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DESIGN AND FABRICATION OF AUTOMATIC SEED SOWING MACHINE

M. Vamsi krishna[1], P. Lohith[2], M. Manoj kumar[3], M. Siddu[4], K.Naveen[5], Pankaj Kumar[6*]

Department of Mechanical Engineering, GMR Institute of Technology, Rajam, A.P.-532127 Corresponding Author: pankajcryo@gmail.com

ABSTRACT :

The automatic seed sowing machine is designed to reduce manual labor and improve the efficiency of seed placement in agriculture. Traditional methods of seed sowing are time-consuming and often lead to uneven distribution, improper depth, and excessive seed wastage. This project aims to overcome these challenges by developing a compact, automated prototype capable of performing three simultaneous functions: ploughing, seed placement, and land covering. The machine is operated remotely through a wireless blutooth communication interface via mobile device , making it user-friendly and easy to operate. By ensuring uniform seed placement with minimal human intervention, this machine enhances agricultural productivity, reduces seed wastage, and serves as a foundation for future automation in precision farming. Future enhancements could include GPS integration, AI-based monitoring, and sensor-driven automation to further optimize precision agriculture, promoting sustainable farming practices.

Keywords: Automatic seed sowing; Bluetooth-controlled machine; seed dispenser, , soil preparation; four-wheel drive chassis; L293D motor driver

2.Introduction

The demand for agriculture is steadily increasing due to rapid population growth, leading to potential food shortages and the need for higher agricultural productivity. Traditional farming methods using tractors and animals are time-consuming and energy-intensive, often contributing to increased fuel consumption and environmental pollution. Moreover, these methods require significant human labor, escalating the overall costs.

To address these issues, automation and renewable energy solutions must be integrated into agriculture. The fabrication of an automatic seed sowing machine offers a promising step in this direction. The proposed machine minimizes human involvement by automatically performing ploughing, seed sowing, and soil covering tasks. It significantly reduces operational costs, fuel usage, and environmental impact by employing a compact mechanism powered by a rechargeable battery. This project does not rely on solar energy directly, but the concept supports renewable adaptability. The machine can be enhanced with solar panels in the future. As the machine performs all the essential steps automatically and precisely, it enhances efficiency and encourages the use of modern smart agriculture techniques, ensuring food security and economic stability. The objective is to create a cost-effective, labor-saving, and scalable solution for farmers to meet future agricultural demands efficiently.

3. Literature Review

Previous studies and prototypes have explored the automation of seed sowing using solar energy and mechanical drives. However, the emphasis has often been on individual operations rather than an integrated solution. Our review identified a gap in compact machines that can handle multiple processes simultaneously, operate via remote control, and be viable for small and medium-sized farms. The demand for human labor in agriculture is consistently high, which results in increased production costs. To mitigate this, the development of automated technologies is essential. The **Automatic Seed Sowing Machine** addresses these concerns by reducing fuel consumption, preventing air pollution, and cutting labor costs. This system operates automatically, minimizing human intervention while improving efficiency.

India, being an agriculturally driven economy, must support nearly 17% of the world's population with limited land resources. Efficient sowing is critical for ensuring optimal yields. Ideal sowing requires seeds to be placed in rows at specific depths and spacings, then covered with soil and compacted properly. These parameters differ across crops and conditions, emphasizing the need for flexible, efficient sowing equipment. Traditional methods of seed sowing often fall short in precision and efficiency, leading to increased costs and reduced output.

This project explores the development of a multifunctional seed sowing machine that integrates various sowing and covering functions into one compact automated unit. Although this version is battery-powered and not yet solar-operated, the concept can be upgraded for solar integration. With growing interest in renewable energy, solar-powered systems are a sustainable and secure solution to meet energy needs. Most solar systems are static and suffer from reduced efficiency due to suboptimal alignment with sunlight. Implementing solar tracking systems could enhance energy yield.

Farhan Zaman Ha-mim proposed an IoT-based smart agriculture system integrating sensors and automation for real-time crop monitoring and optimization [4].Aditya Vishwas Kanade developed Agri-Rover, an IoT-controlled robotic seed sowing system using Arduino and servomotors for precise automated seed placement [5].Muhammad Danish Aizam Ismayudin designed an electric-powered Automatic Seed Sowing machine for small-scale

farming, running on a 12V battery for sustainability [6].Archana Devi S developed AgriSense, a Bluetooth-operated irrigation and grass-cutting system using Arduino and solar-powered batteries for automation [7].

