

# Fabrication of Solar Powered Mini Electric Tiller

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Date of Submission: 10-08-2024

Date of Acceptance: 20-08-2024

**ABSTRACT**—Agriculture has been an integral part of the human ecosystem. However, traditional farming methods require a lot of human effort and take a long time. Tilling is one of the most labor-intensive operations in agriculture. Manually tiling fields is a very tiring task, while tractors involve a high investment along with high fuel consumption costs. This low-cost battery powered portable electric cultivator is a modern all-round solution to improve conventional farming methods, as it reduces human effort, at very little cost, by using a motorized tillage mechanism. The electric cultivator helps reduce processing time and costs by using a smart portable design, increasing productivity and efficiency in agriculture. The machine uses a wheel with welded corners to provide an efficient grip on the ground. The wheel design was developed to provide a firm grip on the ground strong enough to drag the cultivator forks during the tillage process. A switch provided on the handle is used to turn off the machine. The machine is powered by an electric motor which uses a toothed chain to drive the drive wheel. A battery runs the motor in such a way that it pulls the forks from the ground. The 3 forks of the cultivator allow for smooth working exactly as needed for agriculture. Lightweight and portable design makes it easy to control the direction of the machine during use. It can also be easily transported by vehicle or by hand for the transport of machines. Thus, the electric tiller provides a smart and innovative fuel-free mechanism for tilling farmland and gardens.

**Keywords**— Electric Tiller Machine, Motor, Frame Design, Wheels, Bearings, Battery's, Dynamo.

## I. INTRODUCTION

The human ecosystem has always included agriculture. Traditional farming techniques however demand a lot of labour and take a long time. One of the most labour-intensive agricultural practises is farm tilling. Field tiling by

hand is an extremely taxing task, and using tractors requires a significant upfront investment and hefty fuel expenses. It is an agricultural machine that is mostly used for land development. As it can turn around and cut soil while doing so, it functions adequately. In terms of maintenance, it is more cost-effective, wise to use, and also requires less room. Power Tiller can play out the activities of various agricultural implements like a rotator, harrow, and harvester. A two-wheeled horticulture cart with rotating turners that provides smooth protection from all farm activities is called a power tiller. In actuality, it offers a variety of uses and advantages. Power tillers aid in preparing the soil, sowing seeds, and planting crops. This low-cost battery-operated mini electric power tiller machine is a one-stop modern solution to enhance the conventional agriculture methods of farming as it reduces human effort at a very negligible price using motorized tilling mechanisms. The electric power tiller helps reduce the time and cost involved in tilling using a smart, portable design, thereby increasing productivity and efficiency in agriculture. The power tiller is exceptionally simple to utilize. It merely needs to be tweaked, and it drives accordingly. It made the collection of every type of yield possible. With a clever, adaptable design, the electric power tiller reduces the time and expense involved in tilling, increasing its usefulness and efficiency in farming. All things considered the Mini Electric Power Tiller is a conspicuous venture. Due to the decreased appropriation, it benefits the farmers by generating cash. Agriculture is India's economic backbone. As a growing country, agriculture and businesses based on agricultural products play a critical role in the Indian economy. Agriculture and agriculture-based industries and enterprises support the majority of India's population. One of the many farm mechanisation tools is the soil tiller and weed eater. In comparison to tractors, soil tillers and weeds are non-traditional in terms of labour displacement. In boosting soil tillerand weeds,

particularly given that the majority of farmers have limited plots of land. As a result, they can't afford more expensive tractors. Therefore, the soil tiller and weed should become useful machine in the internal cleaning of crops and digging of soil which having small distance between them like groundnuts, sugarcane, soya bin crops, cultivation of paddy, in particularly, and other crops in general for the smaller farmers. Energy is one of the most important needs for human survival on earth. We are dependent on one form of energy or the other for fulfilling our needs. One such form of energy is the energy from fossil fuels. We use energy from these sources for generating electricity, running automobiles etc. But the main disadvantages of these fossil fuels are that they are not environmental friendly and they are harmful. We need to look at non-conventional energy sources to tackle these concerns with fossil fuels. In order to implement this concept, we created a solar-powered electrical tiller. The vehicle is meant to have two-wheel drive and may be utilised for shuttle service as well as short distance travel. All industries, including agriculture, are seeing fast expansion in the modern period. Farmers must apply innovative practises that do not alter soil texture while increasing total crop productivity in order to fulfil future food demands. Its main purpose is to reduce the number of employees, which is tough to come by in today's market, as well as to reduce working hours. Because it has the potential to be far superior to traditional land cultivation methods that rely on labour or a bull. Lack of mechanisation or automation is one of the most significant impediments to boosting agricultural productivity. Soil cultivation is one of the most time-consuming tasks in the garden, but it is also one of the most useful. Soil cultivation enhances the structure of the soil by reducing soil compaction and increasing aeration. This increases the amount of oxygen accessible to plant roots while also improving water drainage. It also allows plant roots to act more freely and reach deeper into the soil. A graduate student concerned in environmental issues, ageing society, agricultural business, and design and manufacturing proposed the electric tiller. Year after year, the number of individuals working in agriculture fell, but the number of older people climbed. Despite the fact that labour saving machines such as tractors and tillers have been used to replace traditional agricultural tasks, human effort is still required.

