e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:03/March-2025 Impact Factor- 8.187 www.irjmets.com

WIRELESS SEED PLANTER

Mrs. Niyati Sohni[*1], Pranay Sawant[*2], Rushikesh Salunkhe[*3], Sanika Fuke[*4]

[*1]Lecturer, ENTC, JSCOE, Pune, Maharashtra, India.

[*2,3,4]Student, ENTC, JSCOE, Pune, Maharashtra, India.

DOI : https://www.doi.org/10.56726/IRJMETS70128

ABSTRACT

Agriculture is a crucial sector that significantly contributes to the economic stability of a nation. In India, it serves as the backbone of the economy, with crop production playing a pivotal role. The efficiency of crop production largely depends on timely sowing, minimizing manual labor, and improving precision. This paper presents an advanced electromechanical seed sowing machine designed for sowing various crops, including soybean, maize, pigeon pea, Bengal gram, and groundnut.

The proposed system addresses the limitations of conventional seed sowers by integrating modern technological advancements. The design incorporates Bluetooth-based mobile phone operation, enabling remote control of the machine. Essential components such as a DC motor, battery, microcontroller, and other mechanical elements are employed to enhance automation and efficiency. Furthermore, the machine is equipped with a seed flow detection mechanism and obstacle detection sensors, ensuring smooth operation in diverse farming environments.

This innovative approach significantly improves the precision and effectiveness of the sowing process, reducing dependency on manual labor while enhancing productivity. The development and implementation of such intelligent farming equipment aim to support agricultural sustainability and promote smart farming practices.

Keywords: Smart Agriculture, Seed Sowing Machine, Bluetooth Automation, Precision Farming, Electromechanical System

I. INTRODUCTION

With the ever-growing global population, the demand for food production continues to rise. Traditional manual seed sowing methods often lead to inefficient seed placement, improper spacing, and physical strain on farmers. Additionally, smallholder farmers lack the financial means to invest in high-end mechanized planters, limiting their productivity. Therefore, there is an urgent need to develop a cost-effective and user-friendly automated seed sowing machine that can help small-scale farmers increase crop yield while reducing effort and cost.

Need for Automation in Seed Sowing

Manual seed planting has significant drawbacks, including low efficiency, improper seed spacing, and increased labor intensity. These factors directly impact crop yields and overall productivity. By incorporating automation in the sowing process, we can ensure better seed distribution, proper depth placement, and optimized field coverage. Mechanized seed sowing not only enhances efficiency but also reduces dependency on human labor, addressing the agricultural workforce shortage.

II. METHODOLOGY

The design and implementation of the wireless seed planter involve several key components:

Microcontroller (ESP8266): The core of the system, responsible for processing user commands and controlling the motors and actuators.

Motor Driver (L298N): Used to regulate the speed and direction of the DC motors.

Bluetooth Module: Enables wireless communication between the mobile application and the seed planter.

Seed Flow Control Mechanism: Utilizes an electric actuator to regulate seed flow based on seed size.

Moisture Sensor: Detects soil moisture levels and triggers irrigation when necessary.

Obstacle Detection (IR Sensor): Prevents collisions by halting machine movement when obstacles are detected.

Power Supply System: A 12V rechargeable battery ensures continuous operation of the machine in the field.

Mobile Application Interface: A user-friendly mobile application provides remote access to machine controls.

The machine operates through commands received from a mobile application, enabling farmers to control various functionalities remotely. Each command triggers specific actions such as movement, seed release, irrigation, or stopping the machine. The integration of multiple sensors ensures that the machine adapts to real-time field conditions.

III. MODELING AND ANALYSIS

A prototype of the wireless seed planter was developed and tested under controlled conditions. The major aspects analyzed include:

Seed Spacing Accuracy: Ensuring uniform placement of seeds.

Obstacle Detection Sensitivity: Testing the IR sensor's response time to obstructions.

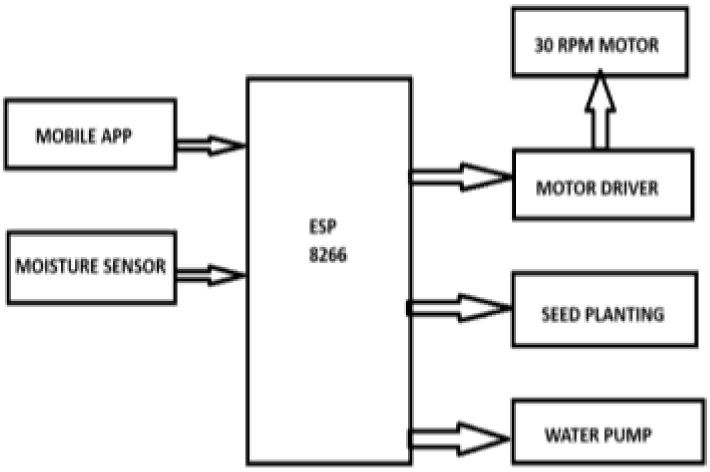
Moisture Sensor Efficiency: Measuring soil moisture levels and response accuracy.

Power Consumption: Evaluating battery performance for sustained operation.

Bluetooth Communication Range: Testing the maximum operational range of the Bluetooth module.

Mechanical Durability: Assessing the robustness of the ploughing and seed-dispensing mechanisms under different soil conditions.

The system was optimized to maintain precision and efficiency, reducing labor dependency and improving agricultural productivity. Extensive field tests were conducted to validate the machine's performance in different soil and weather conditions. The data collected helped refine the machine's control algorithms and improve its seed dispensing accuracy.



IV. RESULTS AND DISCUSSION

The experimental results demonstrated the effectiveness of the wireless seed planter in automating the seed sowing process. Key findings include:

Improved Efficiency: The machine significantly reduced the time required for sowing compared to manual methods.

Precision in Seed Placement: Uniform spacing and depth ensured better germination rates.

Obstacle Avoidance: The IR sensor effectively detected and prevented collisions.

Enhanced Control: The Bluetooth-enabled mobile app provided a user-friendly interface for remote operation.

Reduction in Labor Costs: The need for manual intervention was minimized, leading to cost savings for farmers.

Adaptability: The machine performed well across different soil textures and moisture levels.

Despite its advantages, the system has limitations, such as dependency on Bluetooth range and battery life. Future enhancements could include GPS integration for larger field coverage, AI-based soil condition analysis, and solar-powered operation to improve sustainability. Additional improvements in motor torque and traction design can further enhance the machine's stability in rough terrains.

V. CONCLUSION

The wireless seed planter represents a significant advancement in agricultural mechanization. By integrating automation with traditional farming techniques, this system reduces labor dependency, improves efficiency, and ensures precision in seed placement. The results demonstrate the potential for further development, including scalability for larger agricultural fields.

The implementation of smart agricultural tools such as this wireless seed planter is essential for the future of farming. With emerging technologies such as IoT, artificial intelligence, and machine learning, the efficiency of automated farming can be further enhanced. Future improvements will focus on incorporating AI-driven decision-making for real-time field analysis, automated path navigation, and real-time environmental monitoring for enhanced crop management.

ACKNOWLEDGEMENTS

We express our sincere gratitude to JSPM'S JSCOE, Pune, India, for their support and guidance throughout this project. Special thanks to Prof. Niyati Sohni for her valuable insights and encouragement. We also acknowledge the contributions of our team members, Sanika Fuke, Rushikesh Salunkhe, and Pranay Sawant, for their dedication and hard work in bringing this project to fruition.

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