

## Study on Electric Tractor

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### ABSTRACT

The increasing demand for sustainable and environmentally friendly agricultural practices has led to the development of electric tractors as an alternative to traditional fossil fuel-powered tractors. This abstract provides an overview of electric tractors, highlighting their key features, benefits, and potential challenges. Electric tractors are agricultural vehicles that utilize electric motors as their primary source of propulsion, eliminating the need for internal combustion engines. These tractors rely on electricity stored in on board batteries or obtained through external charging infrastructure. The shift towards electric power offers several advantages, including reduced greenhouse gas emissions, lower operating costs, and improved energy efficiency.

**Keywords:** electric motor, batteries, controller

## I. INTRODUCTION

The electric tractor is a revolutionary vehicle that brings the benefits of electrification to the agricultural industry. Electric tractors are powered by electric motors instead of internal combustion engines. These motors are typically driven by rechargeable batteries, which store electrical energy and provide power to drive the tractor's wheels or operate attached implements. The use of electric motors eliminates the need for fossil fuels, resulting in zero emissions during operation. One of the key advantages of electric tractors is their reduced environmental impact. By eliminating the combustion of fossil fuels, they help reduce greenhouse gas emissions, air pollution, and noise pollution on farms. This not only improves the working conditions for farmers but also contributes to the overall sustainability of agricultural practices.

## II. WORKING

An electric tractor is a type of agricultural vehicle that operates using electric power instead of traditional fossil fuel-powered engines. It combines the benefits of electric vehicles, such as reduced emissions and noise, with the capabilities required for agricultural work. The working of an electric tractor involves several key components and processes, which I'll explain below:

- Electric Motor:** The motor converts electrical energy from the tractor's battery pack into mechanical energy to drive the wheels and perform various tasks.
- Battery Pack:** Electric tractors use a large battery pack to store and supply the required electrical energy to the motor. These battery packs are usually high-capacity lithium-ion batteries or similar technologies, capable of storing sufficient energy to operate the tractor for extended periods.
- Control System:** Electric tractors employ a control system to manage power distribution, motor speed, and other operational parameters. This system uses electronic controllers and sensors to optimize energy efficiency and control the tractor's performance.

The working principle of an electric tractor involves the operator controlling the tractor's movements and operations using the control system. When the operator engages the motor, the electrical energy from the battery pack is supplied to the motor, which converts it into mechanical energy. This energy is transmitted to the wheels or tracks, allowing the tractor to move and perform tasks such as plowing, tilling, or towing.

### III. MAIN COMPONENTS LIST

- a) Electric Motor
- b) batteries
- c) Controller
- d) Foot Throttle
- e) Control and Instrumentation
- f) Steering System
- g) Drive Train
- h) Frame and Chassis

#### a. Electric Motor

An electric motor in a tractor is a device which converts electrical energy into mechanical energy to power the tractor's movement and various functions. It serves as the primary source of propulsion and is responsible for driving the wheels or tracks, as well as operating other attachments or implements. DC Brushless motor is used in it. The electrical system used in Indian versions is 48V, 72V and 96V. The induction motor may also be used if higher capacity is required.

#### b. Batteries

Electric tractors use batteries as their primary source of energy to power their electric motors. These batteries store electrical energy and provide it to the tractor's motor, which drives the wheels. The batteries used in electric tractors are typically large and high-capacity to ensure sufficient power and range for agricultural applications. Lead acid battery are used which is 12volt, 70Ah, 4nos.

We also use lithium-ion battery of 48volt, 30Ah, 2 nos. which may be better performance.

#### c. Controller

The controller of an electric tractor is a key component that manages and regulates the flow of electrical power to various systems and components of the tractor. It is a Battery management system of the electric tractor.

The main function of the controller is to receive inputs from the throttle and send commands to the tractor's electric motor which control the speed of motor according to input.

#### d. Foot Throttle

A foot throttle is a device used in vehicles, typically automobiles, to control the speed of the vehicle's engine. It is usually located on the floor of the driver's side, positioned to be operated with the foot.

The foot throttle is connected to the control system, which regulates the amount of energy entering the motor, thus determining the power output of motor and speed. By pressing down on the foot throttle pedal, the driver increases the engine's throttle opening, allowing more energy to enter the motor. This increases the engine's power and accelerates the vehicle.

