

BATTERY OPERATED ELECTRIC POWER WEEDER MACHINE

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ABSTRACT

Agriculture is the backbone of the Indian economy, and weed control is an important task in crop production. Traditional manual weeding methods require high labor effort, consume more time, and increase operational cost. To overcome these challenges, an Electric Power Weeder is designed and developed to improve efficiency and reduce human effort.

The proposed system uses a 24 V battery-powered PMDC motor to drive the weeding blades. Electrical energy stored in the battery is converted into mechanical energy to rotate the blades, which remove weeds from the soil effectively. The machine includes components such as a motor controller, battery, frame and chassis, forward–reverse switch, safety protection, and weeding blades.

Key Words

Battery Powered Agriculture Machine
Weed Control Technology
Sustainable Farming
Semi-Automated Agricultural Equipment

1.INTRODUCTION

Agriculture is one of the most important sectors for economic development, especially in countries like India where a large portion of the population depends on farming for their livelihood. Increasing agricultural productivity is necessary to meet the growing food demand. However, farmers face several challenges during crop cultivation, and one of the major problems is weed growth in agricultural fields. Weeds compete with crops for nutrients, sunlight, water, and space, which significantly reduces crop yield and quality. Traditionally, farmers remove weeds manually using simple tools such as hoes and hand weeders. Although this method is effective, it requires significant physical effort and consumes a large amount of time. Manual weeding also requires a large number of laborers, which increases the overall farming cost. In many rural areas, the availability of agricultural labor is decreasing, making manual weed removal difficult for farmers.

To reduce labor dependency, farmers have started using mechanical weeders powered by petrol or diesel engines. These machines improve efficiency and reduce the time required for weed removal. However, fuel-powered machines have several disadvantages such as high fuel cost, environmental pollution, noise, and regular maintenance requirements. These problems create the need for a more eco-friendly, economical, and efficient solution.

The Electric Power Weeder is developed to overcome these limitations by using electrical energy instead of fossil fuels. This machine uses a 24 V rechargeable battery and a PMDC

(Permanent Magnet Direct Current) motor to operate the weeding mechanism. The motor converts electrical energy into mechanical energy, which rotates the weeding blades to remove weeds from the soil effectively.

The system is designed to be simple, efficient, and easy to operate. The main components of the Electric Power Weeder include a battery, PMDC motor, motor controller, forward-reverse switch, frame and chassis, weeding blades, electrical wiring, and safety protection devices. The battery acts as the main power source, while the motor controller regulates the speed and direction of the motor.

Electric agricultural machines provide several advantages compared to traditional machines. They produce zero emissions, have low operational cost, and require less maintenance. The Electric Power Weeder also reduces the physical effort required by farmers and allows faster weed removal in crop fields.

The machine is particularly suitable for small and medium-scale farmers who require affordable agricultural equipment. It can be used in vegetable farms, row crops, and small agricultural fields where efficient weed control is necessary. The use of electric power in agricultural machines also promotes the concept of sustainable and smart farming. Important Main Points (IMO) Reduces manual labor

effort in weed removal.

Uses 24 V battery and PMDC motor for operation.

Provides eco-friendly solution with zero fuel emissions.

Low operating and maintenance cost compared to petrol weeders.

Improves efficiency and speed of weeding process.

Suitable for small and medium farmers.

Promotes semi-automation in agriculture.

Helps increase crop productivity and farm efficiency.

Helps achieve net-zero emission power systems.

Improves energy security and reduces fuel imports.

Methodology / Working Principle

The Electric Power Weeder is designed to remove weeds from agricultural fields using electrical energy instead of conventional fuel-based systems. The methodology of the system involves converting electrical energy stored in a rechargeable battery into mechanical energy to drive the

weeding blades. The machine is developed using simple mechanical and electrical components to ensure easy operation, efficiency, and low maintenance.

System Design

The Electric Power Weeder consists of several main components such as a rechargeable battery, PMDC motor, motor controller, forward–reverse switch, electrical wiring, frame and chassis, and weeding blades. These components are integrated to form a compact and efficient weeding machine. The battery acts as the primary energy source, supplying electrical power to the motor through a control circuit.

