

DESIGN AND FABRICATION OF SOLAR ENERGY BASED MULTIPURPOSE AGRICULTURAL VEHICLE

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Abstract :- Agriculture is one of the major occupations in India and plays a vital role in the Indian economy. Over the past few decades, Indian agriculture has witnessed impressive growth. However, despite numerous innovations in this field, many of these ideas are not being effectively implemented on the ground. This is often due to the high costs involved and the complexity of these solutions for rural farmers. To address these challenges, we propose replacing human and animal efforts with advanced mechanical solutions that are economically viable and easy to operate for small-scale farmers. In response to this need, we are developing a solar-powered multipurpose agricultural machine designed to perform key functions such as weeding, seed sowing, and pesticide spraying. This innovation aims to reduce labor dependency and increase efficiency in farming practices.

Key Words :-Agricultural, solar, growth, farming, Arduino:

1. INTRODUCTION

Agriculture is the backbone of India. The history of farming in our country goes back to the time of the Indus Valley Civilization and even earlier in parts of South India. Today, India is the second-largest producer of farm goods in the world. Special vehicles are used in many fields like industry, medicine, and the military. Now, these special vehicles are also being used more in the field of agriculture. In India, farmers face many problems like increasing input costs, lack of skilled labour, shortage of water, and difficulty in monitoring crops. To solve these problems, **automation technology** is being introduced in farming. Automation can help farmers by reducing the effort needed to do farming activities. Machines and vehicles are being developed to do jobs like **weeding, seed sowing, land levelling, and water spraying**. But so far, there is no single vehicle that can do all of these jobs together. That's why we are working on developing a robotic vehicle that can do all these farming tasks automatically and efficiently. This will make farming easier and reduce the need for manual work

1.1 KEY FEATURES

Agricultural vehicle have many useful features. They can do farming work faster and more accurately than people. They

can also work in tough weather or dangerous places where it's hard for humans to go. These robots help save money, increase crop production, and reduce wastage of seeds, water, and other resources.

1.2 Objective

- To reduce the hard work of farmers by using a small machine in farming.
- To do four farming tasks at the same time, which helps save time and increase crop production.
- To finish more work in less time, making the farming process faster and easier.
- To use solar energy for charging the battery, as the machine works in the sunlight while moving through the field.

1.3 Solar power

Every day, the sun gives us a huge amount of energy called solar energy. In fact, the sun gives off more energy in one day than the whole world uses in a year. This energy comes from deep inside the sun through a process called nuclear fusion, where hydrogen turns into helium and produces heat and light. It takes just over eight minutes for sunlight to travel the 93 million miles from the sun to Earth. Solar energy travels very fast—at the speed of light (about 3 lakh kilometres per second). Even though only a small part of the sun's energy reaches Earth, it is still more than enough to meet all our energy needs. Because sunlight comes every day and doesn't run out, solar energy is called a renewable energy source. Today, people use it to heat water, warm homes, and make electricity. However, even though solar energy has many benefits, it currently makes up less than one percent of the total energy used in some countries like the U.S. Most solar energy is used in homes and to generate power for electricity.

2. APPLICATION AREA

- I. Suitable for small and medium-sized farms, making it affordable and easy to use.

- II. Can be used for different types of crops, so farmers don't need different machines for each crop.



Fig -1: Farming

3. PREVIOUS WORK

Research on Multipurpose Solar Agriculture Vehicles (MSAV) is still a new area, but in recent years, some researchers have made progress by creating different models and testing ideas. This research is growing because there is a big need for eco-friendly and renewable energy solutions in farming. Below are some important works and contributions made by experts in this field.

1) Gaurav Kumar et al. (2020)

Title: *Design and Development of Solar Powered Multipurpose Agricultural Vehicle*

Summary: This study talks about a solar-powered farming vehicle that can do different jobs like ploughing, seed sowing, and spraying. It uses solar panels and batteries to keep working without needing fuel, offering a clean and green alternative to diesel tractors.

Published in: *International Journal of Scientific Research and Engineering Development (IJSRED)*

2) Deepak Khapre et al. (2020)

Title: *Design of Multipurpose Solar Operated Agricultural Vehicle*

Summary: This research shows a solar-based machine made for small-scale farming tasks such as tilling, sowing, and carrying loads. The main goal is to help farmers save fuel and lower working costs

Published in: *International Research Journal of Engineering and Technology (IRJET)*

3) Chandrakant Kamble et al. (2019)

Title: *Development of Solar Powered Multipurpose Agricultural Vehicle*

Summary: This project is about building a solar-powered farming machine that can do multiple jobs like **seed sowing,**

pumping water, and spraying pesticides. It focuses on using solar energy to save electricity and reduce pollution in farming.

4. PROPOSED WORK

Agriculture is the backbone of many countries, especially in developing areas. But farmers face big problems like high fuel prices, damage to the environment, and a shortage of workers. Most farming today still depends on diesel-powered machines to do important work like plowing, planting seeds, weeding, spraying pesticides, and harvesting. Using diesel not only increases costs but also causes air pollution and adds to climate change. As the world's population grows and the need for food increases, it's important to find better, cheaper, and more eco-friendly ways to farm. One of the best solutions is using solar energy. Solar power is clean, renewable, and can lower the cost of running machines while protecting the environment. That's where the idea of a Multipurpose Solar Agriculture Vehicle (MSAV) comes in. This type of machine runs on solar power and can do many jobs like plowing, sowing seeds, watering crops, and carrying goods—all with one machine. This helps small and medium farmers save money, because they don't have to buy separate machines for each job. The machine uses solar panels (PV panels) to turn sunlight into electricity, which powers the vehicle and its tools.