By automating sowing operations, the machine reduces time, fuel use, and labor costs. It is particularly effective in placing seeds at appropriate depths and covering them efficiently. Such innovations play a key role in supporting the Indian economy, where agriculture continues to be a foundational sector. With this technology, the burden on farmers is reduced and crop yields can potentially increase.

4. Methodology

The methodology involved selecting appropriate components, designing the layout on a 4WD metal chassis, and integrating electronic and mechanical systems. The machine uses four 100 RPM, 12W motors for wheel drive, and an additional motor for the seed dispensary mechanism. The L293D dual bridge motor driver module manages motor control, while a lead-acid battery powers the setup. The system is controlled via a mobile phone using Bluetooth connectivity.

The fabrication of the **Automatic Seed Sowing Machine** involved a systematic process that integrated both mechanical and electronic subsystems to achieve multifunctionality. The steps taken are as follows:

Firstly, the selection of essential components was carried out based on torque, power efficiency, and functional suitability. A robust **4-wheel drive (4WD) metal chassis** was chosen to ensure the machine's mobility over varied soil conditions. Four **100 RPM, 12W DC motors** were mounted to each of the wheels, enabling independent and controlled movement across the field.

An additional motor was fitted with a custom-designed **seed dispensary wheel**, which collects seeds from the hopper and drops them at regular intervals. These motors are controlled via an **L293D dual bridge motor driver**, which enables bidirectional control of both the wheel motors and the seed dispenser. Power for the entire system is supplied by a **12V lead-acid battery**, chosen for its reliability and current capacity. The battery powers all motors and control systems, and distribution is managed through a small control board setup using dot boards and connectors.

The system is controlled via a **mobile phone using Bluetooth connectivity**. A Bluetooth module receives commands and relays them to a microcontroller, which sends signals to the motor driver to perform respective tasks. The operation sequence is programmed such that the front-mounted tool ploughs the soil, the seed is then placed, and the soil is covered by a rear mechanism, all in one pass.

5. Cad model of Automatic Seed Sowing Machine

The CAD (Computer-Aided Design) model of the Automatic Seed Sowing Machine plays a crucial role in the visualization and design validation of the entire system before physical fabrication. This 3D model offers a comprehensive representation of the machine's mechanical layout, helping engineers analyze spatial relationships between components and ensure all parts are accurately aligned. The model typically includes key components such as the 4-wheel drive chassis, seed dispensary wheel, ploughing blade, land covering blade, DC motors, and the seed hopper.

