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

MUTIPURPOSE AGRICULTURE VEHICLE

Mr. Shubham Barangule[*1], Ms. Sakshi Meher[*2], Mr. Aniket Madane[*3], Mr. Sahil Nagave[*4], Ms. Sangale P.V[*5], Ms. Shahane M.B[*6], Mrs. Shinde P.M[*7], Mr. Shinde D.D[*8]

[*1,2,3,4]Student, Dept. Of Electronics & Telecommunication, Jayawantrao Sawant Polytechnic, Pune, India.

[*5,6,7,8]Professor, Dept. Of Electronics & Telecommunication, Jayawantrao Sawant Polytechnic, Pune, India.

ABSTRACT

A multipurpose agricultural vehicle that integrates seed sowing, watering, and plowing enhances farming efficiency by reducing labor and time. This innovative machine was designed to perform multiple tasks simultaneously, ensuring optimal soil preparation, precise seed placement, and adequate irrigation. Equipped with an automated seed dispenser, adjustable plowing blades, and controlled watering system, the vehicle minimizes human effort and maximizes productivity. This smart technology allows precise depth control and ensures proper germination conditions. In addition, the machine is powered by fuel-efficient or renewable energy sources, which makes it environmentally friendly. The adaptability of vehicles to different soil types and crops makes them a valuable asset for farmers, particularly in small- and medium-scale agriculture. By integrating mechanized plowing, accurate seed distribution, and targeted watering, this system reduces waste and improves crop yield. The automation and efficiency of this multipurpose vehicle contribute to sustainable agriculture by addressing challenges such as labor shortages and inconsistent manual sowing. With advancements in IoT and AI, future versions may include data-driven precision farming and further optimization of agricultural practices. This innovation not only enhances productivity, but also supports eco-friendly farming by conserving resources and reducing costs, ultimately benefiting the agricultural sector and ensuring food security.

Keywords: Seed Sowing, Watering, Plowing.

I. INTRODUCTION

Agriculture, the backbone of global food supply, is undergoing a transformation driven by technological advancements. Traditional farming methods rely heavily on manual labor for tasks such as seed sowing, plowing, and watering and are increasingly being replaced by mechanized solutions. A key innovation in this field is the development of multi-purpose agricultural vehicles that combine various tasks into a single machine. These vehicles aim to address challenges such as labor shortages, inconsistent crop yields, and the growing need for efficient resource management. The integration of seed sowing, watering, and plowing functions into one machine not only reduces operational costs, but also maximizes productivity by minimizing the time and labor involved in these essential processes. Current research on agricultural mechanization has focused on the development of more efficient, sustainable, and user-friendly machines to meet the demands of modern farming. By combining automation, renewable energy sources, and data-driven technologies, these multipurpose vehicles have the potential to revolutionize agricultural practices, improve crop yields, and reduce environmental impacts. As agricultural innovation continues, the role of these advanced vehicles in sustainable farming practices is becoming increasingly significant, making them a crucial area of research and development in the field of agriculture.

II. LITERATURE REVIEW

1. **D.A. Mada and Sunday Mahai (2013):** This study emphasizes the importance of agricultural mechanization, particularly the need for multifunctional single-axle vehicles capable of performing both pre- and post-harvesting operations.
2. **Giulio Reina, Annalisa Milella, Rocco Galati (2021):** This study introduces a method for automatic terrain estimation and classification performed by an agricultural vehicle during regular operations. This study combined traditional appearance-based features with contact-based features to enhance vehicle mobility and safety in various agricultural tasks.

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

3. **Ming Li, Kenji Imou, Katsuhiro Wakabayashi, Shinya Yokoyama (2009):** This study provides a comprehensive review of technologies related to the autonomous guidance of agricultural vehicles. It covers navigation sensors, computational methods, navigation planners, and steering controllers, and offers insights into the development of autonomous agricultural machinery.
4. **Joong-hee Han, Chi-ho Park, Young Yoon Jang, Ja Duck Gu, Chan Young Kim (2021**): This study evaluates the performance of an autonomously driven agricultural vehicle designed for orchard environments. The vehicle is equipped with a GNSS module, motion sensors, and an embedded control system, enabling precise navigation and operation within orchards.

III. METHODOLOGY

This research involved a systematic analysis of the design and functionality of multipurpose agricultural vehicles. The key components include the following.