5.METHODOLOGY

1) Identifying the Problem & Setting the Goal

- First, we decide which farming jobs the machine should do—like sowing seeds, removing weeds, harvesting, checking for plant diseases, watering crops, or monitoring plant health.
- Then we look at the main problems farmers face, such as lack of labour, slow work, or overuse of chemicals.

2) Designing and Building the Machine

- We choose or build a base for the robot—this could be a machine with wheels, tracks, or even a drone.
- Next, we make the mechanical parts the robot needs, such as:

3) Control System and Programming

- We use microcontrollers like **Arduino** or **ESP32**, or computers like **Raspberry Pi** or **Jetson Nano**, to control the machine.

6.EXPERIMENTEL SETUP

- **Chassis:** The body or base of the machine, built with 4 wheels or tracks so it can move easily in fields.

- **Power Source:** The machine runs using a battery or solar energy, making it suitable for places without electricity.
- **Drive System:** It uses DC or BLDC motors to move, along with motor drivers that control the speed and direction
- **Controller:** We use a microcontroller like Arduino or ESP32, or a small computer like Raspberry Pi or Jetson Nano, to control all the parts of the robot.
- **Seed Sowing Unit:** A motor-based seed dispenser is used to plant seeds at the right distance and depth.
- **Sprayer System:** Used to spray fertilizers or pesticides evenly over the crops.
- **Water Pump and Nozzle:** Helps in watering crops by spraying water where needed.
- **Battery :** We use Lithium-ion or Lead-acid batteries (usually 12V to 24V) to store power.
- **Solar Panels:** Solar panels convert sunlight into electricity using photovoltaic (PV) cells, typically made of silicon and used for battery charging
- **Power Distribution Board:** This board shares power properly to all parts—motors, sensors, and controllers.

Since both the freewheel and sprocket are on the same shaft, they rotate together. This causes the connected sprocket (meshed externally) to rotate in the opposite (clockwise) direction. As a result, the main disc starts rotating. A link is attached to the disc, and this movement is passed to the seed sowing mechanism. As the disc turns, it moves the link, which helps to release seeds from the hopper onto the soil. This process continues as the machine moves forward, allowing seeds to be sown evenly. Additionally, a weeder is attached beneath the frame, in the middle of the machine. It helps to remove weeds from the soil while sowing is taking place. The weeding and sowing mechanisms work together, making the machine efficient and time-saving

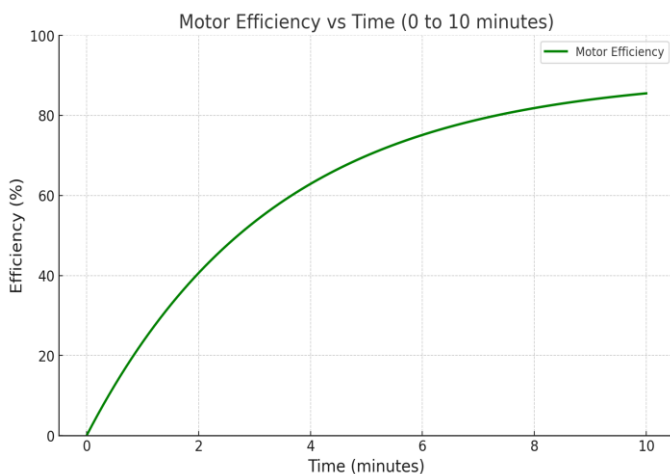


Fig.-2 GRAPH

7. WORKING

This machine works using motor power and a chain-sprocket system to transfer motion. The operator controls the machine from behind, using a toggle switch to move it forward. As the trolley moves, the wheels rotate in the counterclockwise direction. A sprocket attached to the wheel shaft also rotates in the same direction. This motion is passed to a freewheel through a chain drive.



Fig-3: MULTIPURPOSE AGRICULTURAL VEHICLE

7.BILL OF MATERIAL

Component	Description	Unit
Frame	Steel or aluminium frame for supporting the structure	
Wheel	Rubber or pneumatic wheels for agricultural terrain	4
Battery	12V or 24V Li-ion rechargeable battery	1
DC Water Pump	Mini DC water pump for irrigation or pesticide spraying	1
Grass cutter	Cutting the grass	1
Wiring and Connectors	Jumper wires, terminals, connectors, etc.	1 set

Drive Motor	High-torque DC gear motor for driving wheels	2
Solar Panel	12V solar panel for battery charging	1
Microcontroller	Arduino Uno to control the vehicle	1
Power Switch	Toggle switch or relay to control main power	1
Wireless Module	HC-05 Bluetooth remote control	2

8.Future Scope

In future, if we increase the strength and quality of this equipment, it can be used for a lifetime as a multipurpose farming machine. By adding things like hydraulic systems, gear mechanisms, and making a few small changes, we can even convert this setup to be operated using a tractor.

9.CONCLUSION

After the manufacturing and testing of the *Multipurpose Agricultural Machine*, the following conclusions were drawn:

- The machine performs well and is especially useful for small-scale farmers who cannot afford expensive agricultural equipment.
- It reduces both manpower and time compared to traditional farming methods. With mass production, the cost of the machine can be further reduced, making it more affordable.
- This machine can help solve the current labour shortage in Indian farming and support the push for more efficient agricultural practices.

10. REFERENCES

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