iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** V **Month of publication:** May 2024

DOI: https://doi.org/10.22214/ijraset.2024.62584

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue V May 2024- Available at www.ijraset.com

Agricultural Pesticide Spraying Robot

Mrs. Sumalatha N[1], Manasa Lakshmi R[2], Manoj K[3], Rakshitha Prabhushettar[4], K V Shashidhar[5]
[1]*Associate Professor, Department of Electronics and Communication Engineering, Ballari Institute Of Technology and Management, Ballari, India*
[2, 3, 4, 5]*8th Semester B.E(ECE),Ballari Institute of Technology and Management, Ballari, India*

Abstract: ***The goal of this project is to develop an intelligent spraying robot that will reduce the usage of pesticides and harm to human health, protecting farmers and requiring less labor. Complete route planning and navigation systems, driving control, a spraying mechanism, system construction, obstacle avoidance, and the integration of several sensor modules will all be features of the robot. The design of the spray robot will include simulations and analysis for sensor integration, obstacle avoidance, and spraying. In order to achieve strong stability and dependability, it is utilized not only to track motion and monitor orientation but also to adjust for path errors. In the interim, the spraying system will be enhanced with automated sprays that adjust based on the target in order to remove leaks and avoid repeated spraying. The pesticide spraying strategy that this study suggests will assist farmers in the agricultural sector.***
Keywords: Pesticides, farmers, drivers, spraying, and agriculture.

I. INTRODUCTION

We are thrilled to present our most recent engineering endeavor, a robot that applies pesticides on farms. Our group was working very hard to develop a cutting-edge solution that will benefit today's farmers and increase sustainability and production in the agriculture industry. Our robotic pesticide sprayer is made to give farmers a very practical and economical way to safeguard their crops. Our robot uses the most recent advancements in robotics technology to spray pesticides in a precise and regulated manner, decreasing the environmental impact and lowering the amount of chemicals required. For the people of India, who make up about 60% of the overall population, agriculture is their main source of income. Based on the available resources and the surrounding conditions, farmers labor in their fields to develop a variety of crops. To meet the high food demand of such a huge population, farmers must increase food output by using massive amounts of pesticides. Conventional manual pesticide spraying procedures expose workers directly to liquid pesticides, which is extremely harmful to human health. Additionally, if the farmer comes into touch with the pesticide while spraying, it can cause asthma attacks and skin cancer. As pesticides enter the food chain, increased pesticide spraying may have an effect on consumer health. Applying fertilizer and pesticides are labor-intensive tasks. Even though spraying pesticides is now required, farmers still consider it to be a risky practice. This project aims to develop an agricultural robot vehicle that uses an Android application to drive between crops by following farmer commands.

This truck is more economical because its parts are less expensive. The farmer can use any Android smartphone with this software to move the robot around the field. Farmers can operate pesticide sprinkling equipment via an IoT application. In agricultural applications, this low-cost robotic vehicle would match labor demand while improving efficiency and safety.

II. LITERATURE SURVEY

1) "Efficiency optimization pesticide sprayer based on agricultural robotic vehicle" This essay explains how robotics is frequently used in several agricultural domains. Agriculture is the most essential profession in an emerging nation such as India. It's critical to replace human laborers in agriculture with intelligent machines like robots that use new technologies to be able to increase production and effectiveness. To be able to provide farmers with safety and precision agriculture, the article suggests a novel way to replace humans in a range of agricultural tasks, like identifying the existence of pests and spraying pesticides and fertilizers. The developed framework entails creating a model that makes use of straightforward, reasonably priced components to assist farmers with various crops, such as microprocessors, wireless cameras, various motors, and terminal parts that support farmers in various agricultural field tasks.

2) "Unmanned robotic service units in agricultural tasks, agricultural robotics" Because robotics applications are used in the construction of machinery and task execution, the application of agricultural appliances in precision agriculture has lettorise in investment and exploration. Precision autonomous farming refers to the operation, guidance, and management of self-sufficient machinery to perform agricultural chores. Robotic agriculture is inspired by it. Autonomous vehicles are anticipated to form the

core of all precision agriculture applications in the near future. Agricultural robotics aims to do more than merely apply robotics technologies to farming. The majority of automated agricultural devices used today are operated by humans and are utilized for tasks including irrigation, weed detection, terrain leveling, and the dissemination of agrochemicals. Due to the autonomous acquisition of environmental information, which enables the vehicle to fulfill its mission appropriately, an autonomous execution of such vehicles can provide continuous farm oversight.

