International Journal of
DATA SCIENCE AND IOT MANAGEMENT SYSTEM
ISSN: 3068-272X www.ijdim.com Original Research Paper

SEED DISPENSER

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ABSTRACT:

This project presents the design and development of a seed dispenser aimed at enhancing precision and efficiency in agricultural sowing practices. The system is built around an Arduino Uno microcontroller, which governs the seed dispensing mechanism through programmed logic. Key components include a motorized seed hopper, a soil sensor, and a servo-controlled dispenser that ensures uniform seed spacing. The automation reduces manual labour, minimizes seed wastage, and improves planting consistency. The prototype was tested across various soil types and demonstrated reliable performance, making it a cost-effective and scalable solution for small to medium-scale farmers. This innovation contributes to the modernization of agriculture by integrating accessible microcontroller technology with practical field applications.

Keywords: Seed dispenser, Arduino uno, microcontroller, precision agriculture,automated sowing, soil sensor, small scale forming,cost-effective, seed spacing, reliable performance.

Received: 08-10-2025 Accepted: 17-11-2025 Published: 24-11-2025

I. INTRODUCTION

It In modern agriculture, automation plays a critical role in improving productivity and reducing the workload on farmers. However, many automation solutions are expensive and complex. This project addresses that gap by developing a simple, low-cost robot that can perform essential agricultural operations. Using an Arduino Uno, motor drivers, and basic components like a servo motor and DC motors, the machine can be manually controlled to move in different directions, cut grass, dispense seeds, and manage irrigation.

II. LITERATURE SURVEY

Adedeji et al. (2023) – In their paper *"Design, Fabrication, and Development of an Automated Seed-Sowing Machine"*, the authors developed a seed dispenser using Arduino programming to automate sowing. The system included a chassis, power unit, and mechanical dispensing mechanism. It demonstrated improved efficiency, reduced seed wastage, and time savings.

Abhijith et al. (2025) – Their study *"Analysis on Automated Seeding and Irrigation Using Arduino"* explored a combined system for seed dispensing and irrigation. It used soil moisture sensors, motorized dispensers, and real-time monitoring to optimize water and seed usage. The paper emphasized the role of IoT and AI in precision farming.

Roshan et al. (2013) – This earlier work highlighted the evolution of seed-sowing technologies, from manual to semi-automated systems. It laid the groundwork for integrating microcontrollers like Arduino into agricultural machinery for better control and consistency.

Kalay Khan et al. (2015) – Focused on the economic and agricultural impact of automation, this study discussed how Arduino-based systems can be scaled for developing countries to improve crop yields and reduce labour dependency.

III.SYSTEM SPECIFICATIONS

The proposed system for a seed dispenser using Arduino Uno typically integrates several components to automate the seed

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sowing process with precision and minimal human intervention. Here's a breakdown of a commonly proposed setup:

1. **Microcontroller Unit** :Arduino Uno acts as the brain of the system, controlling all operations based on programmed logic.
2. **Seed Dispensing Mechanism:**A servo motor or stepper motor rotates a seed drum or funnel to release seeds at regular intervals. The spacing can be adjusted via code or mechanical design.
3. **Mobility System:**DC motors with wheels allow the system to move across the field. Controlled via an L298N motor driver.
4. **Power Supply :** Rechargeable battery
5. **Communication Module:**Bluetooth or GSM module for remote monitoring or alerts control.