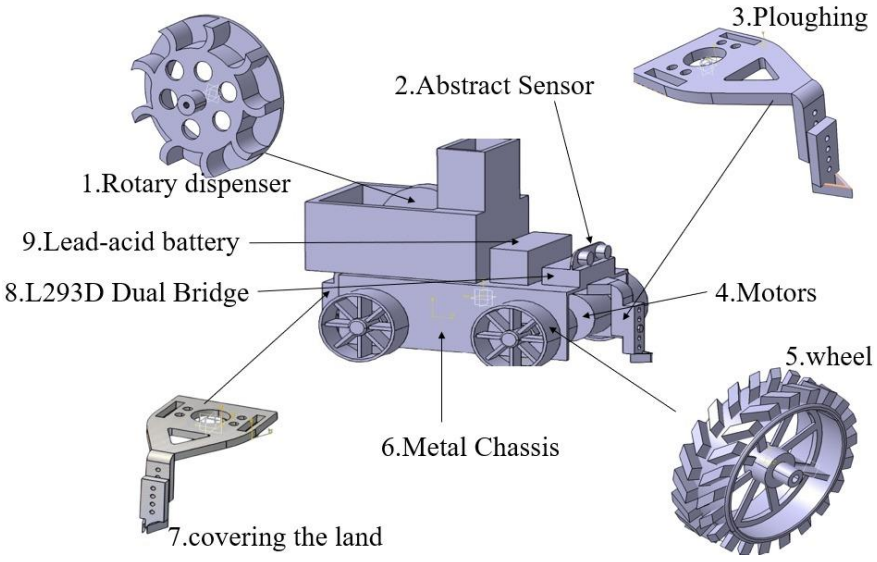

Fig 1.components of the automatic seed sowing Machine

Using CAD software like SolidWorks, AutoCAD, or Fusion 360, the design is rendered in three dimensions to study mechanical movements and clearances. The chassis is designed to be lightweight and stable, ensuring balance during movement. The positions of motors and wheels are carefully arranged for optimal weight distribution and traction. The seed dispenser and plougher are placed in alignment with the motion path to enable smooth seed placement and soil covering. Additionally, the CAD model allows for simulation of motion and stress analysis, ensuring the structure can withstand

field conditions. Overall, the CAD model helps in reducing design flaws, saving time and material during actual fabrication, and provides a clear blueprint for assembly and future upgrades.

6. Working Principle

The machine operates through a mobile-controlled interface. As it moves forward, the front plough digs the soil. Simultaneously, seeds are collected from the hopper by a rotating seed wheel and dropped into the furrow. The rear mechanism then covers the soil, completing the sowing process. The operations are synchronized via programming logic, ensuring precise timing and placement. The working of the **Automatic Seed Sowing Machine** is based on the integration of mechanical motion and electronic control to automate the agricultural sowing process. The entire system is wirelessly operated via a mobile phone using a **Bluetooth interface**, offering remote control over movement and sowing functions. Below is a step-by-step explanation of its working principle:

The machine rests on a **4-wheel drive chassis**, each wheel powered by a 100 RPM, 12W DC motor. The **Bluetooth module** receives signals from the mobile phone and transmits them to the onboard **microcontroller**. This microcontroller interprets the input commands and sends control signals to the **L293D dual motor driver**, which then controls the direction and speed of the motors.

As the machine moves forward, a **ploughing blade or furrow opener** attached at the front penetrates the soil, creating a narrow trench or furrow. At the same time, a **rotating seed wheel** located beneath the hopper starts turning. This wheel is carefully designed with holes or grooves that pick up seeds from the hopper and drop them one by one into the open furrow at regular intervals.
To ensure consistency in seed spacing and depth, the rotation of the seed wheel is synchronized with the forward movement of the machine. The placement of seeds is timed using simple programming logic or mechanical gearing mechanisms. This coordination ensures each seed is dropped at a desired spacing and depth, improving germination efficiency.

Immediately after the seed is placed into the furrow, a **soil covering mechanism**—typically a flap or small rotary blade—comes into action. This component gently pushes soil over the seed to ensure it is properly covered. Some setups may also have a **soil compactor or roller** to press the soil lightly over the seed to maintain proper contact and protect it from external elements.
All of these processes are **powered by a 12V lead-acid battery**, and the system can operate continuously in small agricultural plots. Optionally, the machine may be enhanced with sensors to detect obstacles or monitor soil conditions, adding a level of automation and precision farming.
The combination of mobile control, synchronized mechanisms, and compact design makes this machine an effective solution for small to medium-scale farmers, significantly reducing manual labor, improving seed placement accuracy, and lowering overall costs.

7. Conclusion

The fabricated seed sowing machine offers a compact, affordable, and efficient solution for small-scale farmers. Its ability to perform multiple tasks with minimal human intervention can significantly reduce labor costs and increase productivity. Future improvements may include solar integration and automatic obstacle detection for smarter operation. The **Fabrication of an Automatic Seed Sowing Machine** marks a significant step toward modernizing traditional farming practices. By integrating mechanical components with electronic control systems, the machine efficiently performs essential agricultural tasks such as ploughing, seed dispensing, and soil covering—all in a single pass. Its compact and cost-effective design makes it particularly suitable for small and marginal farmers who often face challenges in accessing expensive or large-scale farming equipment.The Bluetooth-based mobile control ensures user-friendly operation, reducing the need for continuous human supervision and thereby lowering labor costs. Moreover, the system's modular nature allows for future scalability and enhancements, such as solar power integration for sustainable energy use and obstacle detection for autonomous navigation.
Overall, this project contributes to promoting smart and precision farming, with the potential to boost agricultural productivity while minimizing environmental impact and resource consumption. It serves as a promising solution for advancing rural agriculture through affordable automation.

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