#### e. Control and Instrumentation

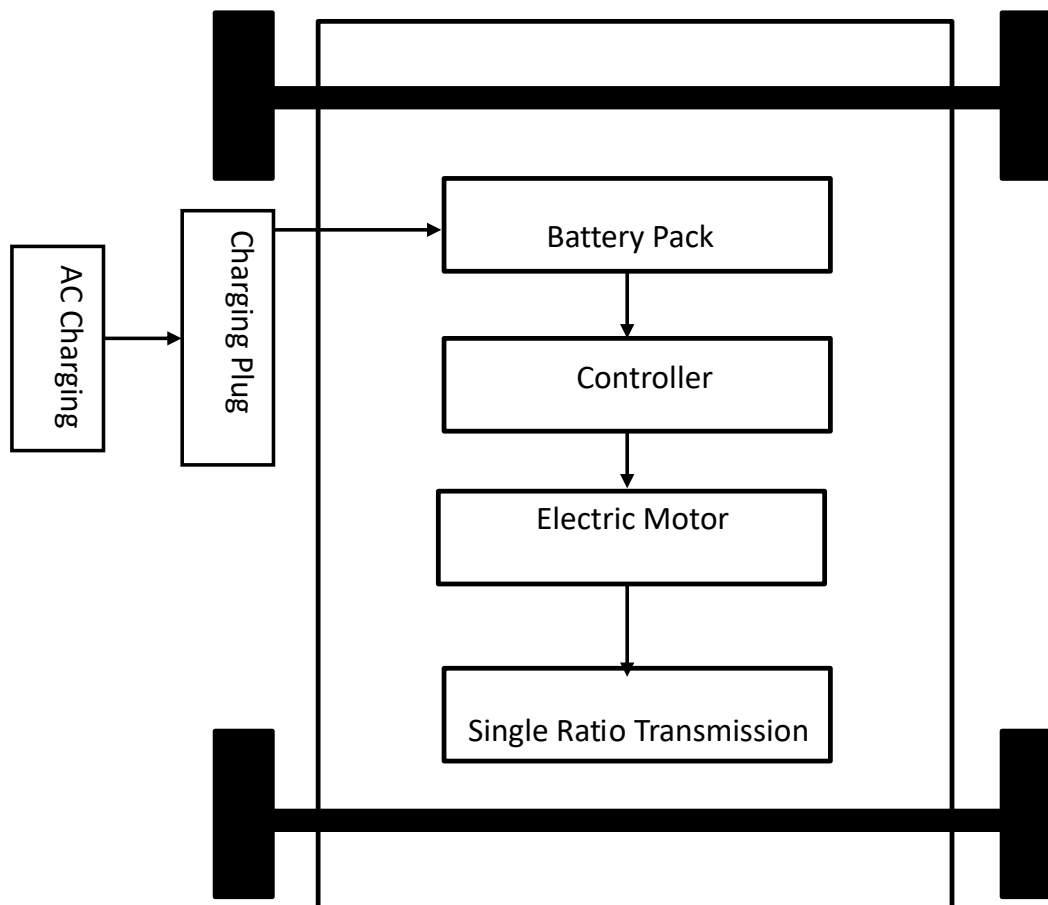
**Regenerative Braking System:** In an electric tractor, the moment the vehicle stop accelerating, the powertrain automatically engages a regenerative braking system to cover the loss of energy due to deceleration to transfer the energy back to the motor which now acts as the generator to recharge the battery.

#### f. Steering System

The steering system is worm gear or screw gear, and rack and pinion or steering box intended to convert the rotation of the steering wheel into a movement of the road wheels. The steering system also provides a driver to use light force to steer a heavy System. The steering effort transmits to the wheels through a system of pivoted joints.

Pivoted joints are allowing the wheels to move up and down with the suspension without changing the steering angle. Pivoted joints adjusting must be very precisely, because even a little looseness can be a reason of a dangerous situation on the road.

#### g. Drive Train



#### h. Frame and Chassis

Chassis frame is the basic frame work of the automobile. It supports all the parts of the automobile attached to it. It is made of drop forged steel. All the parts related to automobiles are attached to it only. All the systems related to automobile like power plant, transmission, steering, suspension, braking system etc. are attached to and supported by it only.

### IV. ADVANTAGES

- Environmental benefits
- Energy efficiency
- Reduced operating costs
- Noise reductions
- Versatility and performance
- Renewable energy integration
- Regulatory incentives

### V. APPLICATION

- Agriculture
- Horticulture
- Livestock farming
- Landscaping and gardening
- Golf courses
- Municipal services
- Industrial applications

## **VI. FUTURE SCOPE**

- a) Environmental Benefits
- b) Government Support and Regulations
- c) Advances in Battery Technology
- d) Cost Efficiency
- e) Increasing Farming Automation
- f) Noise Reduction
- g) Diversification of Energy Sources

## **VII. CONCLUSION**

The conclusion of an electric tractor project would depend on the specific goals, objectives, and outcomes of the project. However, here is a general outline of possible conclusions that could be drawn from an electric tractor project:

- a) Feasibility
- b) Environmental Impact
- c) Economic Viability
- d) Performance and Adaptability
- e) Infrastructure Requirements
- f) Future Directions

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