3) "An advanced electrostatic nozzle with improved performance through air induced assistance" Modern chemical application sprayers are desperately needed for India's small-scale farmlands where pesticides are sprayed. A new air-assisted electrostatic nozzle has been created specifically for small-scale farms in rural emerging economies and agriculture in India. An induction-dependent electrostatic charging system and an air-assisted nozzle are combined to create an air-assisted based electrostatic nozzle. Spray particles are charged to above 10 mC/kg charge-by-mass proportion by using a minimum power usage of 75 mW and a charging voltage of 2.5 kV at a liquid flow rate of 150 ml/min. Increased charge-to-mass ratio ensured that charged liquid droplets and naturally occurring ions in the environment would recombine to defeat the charge neutralization process across a longer spraying distance. A charge-to-mass ratio was used to identify the results of the applied induction electrification procedure, and the results are in good agreement with the theoretical matters. Liquid discharge has increased two to three times, with improved equivalency on both the front and hidden targets. This nozzle is lightweight, incredibly effective, less harmful to human health and the environment, and it useless pesticide.

4) "Examination of charged droplet properties, substrate impact behavior from pesticide spraying, and electrostatic system parameters" Crop protection uses electrostatic spraying to prevent pest infestation, improve product quality, and maximize output. To attract substrate ions at hidden surfaces, pesticide spray droplets are charged and superposed. The wraparound effect of the droplets reduces deposition off course, increases spray on course, and always increases spray efficiency. The optimal charging voltages, application pressures, spraying height regimes, flow rate, travel speed, electrode material, and nozzle orientation are all necessary for an electrostatic spraying system to operate effectively. Scientists routinely use many groups of system parameter settings for electrostatic application, but they are unaware of the precise best parameter groups for pesticide spraying. Since the chargeability of droplets affects the electrostatic spraying process' effectiveness, the parameters that provide the maximum charge by mass ratio determine the spraying deposition, retention, and surface coverage functionality. As a result, the electrostatic system parameters that produce appropriately charged droplets with characteristics for pesticides to successfully alter substrate behavior are examined in this work. The charge- by-mass ratio approaches ideal when applied voltages are increased correspondingly, and it begins to decline beyond a certain point when voltage climbs further. This research additionally suggests the selection of an optimal combination of electrostatic factors that yields optimal droplet chargeability during pesticide application. In order to properly superpose the opposing charge on the spray droplets at the burst moment during the electrostatic spraying system, it is also required to investigate the charge properties of the substrates prior to applying pesticides.

III. METHODS AND MATERIALS

For this task, farmers primarily employ hand-operated or fuel-operated spray pumps. Because of its large mass and weight, as well as its close proximity to pesticides, which might have adverse consequences including skin rashes, farmers are experiencing weariness from using this conventional sprayer. This inspired us to create a model that is essentially a robot-based sprayer through design and fabrication.

A. Node MCU

NodeMCU is an open-source, inexpensive IoT platform. Initially, it came with hardware based on the ESP-12 module and firmware that uses Espressif Systems' ESP8266 Wi-Fi SoC. Subsequently, the ESP32 32-bit MCU was given support. Based on the low-cost ESP8266 System-on-a-Chip (SoC), the NodeMCU (Node Micro Controller Unit) is an open- source software and hardware development environment. The Espress if Systems-designed and -produced ESP8266 has all of the essential components of a computer, including networking (WiFi), CPU, RAM, and even a contemporary operating system and SDK. This makes it a fantastic option for any form of Internet of Things (IoT) project.

Fig: Node MCU

The ESP8266 WI-FI Module is used to transmit data wirelessly to the cloud. With the ability to either host the program or delegate all Wi-Fi networking tasks to another application processor, the ESP8266 provides a comprehensive and self-contained Wi-Fi networking solution. It can boot straight from an external flash when the program is hosted by ESP8266 and acts as the device's only application processor.

B. Motor Driver

Two DC motors can be simultaneously controlled for both speed and direction thanks to the twin H-Bridge motor driver L298N. DC motors with a peak current of up to 2A and a voltage between 5and35Vcanbe driven by this module. An interface between the motors and the control circuits is provided by motor drivers. While the controller circuit operates on low current signals, the motor requires a large quantity of current. Hence, the purpose of motor drivers is to convert a low-current control signal into a higher-current signal that is capable of powering a motor.

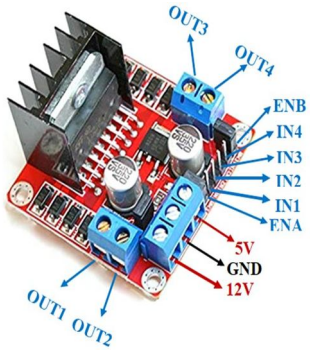

Fig: Motor Driver

C. Relay

A relay is an electromechanical switch that turns things on and off without requiring human interaction. A general representation of the two-contact hand-off is shown. Transfers are used in situations where a low power signal must completely limit electrical current between the controlled and controlled circuits in order to regulate a circuit, or where multiple circuits must be constrained by a single signal. You can use the single channel 5Vrelay module to manage a solenoid, motor, or lighting system, among other loads. It is also capable of switching between DC and AC voltages. Relay specifications determine the maximum voltage and current that the 5V relay module can regulate.