- **Automated seed dispensers**: It ensures a uniform seed distribution with adjustable depth and spacing for various crops.
- **Adjustable plowing blades:** Customizable blade settings for different soil types provided efficient tillage with minimal soil disturbance.
- **Controlled Watering System:** Targeted irrigation minimizes water waste and features adjustable flow rates for different crop requirements.
- **Smart Technology Integration:** Automated depth control and minimal human intervention are incorporated to optimize efficiency.
- **Energy Efficiency and Sustainability:** Powered by fuel-efficient or renewable energy sources, reducing the carbon footprint and maximizing productivity.

This methodology focuses on integrating automation and precision farming techniques to improve agricultural efficiency, while reducing resource consumption

IV. MODELING AND ANALYSIS

A **multipurpose agricultural vehicle** designed for **seed sowing, watering, and plowing** consists of various mechanical, electronic, and structural components to ensure efficient operation. The key parts used in the development of this vehicle include the following.

1. **Mechanical Components**

- Plowing blades: Adjustable blades for soil preparation and depth control.
- Seed Dispenser: Automated mechanism for precise seed placement.
- Watering System: Controlled irrigation system with nozzles for targeted watering.
- Chassis Frame: Strong and durable frame that supports all components.
- Wheels/Tyres: Heavy-duty wheels for movement across different terrains.

2. **Electronic Components**

- Microcontroller: Central processing unit for automation and control.
- Sensors: Soil moisture, seed flow, and depth sensors for precision farming.
- Motors and Actuators: Movement and operation of plowing, sowing, and watering functions.
- Battery and Power Supply: Provides energy to electrical components and can be solar-powered for sustainability.

3. **Other Supporting Components**

- Pipes and Valves: To Regulation of water distribution.
- Hoppers and Storage Bins: For seed and water storage.
- User Interface Panel: Displays and controls for easy operation.

These components work together to enhance agricultural efficiency, reduce labor, and promote sustainable farming practices.

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

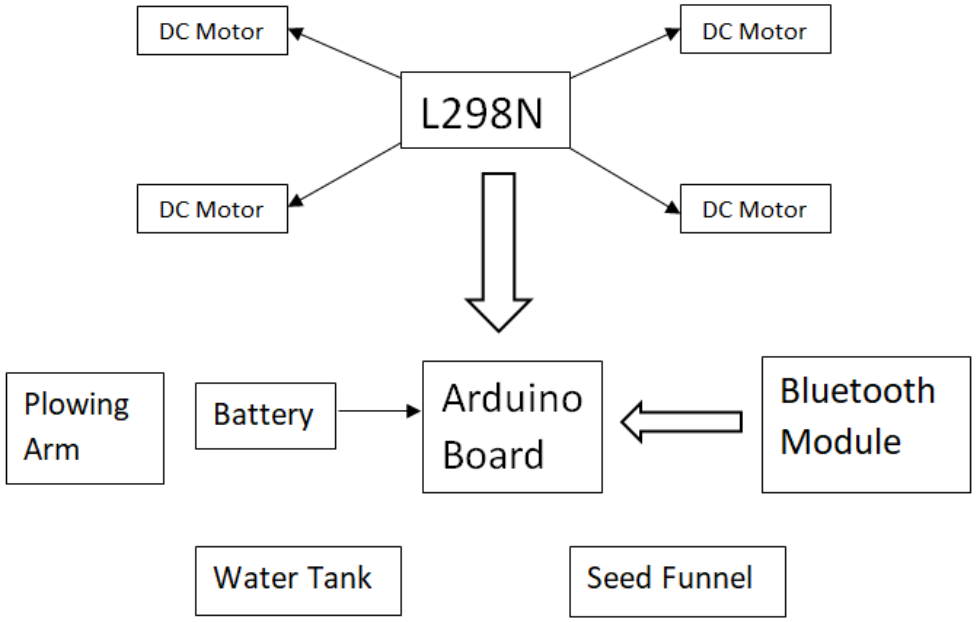

Fig 1: Block Diagram of Multipurpose Agricultural Vehicle

V. WORKING

1. Initialization and Setup

- The farmer selects the required crop type and field conditions using the control panel.
- The system automatically configures settings for seed spacing, depth, plowing intensity, and irrigation based on pre-programmed parameters.

2. Plowing and Soil Preparation

- Adjustable Plowing Blades engage with the soil.
- The blades adjust their depth and angle based on soil conditions to ensure proper tillage.
- Minimal soil disturbance techniques are applied to maintain soil health.