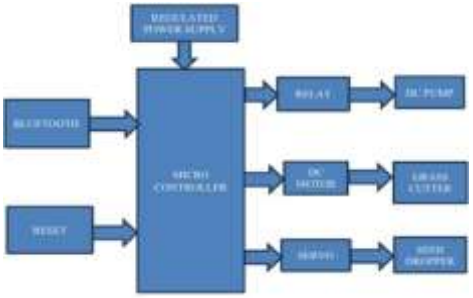

Fig. 1. Block diagram

IV. HARDWARE COMPONENTS

1. Microcontroller ATMEGA328

A microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system. It typically includes a processor core, memory (both RAM and ROM), and input/output peripherals—all on a single chip. Unlike general-purpose computers, microcontrollers are optimized for control-oriented tasks, such as reading sensor data, controlling motors, or managing user interfaces. They are widely used in everyday devices like washing machines, microwave ovens, remote controls, and even in complex systems like automotive electronics and medical instruments. Their small size, low cost, and energy efficiency make them ideal for applications where dedicated control is needed.

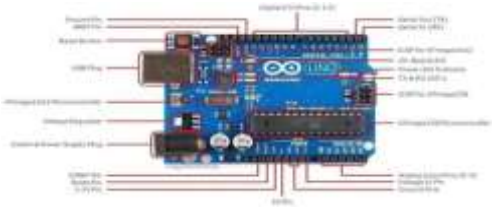

Fig 2: Arduino uno

2. RELAY

A **relay module** is an electronic device used to control high-voltage or high-current circuits with a low-voltage signal, typically from a microcontroller like an Arduino, Raspberry Pi, or other control systems. It acts as an electrically operated switch, allowing one circuit to control another without a direct electrical connection between them. The module usually consists of one or more electromagnetic relays, driver transistors, diodes for protection, and terminal connectors. When a small voltage is applied to the input of the module, it activates the internal coil of the relay, which closes or opens the contacts to switch the connected device on or off.

Fig 3: Relay

3. DC MOTOR

A DC motor is an electromechanical device that converts direct current electrical energy into mechanical motion, typically rotational. It operates on the principle that a current-carrying conductor placed in a magnetic field experiences a force. Inside the motor, this is achieved by energizing coils on a rotating armature, which interacts with the magnetic field produced by either permanent magnets or electromagnets in the stator. The commutator and brushes ensure that the direction of

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current in the armature windings reverses appropriately, maintaining continuous rotation. DC motors are valued for their simplicity, precise speed control, and responsiveness, making them ideal for applications ranging from robotics and electric vehicles to small appliances and industrial automation.

Fig 4: DC Motor

4. SERVO MOTOR

A servo motor is a specialized rotary actuator designed for precise control of angular position, speed, and torque. It operates using a closed-loop feedback system, where a sensor continuously monitors the motor's position and sends data to a controller. The controller compares this feedback with the desired position and adjusts the motor's movement accordingly. This mechanism allows servo motors to achieve highly accurate and responsive motion. They are commonly powered by DC or AC sources and are widely used in robotics, CNC machinery, and automation systems where precision is critical. Compact and efficient, servo motors are ideal for applications requiring controlled, repeatable motion.

Fig 5: Servo motor

5. DC PUMP

A DC pump is a type of pump that operates using direct current (DC) electricity, making it ideal for low-voltage and portable applications. It converts electrical energy into mechanical energy to move fluids—typically water—through a system. These pumps are commonly used in solar- powered irrigation, aquariums, fountains, and small-scale water circulation systems.

DC pumps are valued for their energy efficiency, compact size, and quiet operation. They often come in two main types: brushed and brushless. Brushless DC pumps are more durable and require less maintenance since they eliminate friction-prone components like brushes. Many DC pumps are also compatible with battery or solar panel power sources, making them perfect for off-grid or remote applications where AC power isn't available.

Fig 6: DC Pump

6. LEAD ACID BATERIES

The Lead-acid batteries are one of the oldest and most widely used types of rechargeable batteries, known for their simplicity, reliability, and cost-effectiveness. They operate using lead dioxide as the positive plate, sponge lead as the negative plate, and a sulfuric acid solution as the electrolyte. When discharging, a chemical reaction between the lead plates and the acid generates electricity, which is reversed during charging. Despite their relatively low energy density compared to modern alternatives like lithium-ion batteries, lead-acid batteries excel in applications requiring high surge currents, such as automotive starters, uninterruptible power supplies (UPS), and solar energy storage. They come in various forms, including flooded, sealed, and AGM (Absorbent Glass Mat) types, each suited for different environments and maintenance needs. While they are heavy and require careful handling due to the presence of toxic lead and corrosive acid, their recyclability and affordability make them a practical choice for many industrial and off-grid energy systems.