Fig: Relay

D. DC Motor

An electrical machine that transforms electrical energy into mechanical energy is called an electric motor. The majority of electric motors work by applying torque to the motor's shaft through the interplay of the motor's magnetic field and electric current in a wire winding. Electric generators and electric motors are mechanically similar, but they work by reversing the direction of power flow, transforming mechanical energy into electrical energy.

Fig : DC Motor

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IV. PROPOSED METHOD

The method we are using gives farmers a helpful hand in solving a variety of issues. It's fascinating to see how modern farming methods like current farming have replaced manual farming methods. It's incredible that robots are starting to work in fields. We intend to offer a comprehensive explanation of our bot's operation and setup in our suggested manner. Node MCU serves as both a wifi module and a micro controller in this project. Every component interfaces with the node MCU. Robotic motors are linked to a motor driver. We can control the robot's direction by employing a motor driver. Relay and water pump are connected. Motor pump turns on when relay is turned on. LED is ON if switch is in the active position. LED lights are utilized for lighting at night. The Android app is connected via the wifi module. Control the robot with the Blynk app, an Android app.

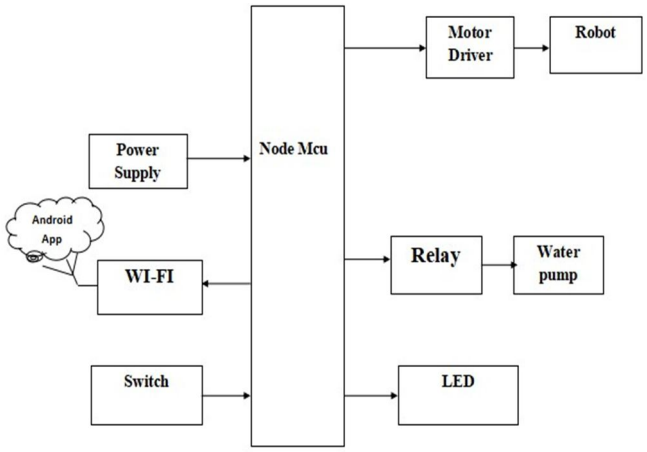
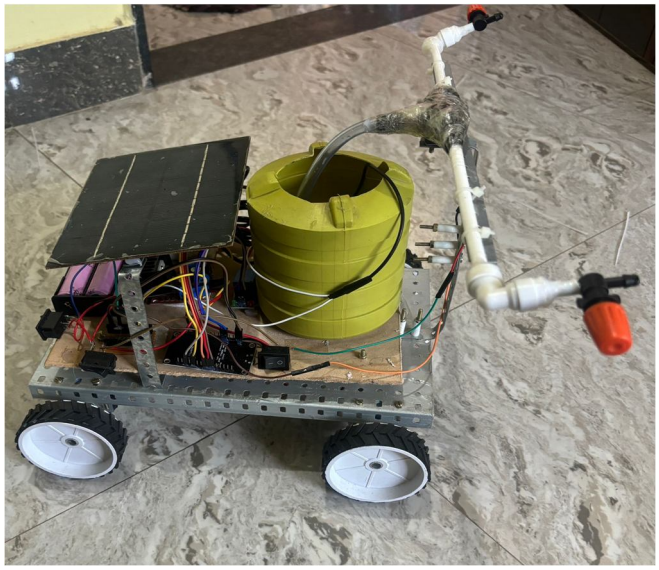
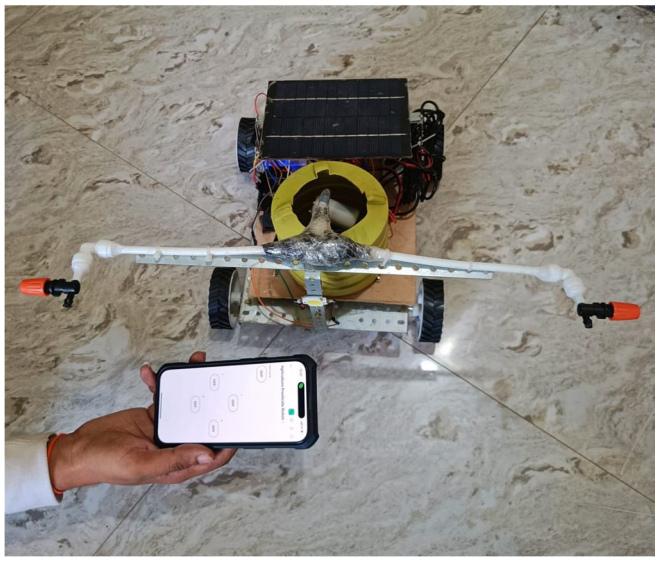


Fig: Block diagram

V. RESULT

This agricultural vehicle shows itself to be an effective and efficient, controlled, and responsive device. The robot is capable of traversing many types of soil and surfaces. The robot is controlled by the Android application, which also serves as a pesticide sprayer.





