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Embedded System – Based Pesticides Spraying Robot

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Abstract: *The agriculture sector is undergoing a transformation with the integration of robotics and automation. One notable development is the emergence of autonomous pesticide spraying robots, designed to enhance precision, efficiency, and sustainability in crop protection practices. This abstract explores the technological advancements, operational mechanisms, and potential implications of these innovative robots. Autonomous pesticide spraying robots leverage cutting-edge technologies such as artificial intelligence, machine learning, and advanced sensors to navigate fields, identify crop areas, and precisely apply pesticides. Equipped with GPS, LiDAR, and cameras, these robots can map fields, detect obstacles, and optimize spraying patterns in real-time, reducing pesticide usage while ensuring effective pest control. Furthermore, the integration of data analytics enables continuous improvement in spraying strategies, tailored to specific crop types, environmental conditions, and pest pressures. The deployment of autonomous spraying robots offers several benefits to farmers, including increased operational efficiency, reduced labor costs, and minimized environmental impact. By eliminating the need for human operators and optimizing pesticide application, these robots contribute to safer working conditions and reduced chemical exposure risks. Moreover, their ability to operate autonomously for extended periods enhances productivity and scalability in large-scale agricultural operations. Additionally, there is a need for comprehensive training and education to enable farmers to effectively integrate these technologies into their existing practices while maximizing their benefits. modern agriculture, offering precision, efficiency, and sustainability in crop protection. As technology continues to evolve and adoption grows, collaboration among stakeholders is essential to address challenges and unlock the full potential of these innovative solutions for the benefit of farmers, consumers, and the environment.*

Keywords: Agriculture,

I. INTRODUCTION

Agriculture is the primary source of revenue for India's population, which accounts for nearly 60% of the country's total. Farmers work in their fields to cultivate various crops based on the environment and resources available. Farmers must use large quantities of pesticides to increase food production in order to meet such high food demand for such a large population. Traditional manual pesticide spraying operations is full of direct exposure to the pesticide liquid work environment, great harm to human body and when this 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. Pesticide spraying and fertilizer scattering are tedious applications. Despite the fact that pesticide spraying is now required, farmers still find it to be a hazardous process. This project is based on the development of an agricultural robot vehicle that navigates between crops using an Android application based on the farmer's instructions. This truck has lower-cost components, making it more cost-effective. To move the robot in the field, the farmer can use any Android smart phone with this application. Through an IoT application, farmers can control pesticide sprinkling devices. This low-cost robotic vehicle would increase efficiency, safety, and meet labour demand in agricultural applications.

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II. EXISTING SYSTEM

In the current methods, the farmers use the backpack sprayer [Fig. 1(a)], which is manually operated by the human along the crop fields. They used to spray the pesticides in the targeted way manually. Here the sprayer is connected to the back of the tractor and this tractor was driven by the human. The pesticides were sprayed to the crops along the field. This method does not uses the selective spraying and the pesticides are spread to the field. In spite of the utilization of pesticide assurance gear (individual head veil and focal filtration framework for the manual and automated spraying strategies, separately) the human is as yet presented to unsafe pesticides that can cause negative medical problems. Other than wellbeing concerns, automated and manual spraying strategies have different downsides. The motorized spraying isn't target explicit and is intended to splash a harvest strip with rearranged stature (e.g., for spraying only the grape bunches the rancher will show the shower spouts to shower a strip 0.5 m wide with no thought of the natural product area). Moreover, manual spraying is repetitive work, moderate, and restricted because of the absence of laborers horticulture.

IV. PROPOSED METHOD (PESTICIDES SPRAYING ROBOT)

The Automation pesticides spraying robot replaces the human labor across multiple industries, also in the agriculture. In agriculture farming most of the tasks are labor where it consists of labor comprised of repetitive tasks. available in the agricultural field for performing tasks ranging from planting and watering, to harvesting and sorting. This new form of smart equipment will make the possible way of producing the more high quality food and also it reduces the human power. The main motive of introducing the autonomous robots in agriculture field is to reduce the reliance on manual labour and the other hand increases the efficiency, production yield and the quality.

V. BLOCK DIAGRAM

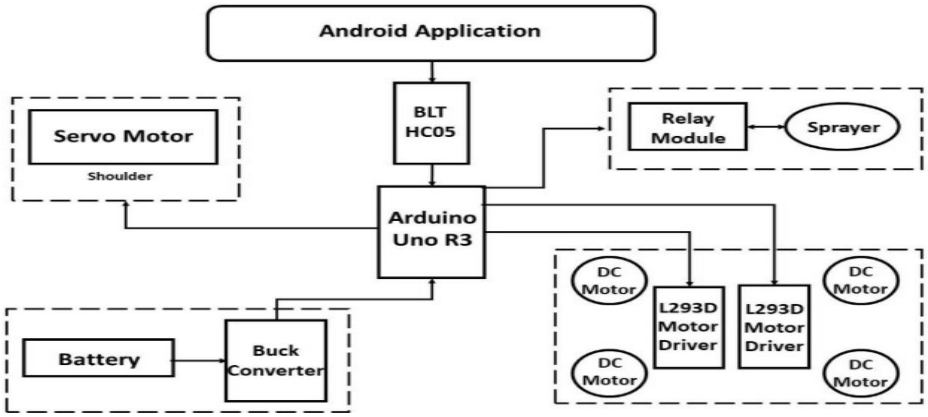

Figure 1: Block Diagram

Hardware Components Used:

