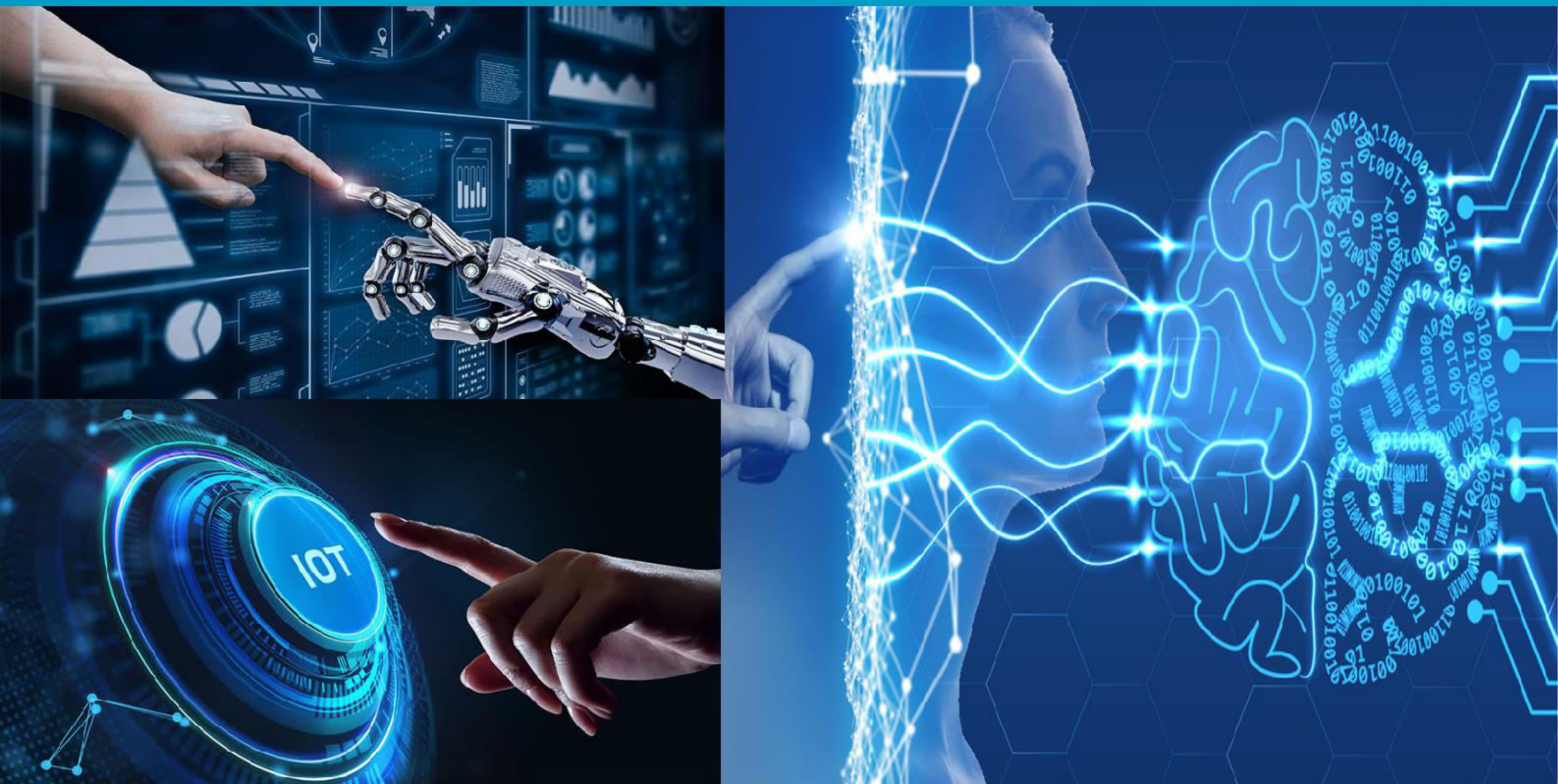
IJMRSETM

e-ISSN: 2395 - 7639



INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

IN SCIENCE, ENGINEERING, TECHNOLOGY AND MANAGEMENT

Volume 11, Issue 5, May 2024

INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.802

IOT Based Fertilizer Spray Robot

M. Monisha[1], G. Nithyasri[2], S. Sharmila[3], S. Sharnitha[4], N. Mohananthini[5] and S. Saravanan[6]

UG Students, Department of Electrical and Electronics Engineering, Muthayammal Engineering College, Tamil Nadu, India[1,2,3,4]

Associate Professor, Department of Electrical and Electronics Engineering, Muthayammal Engineering College, Tamil Nadu, India[5]

