

# A Review of Sustainable Multi-Utility E-Farm vehicle

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**Abstract - This abstract presents the development of a multipurpose electric farm vehicle designed to address key challenges in Indian agriculture, including low mechanization, labour shortages, and high operational costs. The vehicle integrates multiple functions such as seed sowing, ploughing, and water sprinkling to enhance efficiency, reduce manual labour, and lower overall costs. The proposed solution uses electric power to minimize environmental impact and operational costs, offering an eco-friendly alternative to traditional fossil-fuel machinery. It aims to improve productivity for small-scale farmers, making advanced agricultural technology more accessible, sustainable, and cost-effective. This innovation also holds potential for future automation and further mechanization in farming practices. The multi-purpose agricultural vehicle is designed for small farmers in India, powered by solar energy. It performs tasks like seed sowing, water spraying, and ploughing, using a DC motor, and efficient gear mechanisms. The vehicle reduces labour, increases productivity, and is cost-effective for small-scale farming. A multipurpose agricultural vehicle has been designed to perform tasks like pesticide spraying, ploughing, and goods carrying.**

**Keywords - Seed sowing, Water spraying, Ploughing.**

## I. INTRODUCTION

India's agriculture faces challenges like small farm sizes, lack of mechanization, and financial constraints. A solar-powered multifunctional agricultural vehicle can address these issues by performing tasks like seed sowing, water sprinkling, ploughing, and fertilizer spraying. Powered by solar panels, it reduces reliance on fossil fuels, lowers environmental impact, and improves efficiency. This affordable, efficient solution is ideal for small-scale farms, helping farmers reduce labour and operational costs while promoting sustainable farming practices [1].

Agriculture is vital to India's economy, but many farmers still use traditional, labour-intensive methods due to high costs. Multipurpose agro machines, powered by solar energy, can perform tasks like seed sowing, fertilizer spreading, and pesticide spraying, reducing labour and increasing productivity. These machines are cost-effective, eco-friendly, and ideal for small to medium-scale farms,

helping modernize farming and improve efficiency while lowering operational costs [4].

A fertilizer spreading machine was designed to evenly distribute urea over crops using a dropper mechanism. It reduces time by 50% and labour costs by 80% compared to traditional hand-spreading, making fertilizer application more efficient and cost-effective for farmers [5].

1.1 Background: Agriculture plays a crucial role in India's economy, contributing 40% of the GDP and supporting 79% of the workforce. Its development is a top priority, driven by modern agricultural technologies [8]. India, despite having the 2nd largest workforce, faces challenges in farm labour. Greenhouse technology boosts yield and resource efficiency, addressing labour and productivity issues [9]. Weeding in India largely relies on labour-intensive hand-hoe methods, needing 20-30 workers. A proposed solution is a simple, battery-powered weeding tool with a motorized blade, benefiting small-scale farmers by reducing labour and effort [6]. Indian farming faces challenges like limited mechanization, small farm sizes, poor farmer

finances, high labour and time demands, and unorganized farmlands [2].

## II. LITERATURE REVIEW

This paper presents Indian agriculture struggle with low productivity due to limited mechanization. Multi-functional machines can improve efficiency, reduce costs, and increase productivity, benefiting small farmers. Supportive policies and subsidies are needed for widespread adoption.

This paper presents a solar-powered, multi-functional agricultural vehicle for small farmers, combining seed sowing, ploughing, and water spraying. It uses a 12V battery, DC motor, and gear mechanisms to improve efficiency, reduce costs, and increase productivity.

This paper presents a solar-powered, multipurpose agricultural robot that performs tasks like digging, levelling, and spraying. It uses battery and solar energy, with Bluetooth for user interaction, aiming to increase productivity and reduce labour compared to traditional machinery.

A multipurpose agricultural vehicle aims to improve farming efficiency, addressing the high costs and limited access to technology for small farmers, contributing to financial stress and rising suicide rates.

This paper presents a cost-effective fertilizer feeder machine design for efficient urea distribution, addressing wastage and crop-specific requirements for small farmers.

A compact, battery-powered machine for cutting two crop rows and weeding simultaneously reduces labour and time, offering a cost-effective solution for small-scale farmers.

The Universal Multipurpose Cultivator (MPC) is a cost-effective solution for small farms, performing seed sowing, ploughing, fertilizing, and cutting while optimizing yield and reducing labour.

