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IoT-Based Seed Sowing and Spraying Machine

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Abstract: *This paper presents an IoT-based automated system for seed sowing and pesticide spraying, aimed at addressing key challenges faced in modern agriculture, including labour shortages, inefficient resource usage, and excessive reliance on chemicals. The proposed system integrates various components such as soil moisture sensors, temperature and humidity sensors, ultrasonic obstacle detectors, actuators, and a microcontroller (ESP32) with Wi-Fi connectivity. These components work together to assess environmental conditions in real time, enabling precise seed placement and timely pesticide application only when necessary.*

By using real-time data and automation, the system significantly reduces human effort while increasing operational efficiency and accuracy. It ensures optimal use of agricultural inputs, helping to minimize waste and environmental impact. The machine also features cloud connectivity, allowing farmers to monitor and control operations remotely through a mobile application or web interface.

Powered by solar energy, the system is energy-efficient and well-suited for remote or off-grid farming locations. The design promotes sustainable and smart farming practices, making it especially valuable for small and medium-scale farmers. Overall, the implementation of this IoT-based agricultural solution can play a vital role in enhancing crop productivity, conserving resources, and supporting the transition toward precision agriculture.

Keywords: Internet of Things (IoT), Precision Agriculture, Smart Farming, Automated Seed Sowing, Wireless Monitoring System

I. INTRODUCTION

IoT-based agricultural systems are designed to bring intelligence and automation to farming practices, addressing the limitations of conventional manual methods. Traditional farming often relies on labour-intensive processes for seed sowing and pesticide application, leading to inefficiencies such as uneven seed placement, excessive chemical use, and increased operational costs. The integration of the Internet of Things (IoT) enables the development of smart farming machinery that performs these tasks based on real-time environmental data.

The proposed system utilizes a combination of soil moisture sensors, temperature and humidity sensors, and ultrasonic obstacle detectors to automate decision-making in seed sowing and pesticide spraying. A microcontroller (such as ESP32) processes sensor input and controls actuators, while wireless communication via Wi-Fi allows real-time monitoring and remote control through cloud platforms. This facilitates precision farming by ensuring optimal seed placement and targeted spraying, improving both crop yield and resource management.

Designed with small and medium-scale farmers in mind, the machine is solar-powered for off-grid usability, and structured to be cost-effective, modular, and scalable. As final-year students in electronics and telecommunication, we recognize the significance of this innovation in transforming traditional agriculture into a sustainable, data-driven industry. The increasing need for smart farming solutions positions this project as a step forward in addressing global food security challenges.

II. PROBLEM STATEMENT/ OBJECTIVE

The objectives of the project are as follows:

- Manual farming is time-consuming and physically demanding.

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- Seeds and pesticides are often wasted due to lack of precision.
- Traditional methods lack accuracy in seed placement and spraying.
- Farmers can't monitor real-time soil or weather conditions.
- There is heavy dependence on human labour.
- Overuse of pesticides causes environmental damage.
- Current tools offer no automation or remote control.

III. PROPOSED METHODOLOGY

The methodology for the IoT-Based Seed Sowing and Spraying Machine involves several essential steps, from sensing soil and weather conditions to automatically planting seeds and spraying pesticides. The system operates autonomously and is remotely monitored using IoT technology. The following outlines the complete working process:

1. System Initialization and Sensor Activation:

- The system starts by powering up all the sensors and components using solar energy stored in a battery.
- The ESP32 microcontroller initializes the sensors, including soil moisture, temperature, humidity, and ultrasonic sensors, as well as motor drivers.

2. Soil Moisture Detection:

- A soil moisture sensor is used to check if the soil contains enough water for planting.
- If the moisture level is below the required threshold, the machine either waits or moves forward without sowing to avoid seed wastage.

3. Automated Seed Sowing:

- If the soil is suitable, the seed-sowing mechanism is activated.
- A stepper motor rotates the seed dispenser, dropping one seed at a time at predefined intervals and depth, ensuring accurate spacing and planting.

4. Environmental Monitoring for Spraying:

- A DHT11 sensor measures the temperature and humidity of the environment in real-time.
- If conditions indicate the likelihood of pest activity or disease (based on pre-set thresholds), the system prepares for spraying.

5. Smart Pesticide Spraying:

- The solenoid valve opens and controls the flow of pesticide when required.
- The machine sprays only the needed amount of pesticide, minimizing chemical usage and environmental impact.

6. Obstacle Detection and Navigation:

- An ultrasonic sensor continuously scans for obstacles like rocks, animals, or uneven land.
- If an obstacle is detected, the machine automatically changes its path or stops to avoid collision or damage.

7. IoT-Based Monitoring and Control:

- All sensor readings and actions (e.g., sowing and spraying status) are sent to a cloud platform through Wi-Fi using the ESP32.

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- The farmer can access this data in real-time via a mobile app or website and control the system remotely if needed.

8. Power Supply and Energy Management:

- The machine is powered by solar panels connected to a rechargeable battery, making it ideal for remote or off-grid locations.
- Power consumption is optimized for long operation hours without frequent charge.

9. System Evaluation and Optimization:

- The system performance is evaluated based on seed spacing accuracy, spraying efficiency, and battery usage.
- Adjustments are made to improve the machine's speed, precision, and energy efficiency based on real-world testing.