Professor, Department of Electrical and Electronics Engineering, Muthayammal Engineering College, Tamil Nadu, India[6]

ABSTRACT: Precision agriculture is a rapidly evolving field that leverages advanced technologies to optimize farming practices. The proposed work introduces an IoT-based fertilizer spray robot Control System designed specifically for Fertilizer Spray Robots, aiming to enhance the precision and efficiency of fertilizer application in agricultural settings. The proposed system integrates Internet of Things (IoT) devices into the control mechanism of Fertilizer Spray Robots, enabling real-time monitoring and responsive control. The key components of the system include sensor nodes, communication modules, and an intelligent control algorithm. The Fertilizer Spray Robot is equipped with sensors such as soil moisture sensors and GPS units to collect crucial data from the agricultural environment. The integration of GPS technology ensures accurate positioning, enabling precise control over the application of fertilizers in specific areas of the field.

KEYWORDS: Agri Robot, Spray Mechanism, Bluetooth Control and Arduino NANO.

I. INTRODUCTION

The accelerated population growth and the continuous shortage of labor in the area of agriculture, are two of the main motivations for the growingly interest in the area of robotics and precision farming. Here, agricultural vehicles play a very important role, and a lot of research activities related to navigation, path planning and control have been increasingly taking place in the past recent years. For instance, presents a new concept with a fleet of small robots providing a solution for soil compaction in a scalable and energy-efficiently manner. In the same line of small vehicles, here we present a controller for a skid-steered robot used for corn seeding tasks. Smart farming and precision agriculture involve the integration of advanced technologies into existing farming practices in to increase production efficiency and the quality of agricultural products.

As an added benefit, they also improve the quality of life for farm workers by reducing heavy labor and tedious tasks. “What will a farm look like in 50 to 100 years?” is the question posed by David Slaughter, a professor of biological and environmental engineering at UC Davis. “We have to address population growth, climate change and labor issues, and that has brought a lot of interest to technology.” Just about every aspect of farming can benefit from technological advancements—from planting and watering to crop health and harvesting. Most of the current and impending agricultural technologies fall into three categories that are expected to become the pillars of the smart farm: autonomous robots, drones or UAVs, and sensors and the Internet of Things (IoT). Replacing human labor with automation is a growing trend across multiple industries, and agriculture is no exception. Most aspects of farming are exceptionally labor-intensive, with much of that labor comprised of repetitive and standardized tasks—an ideal niche for robotics and automation. We’re already seeing agricultural robots—or Ag Bots—beginning to appear on farms and performing tasks ranging from planting and watering, to harvesting and sorting. Eventually, this new wave of smart equipment will make it possible to produce more and higher quality food with less manpower. Sowing seeds was once a laborious manual process. Modern agriculture improved on that with seeding machines, which can cover more ground much faster than a human. However, these often use a scatter method that can be inaccurate and wasteful when seeds fall outside of the optimal location. Effective seeding requires control over two variables: planting seeds at the correct depth, and spacing plants at the appropriate distance apart to allow for optimal growth. Precision seeding equipment is designed to maximize these variables every time. Combining geo mapping and sensor data detailing soil quality, density, and moisture and nutrient levels takes a lot of the guesswork out of the seeding process. Seeds have the best chance tosprout and grow and the overall crop will have a greater harvest.

| ISSN: 2395-7639 | www.ijmrsetm.com | Impact Factor: 7.802 | A Monthly Double-Blind Peer Reviewed Journal |

| Volume 11, Issue 5, May 2024 |

II. EXISTING SYSTEM

This project is part of an on-going research aimed to replace the traditional spraying methods with an agricultural robotic sprayer. The robot navigates autonomously along the vineyard rows and performs specific spraying toward detected targets. For site-specific spraying the target must first be detected and then sprayed. This research focuses on the spraying process to completely cover the target while minimizing the amount of material sprayed. On-going research focused on the target detection and on the development of a fully operational agricultural spraying robot. The diameter of the sprayer is set according to the shape and size of the target like the recently proposed patent that suggests a changeable nozzle aperture. However, in existing approach was designed, built, and implemented in real-world conditions and included experimental procedures and experiments for evaluation and validation of the spraying device for agricultural amorphous shapes and variable-sized targets.

III. PROPOSED SYSTEM

The spraying device (SD) was designed and built as an experimental tool to implement the One Target–One Shoot (OTOS) spraying method. The device is mounted on a mobile robotic sprayer and supplies pressurized pesticide. A pesticide spraying mechanism with the help of current robotics technology is the main purpose of this project which would help the farmer in his day-to-day spraying activity. This project is basically a robot with an attached spraying mechanism and is divided into two parts. First, we started by designing the chassis for our robot. Our main challenge was to design an adjustable chassis which could carry a load of 1 Kg, so for it we used iron as the metal for chassis. But the chassis itself weighed 1Kgs, so in order to avoid excessive weight of the device, iron has not been used as the only metal in the chassis of the device.