- **Arduino UNO:** The Arduino Uno contains a set of analog and digital pins that are input and output pins which are used to connect the board to other components.
- **Relay Module:** A relay is an electromechanical switch. It is electrically operated.
- **L293D Motor Drivers:** L293D is a basic motor driver integrated chip (IC) that enables us to drive a DC motor in either direction and also control the speed of the motor.
- **DC Motors:** An electric motor is a machine, which converts electrical energy into mechanical energy.
- **Bluetooth Module:** connect the Bluetooth HC-05 module to the PC via serial to USB converter. Before establishing communication between two Bluetooth devices, 1st we need to pair HC-05 module to smartphone for communication
- **Water Pump:** These pumps are used for pumping the huge amount of water from one place to another
- **Servo Motor:** A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position

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VI. MODELING AND ANALYSIS

Before spraying the pesticides with this robot, the farmer must follow the steps:

- Fill the required pesticides into tank
- Start spraying rover
- Login with android application
- Connect app with Bluetooth
- Send commands using application
- Move rover on field
- Change direction of sprayer
- Switch sprayer/pump on/off
- Charge the battery

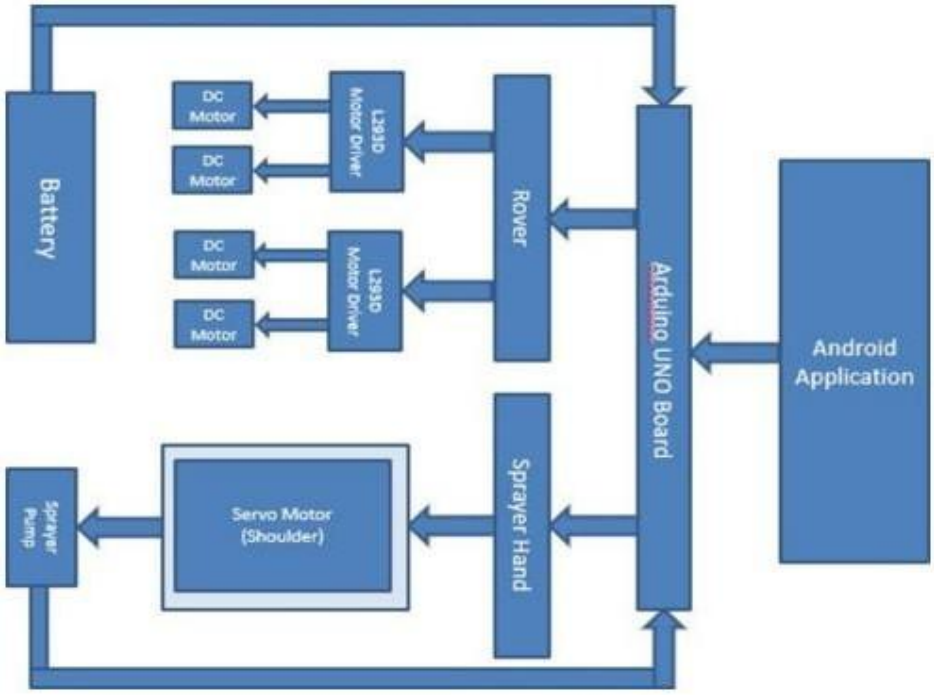

Figure 2: Block Representation 2

The robot is installed in the farm and is operated by an Android application and is powered by IoT. DC motors are used for the robot's motion that are governed electronically by Arduino UNO with the assistance of L293D. The HC-05 Bluetooth module receives signals from the input and sends them to the controller, which in turn spins the engine. By obtaining the signal, DC motors are switched ON and OFF by allowing Arduino to have a
specific pin. An adequate velocity is provided by 300rpm DC motors. Bluetooth module connects to the digital key of Arduino UNO, which receives the signal installed on the operator's Smartphone from the Android app. Pesticide spraying, which can be done with the assistance of a pesticide sprinkling pump, can be done on a
regular basis if the relay switch is turned on. The agricultural robot is used to control functions such as pesticide spraying, and it is controlled using a Bluetooth module that communicates between an Android application and the robot for a low cost

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Figure 3: Working Module of Robot

VII. RESULTS AND DISCUSSION

This agriculture vehicle proves to be an effective and efficient machine which can be easily navigated and controlled. The robot can traverse a variety of terrains and soils. The android application is used to control the robot's movement as well as spray pesticides.