**OBJECTIVES :**

- To employ other renewable energy sources in place of using non-renewable energy source.
- To may decrease the investment on fuel, and its price.
- To make farming more effective and easier.
- To facilitate the growth of agribusiness in the state for farmer, social, corporate & environmental good.
- To Facilitate Transformation of traditional farming system in to a commercial and technology.

A power tiller is an agricultural machine used for preparation of soil, weeding, sowing which contains a set of rotating blades mounted wheel type housing and it is powered by IC engine or electric motor. Through literature review and also the practical applications, came across several advancements and different design types in the field of power tiller. Below we have discussed a few types of power tillers.

**ELECTRIC POWER TILLER BENEFITS :**

1. Manual Operation
2. Battery Powered No Fuel Needed
3. Versatile and simple to work
4. Decreases Tilling time .

**SOME MAIN COMPONENTS OF SOLAR TILLER:**

- **SQUARE TUBE:**  
 Rectangular and square HSS are also commonly called tube steel or box section. Circular HSS are sometimes mistakenly called steel pipe, although true steel pipe is actually dimensioned and classed differently from HSS. Square tubes are generally used for maintenance and structural purposes. Some examples of applications would be building construction, railings, and signposts. They are measured by their outside dimensions and their wall thickness. Square Steel Tube is a welded structural grade tubing that is available in either type A513 or A500 Grade B, depending on its size and wall thickness. Either grade is ideal for all structural applications, general fabrication, manufacturing and repairs.
- **16MM ROD:**  
**16 mm film** is a historically popular and economical gauge of film. 16 mm refers to the width of the film (about 2/3 inch); other common film gauges include 8 mm and 35 mm.
- **BATTERY:**  
 This is a device which stores electrical energy, it stores the 12-volt DC current and used in power transmission.

**SPECIFICATION OF BATTERY:**

Table 1 Specifications of Battery

Voltage	12VX2 =24V
Type	SEALED LEAD-ACID BATTERY
Ampere	7Ah

Windshield wipers are powered by a small electric motor, usually mounted on the firewall or under the cowl (the area under the windshield's base). The motor activates linkage that moves the wiper arms back and forth. Wiper motors rotate in a continuous motion (not back-and-

forth like you would naturally think based on the actions of your windshield wipers) and run on DC voltage. Since they run on DC, the motors can be sped up and slowed down based on the voltage level applied to them, and the direction can be reversed by reversing the power leads.

• **WIPER MOTOR:**

**SPECIFICATION OF WIPER MOTOR:**

Table 2 Specification of Wiper Motor

Voltage	24V
Test Voltage	27V 30Nm
Brake Torque	30Nm
Working Torque	8Nm
Noise	<55dB(A)
Speed Low	28 +/- 3RPM
Speed High	45 +/- 5RPM
Amp Draw	<4A

• **SOLAR PANEL:**

A solar cell panel, solar electric panel, photo-voltaic (PV) module or solar panel is an assembly of photo-voltaic cells mounted in a framework for installation. Solar panels use sunlight as a source of energy to generate direct current electricity. A collection of PV modules is called a PV panel, and a system of PV panels is called an array.

**MULTIMETER:**

A **multimeter** (also known as a **volt-ohm-milliammeter**, **volt-ohmmeter** or **VOM**) is a measuring instrument that can measure multiple electrical properties. A typical multi meter can measure voltage, resistance, and current, in which case can be used as a voltmeter, ammeter, and ohmmeter. Some feature the measurement of additional properties such as temperature and capacitance. Analog multi meters use a micro ammeter with a moving pointer to display readings. Digital multi meters (DMMs)

have numeric displays and have made analog multi meters virtually obsolete as they are cheaper, more precise, and more physically robust than analog multimeters. Meters will typically include probes that temporarily connect the instrument to the device or circuit under test. Any meter will load the circuit under test to some extent. For example, a multi meter using a moving coil movement with full-scale deflection current of 50 microamps ( $\mu A$ ), the highest sensitivity commonly available, must draw at least 50  $\mu A$  from the circuit under test for the meter to reach the top end of its scale. This may load a high-impedance circuit so much as to affect the circuit, thereby giving a low reading. The full-scale deflection current may also be expressed in terms of "ohms per volt" ( $\Omega/V$ ). The ohms per volt figure is often called the "sensitivity" of the instrument. Thus a meter with a 50  $\mu A$  movement will have a "sensitivity" of 20,000  $\Omega/V$ . "Per volt" refers to the fact that the impedance the meter presents to the circuit under test will be 20,000  $\Omega$