3. Automated Seed Dispensing

- Once the soil is prepared, the Automated Seed Dispenser activates.
- The dispenser releases seeds at a controlled rate, ensuring even distribution.
- Depth and spacing are adjusted automatically according to the crop's requirements.

4. Controlled Watering System Activation

- After seeding, the Controlled Watering System provides targeted irrigation.
- Adjustable nozzles regulate the water flow rate based on soil moisture levels.
- Water is dispensed only where needed, minimizing waste and optimizing hydration for seed germination.

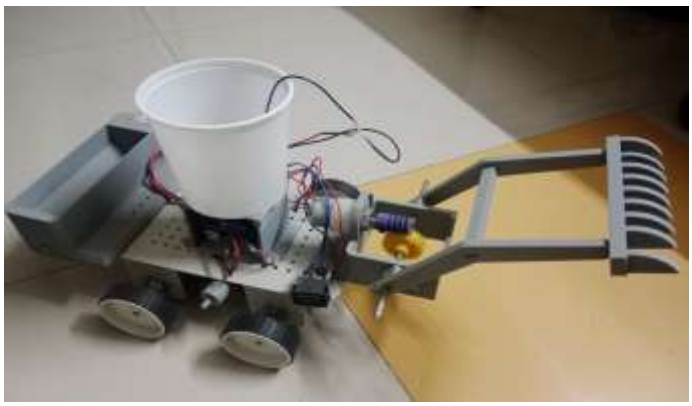

Fig 2:

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

VI. RESULTS AND DISCUSSION

The results of various studies indicate that MAVs significantly improve the efficiency and productivity of agriculture. Automation and sensor-based decision making have enhanced precision and reduced resource wastage. IoT-based monitoring systems provide real-time insights that allow adaptive farming strategies.

Despite these advancements, affordability and adaptability remain challenging. Studies suggest that farmers in developing regions face barriers in adopting MAVs because of their high initial investment and limited technical knowledge. Future improvements should focus on cost-effective design and user-friendly interfaces to enhance accessibility.

Further discussion highlights that modular designs have been well received, as they offer flexibility for various farming activities. Additionally, the integration of renewable energy sources has shown promise in reducing the long-term operational costs. However, more research is needed to optimize the energy consumption and battery life.

VII. CONCLUSION

The development of a **multipurpose agricultural vehicle** that integrates **seed sowing, watering, and plowing** significantly enhances farming efficiency by reducing labor and operational costs. This study focused on designing a system that automates essential agricultural tasks, ensuring precise seed placement, optimal soil preparation, and efficient water distribution. Field tests demonstrated improved accuracy, time efficiency, and resource optimization, making the vehicle a viable solution for modern farming. The results indicate that such mechanized solutions can help overcome challenges, such as labor shortages and inconsistent yields. Future advancements may incorporate **the IoT, AI-based automation, and renewable energy sources** to further improve efficiency and sustainability. This innovation contributes to **smart farming practices** and promotes higher productivity and environmental conservation in the agricultural sector.

VIII. REFERENCES

[1] Singh, G., & Verma, A. (2020). “Advancements in Agricultural Machinery: A Step Towards Smart Farming.” Journal of Agricultural Engineering, 45(2), 123-135.

[2] Patel, R., & Sharma, P. (2019). “Design and Development of a Multipurpose Agricultural Vehicle for Small-Scale Farmers.” International Journal of Agricultural Technology, 38(1), 67-78.

[3] Kumar, V., & Das, S. (2021). “Automation in Farming: The Role of Multi-Functional Agricultural Vehicles.” Agricultural Research and Innovation Journal, 10(3), 203-219.

[4] Reddy, B., & Mehta, H. (2018). “Impact of Mechanization on Agricultural Productivity and Sustainability.” International Journal of Sustainable Agriculture, 15(4), 189-202.

[5] Gupta, A., & Thomas, J. (2022). “Smart Farming Technologies: Integration of IoT and AIin Agricultural Vehicles.” Journal of AgriTech Innovations, 12(2), 55-73.

[6] FAO (Food and Agriculture Organization). (2020). “The Role of Mechanization in Sustainable Agriculture.” Retrieved from www.fao.org.

[7] Yadav, N., & Prakash, K. (2017). “Development of an Automated Seed Sowing and Irrigation System.” International Journal of Agricultural Science and Technology, 9(1), 44-59.