide the lead acid battery and excellent price-performance ratio. Lead acid batteries may provide a significant surge current even if they have a poor energy density. Their low cost and this feature make them a desirable option for usage in automobiles. Nevertheless, lead acid batteries are rendered useless due to their deep discharge vulnerability.

3) *Water Pump-*



An electric water pump motor that runs on a 12-volt Direct current power source is called a water pump. To boost, transfer, raise, or circulate liquids such as water, oil, or coolant for sprayers, cars, fountains, showers, gardens, etc. it uses centrifugal force produced by a high-speed rotating impeller. Due to its low cost, compact size, and extended operational life, the 12-volt water pump is highly sought after by consumers. Thus 12 12-volt pumps are frequently utilized as electric water pumps in automobiles.

4) *Nozzle-*



Flat fan nozzles are commonly used in various applications for spraying liquids. Flat fan nozzles create a flat, rectangular-shaped spray pattern with a wide coverage in one direction and a narrow one in the other. It can be made from various materials such as stainless steel, plastic, or ceramic, depending on the intended use and the type of liquid being sprayed. They are commonly used in agriculture for crop spraying, in the automotive industry for painting, and in many other industrial and agricultural applications.

5) DC Motor-



A 12-volt DC motor is specifically designed to operate at a voltage of 12 volts DC.

DC Motor is a rotary motor that can convert direct current into mechanical energy or convert mechanical energy into DC power. It means that the 12-volt DC Motor can interconvert electric energy and mechanical energy. 12-volt DC Motors are known for their efficiency and ability to provide consistent and reliable rotational motion at the specified voltage. When it is operated as a DC Motor, electric energy is converted into mechanical energy. Overall, 12-volt DC motors are versatile and widely used in a multitude of applications where a reliable and controllable source of rotational motion is needed, especially when powered by a 12-volt DC power source.

6) Ultrasonic sensor-



Ultrasonic Sensors are made up of piezoelectric material, where the ultrasonic sensor detects things regardless of their color, surface, or material by acting as a microphone to receive and transmit ultrasonic sound.

7) Tank-



We want our tank to carry as much fluid as it can be along with its self-weight as little as possible. We have taken a tank which is almost 15 liter capacity. The material of the tank used is plastic fiber. Plastic fiber is very low in weight as compared to other materials.

ADVANTAGES, DISADVANTAGES AND APPLICATIONS:

Advantages

- a. Help to reduce water usage.
- b. Reduce human efforts.
- c. Reduce labour cost.
- d. Help to reduce time.

- e. Make irrigation easy and help to improve it.
- f. Reduce the wastage of unnecessary pesticides.
- g. Charge Lead acid batteries too.

Disadvantages

- a. Required training to operate the vehicle.

Applications

- a. In agriculture for fertilizer spraying
- b. It can be used for watering lawns
- c. In industries, it can be utilized for spray painting
- d. For the herbicide application, to kill the weeds
- e. It is used for transporting agricultural material

CONCLUSIONS:

We will make design & development, safety, performance & sustainability, This innovative technology not only enhances the efficiency of pesticide and nutrient application but also minimizes environmental impacts by reducing the overuse of chemicals. These systems contribute to the preservation of ecosystems and the reduction of chemical runoff into water bodies. Smart agricultural spraying systems have the potential to revolutionize the way that crops are protected from pests, diseases, and weeds.

FUTURE SCOPE:

It is undeniable that there is still work to be done and further research to be made. The largest challenge or limitation that we faced during this project was the unavailability of some important equipment. In the future, this project can be developed further at a larger scale with the availability of all necessary parts. That being said, this capstone project was an amazing and fun experience overall, it allowed me to put to practice a large array of concepts that I have learnt throughout my degree, as well as to discover some new ones and apply them.

ACKNOWLEDGEMENT:

The acknowledgment section for a solar charging station project typically includes recognition of those who contributed to the project's success, such as financial supporters, technical advisors, and research participants. This section may also express gratitude to institutions that provided resources or facilities for the project. Research papers often include this section to give credit to individuals, organizations, or agencies. It is an important part of scholarly writing, highlighting the collaborative nature of scientific work.

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