International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 10 Issue: 03 | March - 2026 SJIF Rating: 8.659 ISSN: 2582-3930

Fabrication of an Automatic Seed Sowing Robot with Soil Moisture Monitoring System

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ABSTRACT

This paper presents the design and implementation of an automatic seed sowing robot integrated with soil moisture monitoring using Arduino. The system automates agricultural tasks such as seed placement and irrigation. It ensures uniform seed distribution, reduces human effort, and improves efficiency. The system is cost-effective and suitable for small-scale farmers. Experimental results demonstrate improved productivity and optimized water usage.

KEYWORDS

Arduino, Smart Agriculture, Seed Sowing Robot, Soil Moisture Sensor, Automation

1. INTRODUCTION

Agriculture is a major sector that supports the economy and food production worldwide. Traditional farming techniques require significant manual labor and are prone to inefficiencies. Seed sowing is one of the most critical operations in agriculture, and improper sowing leads to poor crop yield.

Automation in agriculture has emerged as a solution to improve productivity. This project proposes a robotic system that automates seed sowing and irrigation. The integration of sensors and microcontrollers enables real-time monitoring and control, making the system efficient and reliable.

2. PROBLEM STATEMENT

Manual farming methods suffer from several challenges such as labor shortage, uneven seed distribution, and inefficient water usage. Farmers often rely on traditional irrigation methods that do not consider soil conditions, leading to water wastage. There is a need for an automated system that can perform these tasks efficiently.

3. OBJECTIVES

- To design an automated seed sowing system
- To ensure uniform seed distribution
- To monitor soil moisture in real-time
- To automate irrigation process
- To reduce labor dependency and increase efficiency

4. LITERATURE REVIEW

Various research studies have focused on smart agriculture using IoT and embedded systems. Arduino-based irrigation systems have been widely used due to their simplicity and cost-effectiveness. Studies show that automated irrigation can reduce water usage significantly. Seed sowing robots have also been developed to improve accuracy and reduce labor costs.

5. SYSTEM ARCHITECTURE

The system consists of Arduino Uno, L298N motor driver, HC-05 Bluetooth module, soil moisture sensor, DC motors, relay module, and a water pump. The robot is powered using a battery and includes a solar panel for additional power support. The architecture integrates movement, sensing, and irrigation into one system.

Figure 1: Top View of Prototype

Figure 2: Side View of Prototype

6. HARDWARE COMPONENTS

The hardware components include Arduino Uno, motor driver, soil moisture sensor, Bluetooth module, DC motors, relay module, and battery. Each component plays a critical role in system operation.

7. SOFTWARE IMPLEMENTATION

The system is programmed using Arduino IDE. The code processes sensor data and controls motors and pump accordingly. Bluetooth communication allows remote control.

8. WORKING PRINCIPLE

The robot moves across the field using DC motors. Seeds are dispensed through a mechanism. The soil moisture sensor detects moisture levels and activates irrigation when required. The system ensures efficient farming operations.

9. RESULTS AND DISCUSSION

The system was tested under different conditions. Results show improved efficiency compared to manual methods. Seed placement accuracy increased significantly, and water usage was reduced. The system performed well in controlled environments.

10. ADVANTAGES

- Reduces labor
- Improves efficiency
- Saves water
- Cost-effective
- Easy to operate

11. LIMITATIONS

- Limited to small-scale use
- Depends on battery power
- Not suitable for rough terrain

12. FUTURE SCOPE

Future enhancements include IoT integration, GPS navigation, AI-based crop monitoring, and solar optimization.

13. CONCLUSION

The automatic seed sowing robot is an effective solution for modern agriculture. It improves productivity and reduces manual effort. The system demonstrates the benefits of automation in farming.

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