Power Supply System

A 24 V rechargeable battery is used as the main power source for the machine. The battery stores electrical energy and supplies power to the PMDC motor through the motor controller. The use of a rechargeable battery makes the system portable and suitable for agricultural fields where direct electrical supply may not be available.

Motor and Drive Mechanism

The Electric Power Weeder uses a Permanent Magnet Direct Current (PMDC) motor to generate mechanical motion. When electrical power from the battery is supplied to the motor, the motor shaft rotates at a specific speed. The rotating shaft is connected to the weeding blades either directly or through a gear reduction mechanism. The gear ratio helps increase torque and reduce speed to achieve effective weed removal.

Control System

The system includes a motor controller and a forward–reverse switch to control the operation of the machine. The motor controller regulates the voltage and current supplied to the motor, ensuring smooth and safe operation. The forward–reverse switch allows the operator to change the direction of motor rotation, which helps in maneuvering the machine easily in agricultural fields.

Weeding Mechanism

The rotating shaft of the motor drives the weeding blades mounted at the bottom of the machine. These blades penetrate the top layer of soil and uproot weeds growing between crop rows. The rotating motion of the blades loosens the soil and removes unwanted plants without damaging the main crops.

Frame and Structure

The machine is supported by a strong frame and chassis that holds all the components such as the motor, battery, and blades. The frame is designed to maintain stability during operation and to withstand the mechanical forces generated by the rotating blades.

Safety and Protection

Electrical safety is provided using components such as fuse or MCB, proper wiring, and an ON– OFF switch. These components protect the system from electrical faults such as overcurrent and short circuits. The operator can easily start or stop the machine using the main power switch.

Working Process

The working process of the Electric Power Weeder can be explained in the following steps:

The battery supplies electrical energy to the motor controller. The motor controller regulates power and sends it to the PMDC motor.

The PMDC motor converts electrical energy into mechanical rotational motion.

The rotating motor shaft drives the weeding blades through direct coupling or gear mechanism.

The blades rotate and cut or uproot weeds from the soil while the operator moves the machine along the crop rows.

Advantages of the Methodology

Simple design and easy operation

Reduced human effort compared to manual weeding

Low operating cost due to electric power

Environmentally friendly with no fuel emissions

Suitable for small and medium agricultural fields

Results

The Electric Power Weeder was developed and tested to evaluate its performance in removing weeds from agricultural fields. The system uses a 24 V rechargeable battery and a 250 W PMDC motor to operate the weeding blades. During the testing process, the machine demonstrated effective weed removal with reduced human effort and improved operational efficiency.

The rotating blades successfully uprooted weeds from the top layer of soil without damaging the surrounding crops. The machine operated smoothly with stable motor performance and minimal vibration. The electric motor provided sufficient torque to rotate the blades and penetrate the soil surface.

The battery-powered system enabled the machine to work continuously for a considerable period depending on the battery capacity. The Electric Power Weeder also showed good mobility in small agricultural fields and row crops. The use of electrical energy eliminated the need for fuel, making the machine more economical and environmentally friendly.

The experimental results indicate that the Electric Power Weeder can effectively reduce the time required for weed removal compared to manual methods. It also minimizes physical strain on farmers and improves overall productivity in agricultural operations.

Advantages

The Electric Power Weeder offers several advantages compared to traditional manual weeding methods and fuel-powered weeders.

1. Reduced Labor Effort

The machine significantly reduces the physical effort required for weed removal. Farmers can operate the weeder easily without excessive manual labor.

2. Time Saving

The rotating blades remove weeds quickly, which reduces the total time required for field maintenance.

3. Eco-Friendly Operation

Since the machine uses electrical energy instead of petrol or diesel, it produces zero harmful emissions and reduces environmental pollution.

4. Low Operating Cost

The operating cost of the Electric Power Weeder is lower compared to fuel-powered machines because electricity is cheaper than fossil fuels.

5. Low Noise and Vibration

Electric motors operate more quietly than internal combustion engines, which improves the working environment for farmers.

6. Simple Design and Maintenance

The machine has fewer moving parts and a simple electrical system, which reduces maintenance requirements.

7. Suitable for Small Farmers

The Electric Power Weeder is particularly suitable for small and medium-scale farmers due to its affordability and ease of operation.

8. Promotes Sustainable Agriculture

By using electric power, the machine supports the concept of sustainable and eco-friendly farming practices.



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