Fig 7: lead acid batteries

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7. REGULATED POWER SUPPLY:

A regulated power supply is an electronic circuit designed to deliver a constant and stable DC voltage, regardless of fluctuations in input voltage or variations in load current. It typically consists of four main components: a step-down transformer to reduce the AC mains voltage, a rectifier to convert AC to pulsating DC, a filter to smooth out the ripples, and a voltage regulator to maintain a steady output. This type of power supply is essential in sensitive electronic devices and embedded systems, where consistent voltage is critical for reliable operation. By ensuring a clean and stable power source, regulated power supplies help protect components from damage and improve overall system performance.

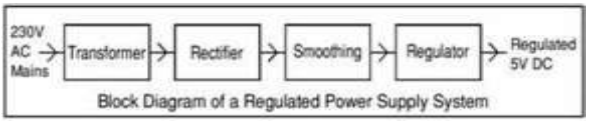

Fig 8: Regulated power supply

8. BLUETOOTH

Bluetooth module, such as the RN41, is a device that enables wireless communication between electronic devices over short distances. It is designed to be easily integrated into embedded systems and supports various data connection interfaces.

Fig 9 : Bluetooth

V. WORKING PROCEDURE

- The machine receives character commands through serial communication.
- Based on the command:
- A = Move Forward
- B = Move Backward
- C = Move Right
- D = Move Left
- E = Stop
- F = Turn Grass Cutter ON
- G = Turn Grass Cutter OFF
- H = Turn Pump ON
- I = Turn Pump OFF
- J = Perform Seeding using a servo
- The DC motors are connected to pins 2-5 for movement.
- Grass cutter motor is connected to pin 6.
- Water pump motor is connected to pin 7.
- Servo motor on pin 9 is used for dispensing seeds.
- Each of these operations is controlled using digital output pins defined in the Arduino sketch. The servo motor is connected to pin 9, DC movement motors are connected to pins 2–5, and the grass cutter and pump are connected to pins 6 and 7 respectively

The above shows the working mechanism of a hardware model.

VI. RESULTS

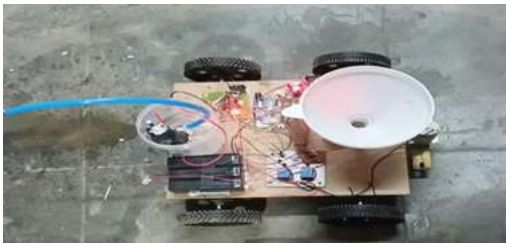

Fig 10: Module for seed dispenser machine

The implementation of seed dispenser machine controlled via Bluetooth is an semi-automated, remote-controlled system that dispenses seeds,sprinkling and grass cutting with increased precision and efficiency compared to manual methods. This technology successfully reduces labor costs and minimizes seed wastage, contributing to improved crop yields and more sustainable agricultural practices.

VII. CONCLUSION

The multi-function agriculture machine demonstrates an affordable and functional prototype to assist with basic farming

operations. Though currently limited to manual control, it paves the way for scalable automation solutions that can support precision farming and reduce physical effort for farmers.

VIII. FUTURE SCOPE

The future scope of Seed dispenser including functions like seed sowing, Water sprinkling, grass cutting:

- Add wireless Bluetooth or Wi-Fi control (using HC-05 or ESP8266)
- Include sensors (soil moisture, obstacle detection, GPS)
- Enable autonomous navigation using AI or path planning
- Upgrade motor power and protection circuits
- Add solar panel for sustainable operation

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