TRANSMITTER MODULE

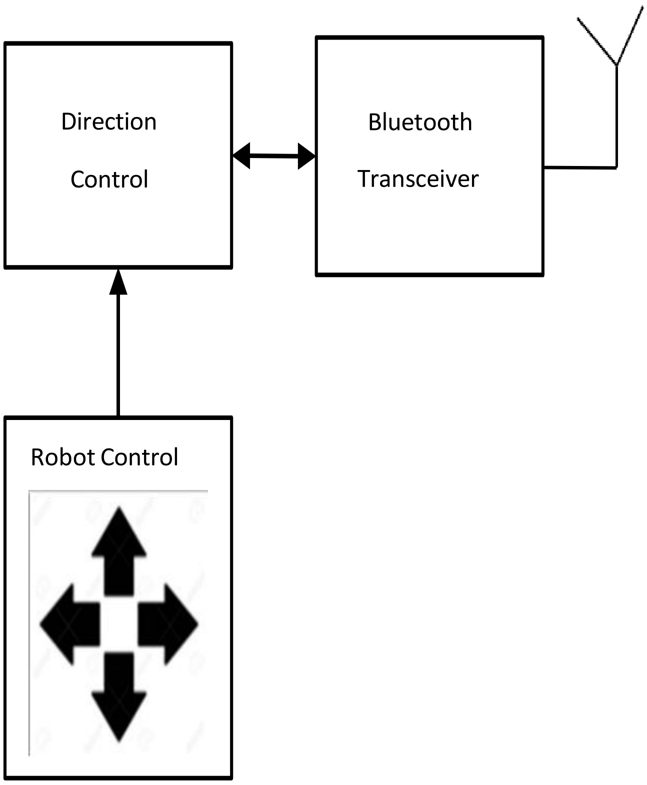


Figure 1. Transmitter Module

RECEIVER MODULE

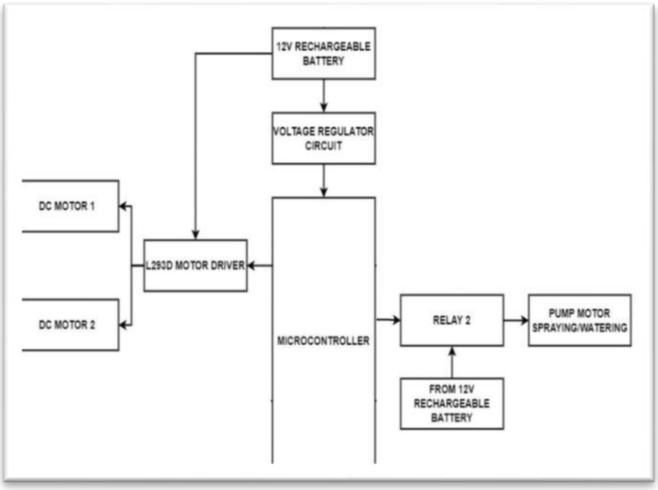


Figure 2. Receiver Module

ARDUINO NANO

Figure 3. Arduino Nano

Arduino Nano controls the other components Raspberry Pi, motors, motor driver module, ultrasonic sensor.

L298N DRIVER MODULE

Figure 4. L298n Driver Module

Useful in robotics application, bidirectional DC motor controller and stepper motor driver.

DC GEAR MOTOR

Figure 5. DC Gear Motor

The DC Gear Motor was moved to the rover forward, backward, left, and right.

IV.RESULTS AND DISCUSSION

The key outcome of the project is the achievement of accurate fertilizer dropping. The robot's servo motor-controlled fertilizer dispenser mechanism ensures precise placement and optimal contact, ultimately leading to improved germination rates and crop yield. Moreover, the integration of a sensor allows the robot to monitor the content in the soil effectively.