10. Safety and Environmental Considerations:

- The system uses non-harmful sensors and components, ensuring user safety.
- Automated and targeted pesticide spraying reduces environmental contamination and supports sustainable farming practices.

IV. BLOCK DIAGRAM

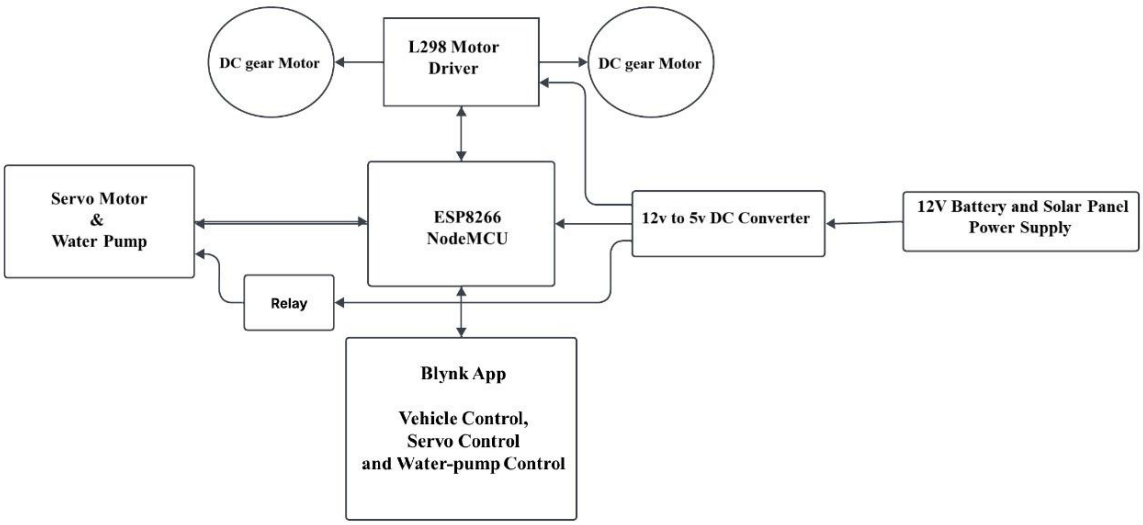

Fig. 1 Block Diagram of IoT Based Seed Sowing and Spraying Machine

V. CONCLUSION

The IoT-Based Seed Sowing and Spraying Machine demonstrates how smart technology can transform traditional farming methods into more efficient, precise, and environmentally friendly practices. By integrating sensors, motors, and IoT capabilities, the system automates two critical tasks in agriculture—seed sowing and pesticide spraying—while reducing the need for manual labour.

The machine begins by checking soil moisture to ensure the soil is suitable for planting. If the conditions are right, it automatically sows seeds at correct intervals and depth. It also measures temperature and humidity to decide when

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spraying is necessary, ensuring pesticides are used only when needed. An ultrasonic sensor helps the machine navigate safely by avoiding obstacles in its path.

All actions and environmental data are shared with farmers through a mobile app or website, allowing them to monitor and control the system remotely. The entire setup runs on solar power, making it suitable for rural or off-grid locations.

Overall, this smart farming solution promotes sustainability by saving resources, minimizing chemical usage, and increasing productivity. It offers a practical and cost-effective approach for small and medium-scale farmers, making agriculture more accessible and future-ready.

REFERENCES

[1]. Mahajan, R., & Sharma, V. (2018). Design and development of an automated seed sowing system with IoT integration. *International Journal of Engineering Research and Technology*, 6(11), 98-104.

[2]. Meena, S., & Gupta, N. (2017). Precision Agriculture: Smart Farming Technologies. *International Journal of Recent Technology and Engineering*, 5(4), 23-29.

[3]. Patel, H., & Joshi, R. (2020). IoT-driven automated pesticide spraying system for sustainable agriculture. *International Journal of Advanced Research in Electrical, Electronics, and Instrumentation Engineering*, 9(3), 54-60.

[4]. Soni, P., & Verma, R. (2022). Role of IoT and AI in agriculture: A futuristic approach. *Journal of Agricultural Science and Technology*, 14(2), 112-128.

[5]. Wang, J., & Li, Y. (2016). Real-time monitoring system for precision agriculture using IoT. *International Journal of Computer Science and Mobile Computing*, 5(8), 89-97.

[6]. Zhang, Y., & Zhang, X. (2019). A novel approach to automated seed sowing and pesticide spraying using IoT and machine learning. *International Journal of Smart Agriculture and Environment*, 7(1), 33-47.

[7]. Awati, J. S., & Patil, V. S. (2012). Automatic irrigation control by using wireless sensor networks. *Journal of Computer Science*, 8(5), 648-652.

[8]. Blackmore, B. S., Griepentrog, H. W., & Nielsen, H. (2002). Development of a precision seeding system for automated seed drills. *Precision Agriculture*, 3(3), 295-310.

[9]. Godfrey, S. (2018). Smart Agriculture with IoT: Implementation of Smart Irrigation and Smart Spraying. *International Journal of Emerging Trends in Engineering Research*, 6(9), 1-7.