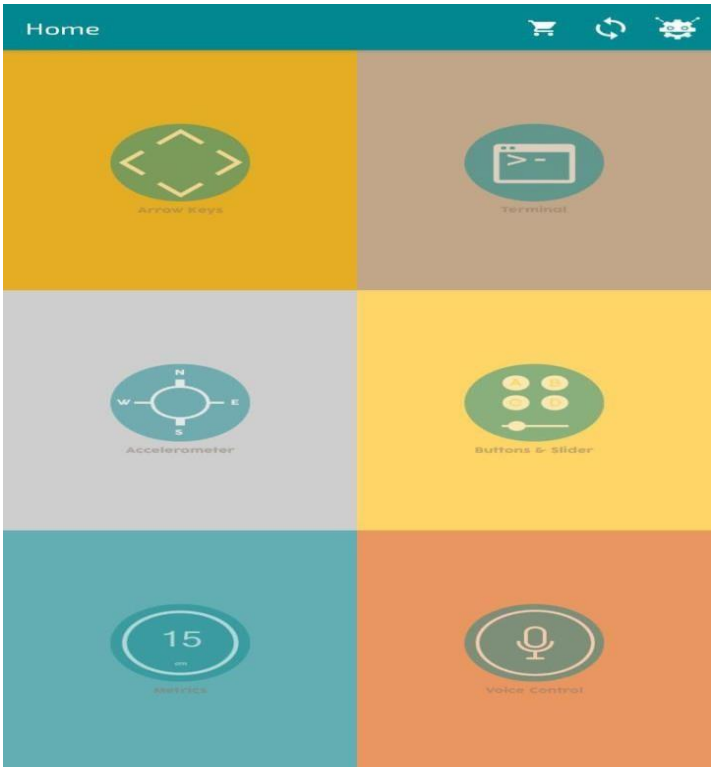

Figure 4: Sample Output of Android

As a result, the robot's control is simple, and farmers can easily operate this intelligent vehicle. The application was built by using MIT app Inventor. This robot focuses on farmers spraying pesticides from a distance without coming into direct contact with them. Because the task's complexity is reduced and the manned task is converted to an unmanned task, this feature would encourage more people to take up agriculture.

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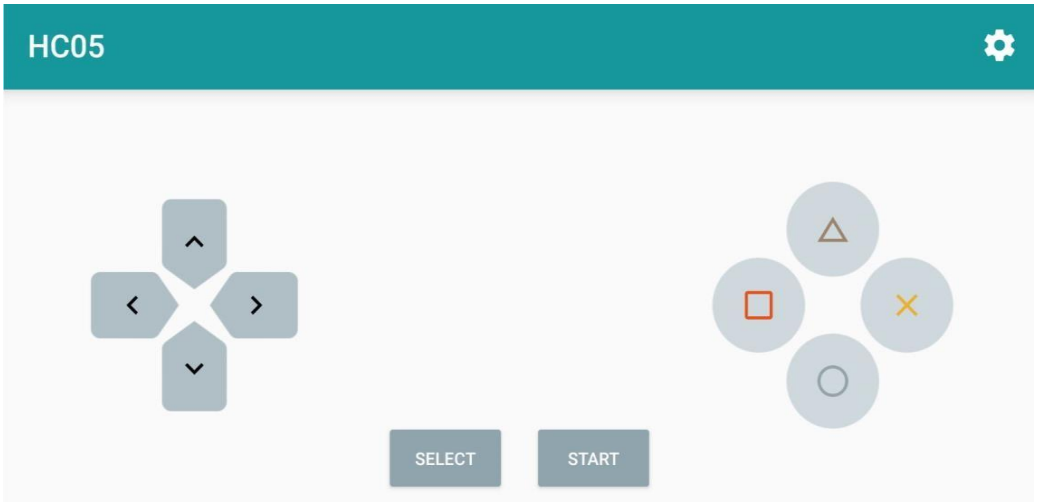

Figure 5: Sample Output of Android Application

Advantages:

- Reducing direct exposure to pesticides and the human body and improve production efficiency.
- They can operate with closer tolerances
- They produce fewer errors and at higher speeds, and the machines can reliably detect higher-quality goods.
- The robots can reduce up to 30% of farm's use of pesticide
- Robots have the potential to create jobs for those who must build and repair them

Disadvantages:

- Robot can work in wet crops, only works at dry crops

VIII. CONCLUSION

In this project, we have implemented a pesticide spraying robot. A robot for use in agriculture An Agrobot is a concept for improving the product's performance and cost, which, once optimized, would show to be useful in agricultural spraying operations. Farmers' workloads are reduced, as are health issues. Successfully constructed a robot that can travel on rough surfaces as well as carry a sufficient load of compressor and other equipment. Successful in creating a robot with a strong enough structure to resist the field's challenges. Sure,
once this idea is presented in a way that is appropriate for the Indian market, it will undoubtedly aid in lowering the 15% molality rate found in Indian formers associated with agricultural spraying operations. Projects like this inspire people to pursue agriculture as a full-time or part-time occupation. This is critical in developed countries, particularly India, where agriculture is the economic backbone

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