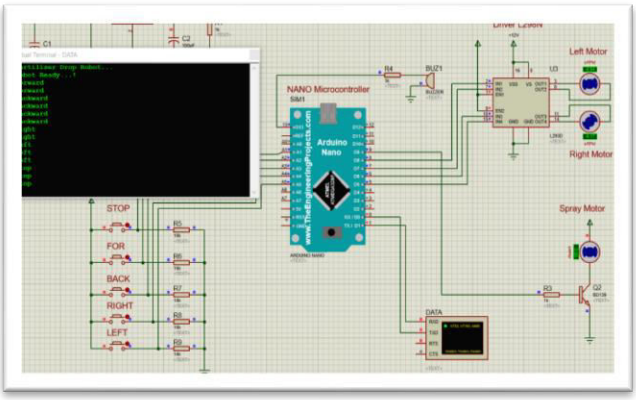


Figure 6. Simulation Result

The robot's ability to follow predefined paths accurately is critical for efficient seed sowing operations. The integration of a Bluetooth module facilitates wireless communication between the agri-robot and external devices such as smartphones or computers. This wireless control and monitoring capability allows users to remotely control the robot, send commands, and receive real-time data and feedback regarding the robot's operation and status. This feature provides convenience and flexibility for farmers and agricultural practitioners. The robot's servo motor-controlled fertilizer dispenser mechanism ensures precise placement and optimal contact, ultimately leading to improved germination rates and crop yield. Moreover, the integration of a sensor allows the robot to monitor the content in the soil effectively. The key outcome of the project is the achievement of accurate fertilizer dropping. The robot's servo motor-controlled fertilizer dispenser mechanism ensures precise placement and optimal contact, ultimately leading to improved germination rates and crop yield. Moreover, the integration of a sensor allows the robot to monitor the content in the soil effectively. The robot's ability to follow predefined paths accurately is critical for efficient seed sowing operations. The integration of a Bluetooth module facilitates wireless communication between the ag-robot and external devices such as smartphones or computers. This wireless control and monitoring capability allows users to remotely control the robot, send commands, and receive real-time data and feedback regarding the robot's operation and status. This feature provides convenience and flexibility for farmers and agricultural practitioners.

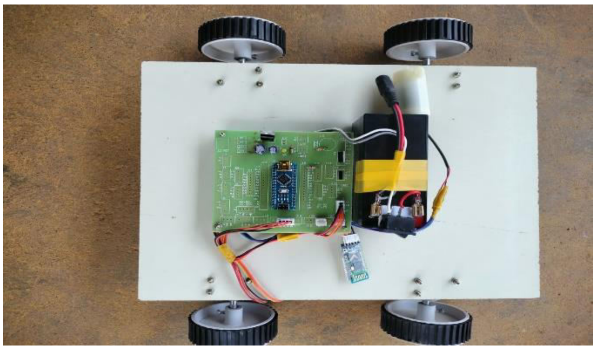


Figure.7. Hardware Model

The implementation of the proposed IoT-based fertilizer spray robot Control System yielded significant outcomes in enhancing precision agriculture practices. By seamlessly integrating advanced technologies into the control mechanism of Fertilizer Spray Robots, the system enabled real-time monitoring and responsive control. The key components, including sensor nodes, communication modules, and an intelligent control algorithm, collectively contributed to the success of the system. Equipping the Fertilizer Spray Robot with sensors such as soil moisture sensors and GPS units proved instrumental in collecting crucial data from the agricultural environment. The continuous monitoring of soil moisture levels by IoT-enabled sensors and the transmission of this data to a centralized control system exemplified the system's effectiveness. The control system, driven by an intelligent algorithm, demonstrated proficient decision-making capabilities regarding the activation and deactivation of the fertilizer spray mechanism on the robot. This strategic approach ensured that the application of fertilizer occurred precisely when and where needed, leading to optimal resource utilization. The integration of GPS technology played a crucial role in achieving accurate positioning, thereby facilitating precise control over the application of fertilizers in specific areas of the field. These results collectively signify the system's effectiveness in advancing precision agriculture through innovative hardware solutions.

V.CONCLUSION

The proposed work an easy code implementation not only for the simulation, but also into the embedded ECU. An intelligent robot system spraying pesticides, to control the robot through a wireless alternative to manual completion of plant spray test, reducing direct exposure to pesticides and the human body, reduce pesticide harm to people, and improve production efficiency. By good, can be different terrain, different heights crops by spraying operation tests show that a certain protective, practical, mobile robot, better spray effect at the right working environment, such Its low cost, ease of handling and easy maintenance and other characteristics of individuals with a broad market in agricultural production. The integration of a Bluetooth module facilitates wireless communication between the ag-robot and external devices such as smartphones or computers. This wireless control and monitoring capability allows users to remotely control the robot, send commands, and receive real-time data and feedback regarding the robot's operation and status. This feature provides convenience and flexibility for farmers and agricultural practitioners. An intelligent robot system spraying pesticides, to control the robot through a wireless alternative to manual completion of plant spray test, reducing direct exposure to pesticides and the human body, reduce pesticide harm to people, and improve production efficiency.

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