This paper proposes affordable mechanization to replace traditional farming methods, addressing the challenges of small-scale Indian farmers with limited resources.

A pneumatic seed sowing machine improves productivity, reduces costs, and ensures efficient seed placement, addressing labour shortages in Indian agriculture.

The RAMseS project demonstrates a renewable energy-powered agricultural vehicle, cutting 23 tons of CO<sub>2</sub> annually and achieving cost parity with fossil-fuel systems under certain conditions.

This paper presents a Solar Electric Tractor, using solar panels, a lithium-ion battery, and a dual-motor system for efficient, sustainable farming tasks like ploughing and irrigation. Field tests confirm its performance, economic feasibility, and environmental benefits.

This study presents a Solar Powered Autonomous Agriculture Robot that autonomously performs tasks like crop monitoring, irrigation, and pest control, promoting sustainable farming while reducing environmental impact.

A low-cost agricultural utility vehicle was developed for Cameroon, using locally available materials. Powered by a 5-9kW engine, it carries 600kg and reaches 30km/h. A prototype was built and tested in 2011, promoting local manufacturing and employment.

The study proposes a sustainable AFGSC framework for e-commerce, optimizing costs and sustainability in first-mile pickups and last-mile deliveries using nature-inspired algorithms for practical solutions.

This paper evaluates small multipurpose farm vehicles via a nine-step test cycle, emphasizing rigorous testing for stability, traction, and performance in agriculture.

This work presents a Smart Electric Tractor prototype as a sustainable alternative to fossil-fuel vehicles. Key subsystems, including steering, braking, powertrain,

and chassis, focus on IoT integration and automation. Design calculations optimize the powertrain for efficient performance.

This IoT-based portable vehicle performs sowing, sprinkling, and spraying, using NImyRIO and LabVIEW for efficient, cost-effective farming.

The PUP, by Purdue and ACREST, is a versatile, sustainable agricultural vehicle hauling 900 kg, powering tools, and achieving 18–26 km/L fuel efficiency.

This project creates a modular, affordable vehicle for small-scale farmers, combining tools for efficient, eco-friendly farming with low maintenance and zero emissions

This research develops a compact, eco-friendly electric loader for greenhouses, offering high performance, low noise, and nearly zero emissions

### **Objectives**

The project aims to design a specialized farm vehicle for seed sowing, ploughing, and water sprinkling. It will feature a ploughing mechanism, a controlled seed release system, and a water sprinkling component to optimize seed germination, reducing manual labour and increasing efficiency [1].

The Multipurpose Farm Robot automates key farming tasks like digging, sowing, and backfilling, reducing human effort and increasing efficiency. It operates in sequence, is easy to control, reliable, durable, and cost-effective [3].

The multipurpose agricultural equipment performs tasks like sowing, weeding, ploughing, grass cutting, grinding, and spraying. It runs on an engine, is lightweight, compact, and easy to handle. By enabling simultaneous spraying and inter-cultivating, it helps reduce labour costs [4].

The design focuses on a low-cost, walk-behind, push-operated urea fertilizer dropper machine, making urea spreading efficient, uniform, and safe. It reduces farmers' efforts, protects them from

hazardous exposure, and ensures effective fertilization [5].

### **Problem Statement**

Traditional farming requires multiple machines and labour for tasks like sowing, spraying, and ploughing, leading to inefficiency, high costs, and time loss. This highlights the need for a combined machine that can perform all these tasks, improving operational efficiency, precision, and time management [1].

Automation in Indian agriculture addresses challenges like rising input costs, labour shortages, water scarcity, and crop monitoring. Robots are being developed to perform tasks like ploughing, seed sowing, levelling, and spraying autonomously, improving efficiency, precision, and reducing environmental impact. These robots can work continuously, helping farmers manage crops more effectively [3].

## **III. CONCLUSIONS**

In conclusion, the development of a multipurpose electric farm vehicle offers a promising solution to the challenges faced by small-scale farmers in India. By integrating key farming tasks such as seed sowing, ploughing, and water sprinkling into a single, energy-efficient machine, this innovation not only reduces labour costs and operational inefficiencies but also provides an environmentally sustainable alternative to traditional farming equipment. The vehicle's electric-powered design further enhances its accessibility, cost-effectiveness, and eco-friendliness. This technology has the potential to transform agricultural practices, boost productivity, and support sustainable farming in India, paving the way for more widespread adoption of modern agricultural technologies.

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