VI. CONCLUSION ANDFUTURESCOPE

We've included a robot that sprays pesticides in this project. An agricultural robot When perfected, an agriculture robot could prove beneficial in spraying operations by increasing both the product's cost and performance. Health problems and the workload of farmers are decreased. created a robot that can move over uneven terrain and support a heavy enough compressor and other piece of equipment successfully building a robot whose structure is robust enough to withstand the difficulties in the field. In the future, we'll integrate machine learning and artificial intelligence to automatically operate the robot. The robot will then be completely autonomous.

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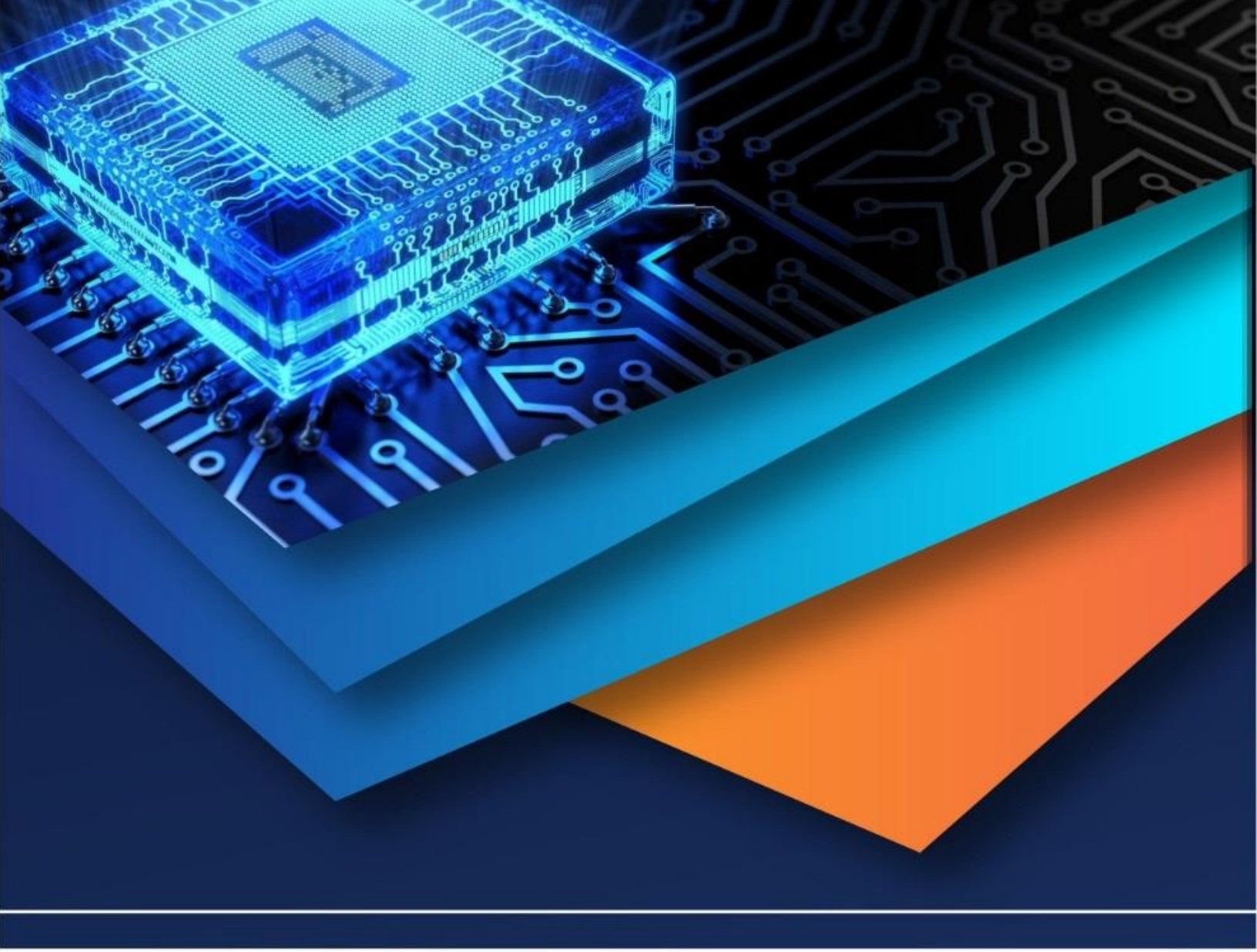

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