multiplied by the full-scale voltage to which the meter is set. For example, if the meter is set to a range of 300V full scale, the meter's impedance will be  $6M\Omega$ .  $20,000 \Omega/V$  is the best (highest) sensitivity available for typical analog multimeters that lack internal amplifiers. For meters that do have internal amplifiers (VTVMs, FETVMs, etc.), the input impedance is fixed by the amplifier circuit.

#### • TILLER COMPONENT:

A tiller or till is a lever used to steer a vehicle. The mechanism is primarily used in watercraft, where it is attached to an outboard motor, rudder post or stock to provide leverage in the form of torque for the helmsman to turn the rudder. A tiller may also be used in vehicles outside of water, and was seen in early automobiles.

### II LITERATURE REVIEW

V.N.MUJBAILE,

**P.R.Kaware, A.G.Umare, S.S.Taksande, S.S.Malot, M.N.Lanjewar.** [1] : The shaft of engine can be coupled with wheels of frame. Also cultivating tool is attached to the frame. So that the power developed by engine will force the tool in downward direction inside soil. Also handle can be provided for proper guidance of machine by changing the direction of wheels in required direction. Seed sowing operation can also be performed by providing sowing pans near the tool. So that when the tool dig simultaneously seed can be sowed as per required. In their experimentation they observed that the depth of tool totally depends on the molecular structure, condition of soil as well as moisture content into the soil.

**Waghmode R.S., Shinde S.R., Dixit A.K., Chanchure A.A., Jadhav K.H.** [2] : This research paper deals with design of solar power rotary tiller. Comparative study for small weeders machines and power tillers machine in the Indian market is discussed in this paper. Various techniques used for weed removal in crops field are also discussed here. Their study revealed that most of the Indian farmers are small scale farmers can afford only portable weeders. The soil tiller and weeder are one of the many farm mechanizations in promoting soil tiller and weeders especially considering the fact that the majority of farmers are having small land. It reduces human effort. Working of their project is based on solar panel energy and it generates energy to run this machine which moves the cutter or tiller. It is a saver of time and cost on field operations. Thus, it will have very effective uses on the farm field either for tilling as well as for weeding. Development of energy efficient versatile

machines can increase labor productivity, reduced unit cost of operation, improved timeliness of operation.

**Po Niu, Jian Chen, Chenjun Hu, Jindou Zhao.**

[3] : This research paper deals to improve comfort of electric mini tiller based on various field tests. Many researches have been conducted on field to improve its operating comfort, but output result is less as expected. As an alternative, a new type of electrical mini tiller machine was developed. For further improvement of its

operating comfort, field test experimentation was conducted by these researchers to reduce the vertical force and vibration RMS values at handle. The experiment results showed that when the position of center of gravity (C.G) moved 19.78 cm toward handle, the vertical force was reduced from 154.24 N to 0 N and vibration RMS values decrease by 20.16% under working condition.

**Ashish Kumar, Rajat Gethe, Sattayendra Pethe Patil, Akshay Waychal.** [4] :

The basic objective of their study is to reduce efforts required in using the manual farm equipment. Their proposed model for soil tiller machine is operated on the solar power and it consists of parts like solar plate, motor, 12 V batteries, pedestal bearings, tiller blade. In this updated soil tiller machine, the rotor blade is fixed on shaft between two bearings which is fixed on the frame of tiller and wiper motor is attached to the rotor blade using belt and wiper motor is attached on the frame. Solar plate is fixed on the upper section of the tiller so that the sun rays will directly incident on the solar plate and solar plate will provide energy in electrical energy form to the battery which supplies current to the motor. The rotation of the motor either clockwise or anticlockwise depending on the connection arrangement. The project mainly concentrates on designing of suitable solar power tiller machine. Project achieves high safety and reduces human efforts.

**Ryss (Rythu Sadhikara Samstha, Andhra Pradesh Community Managed Natural Farming (APCNF)):** Tillage is a practice that is done generally to loosen up the soil to absorb rainwater and allow seeds to grow roots deeper. But this practice harms the soil in many ways as follows.

### III PROPOSED STATISTICAL METHODOLOGY

We decide to make a Solar Powered Mini Electric Tiller, for which we create a block diagram and circuit diagram first on the computer, followed by its construction design. After it, we can decide the capacity of the load carried by the mini electric power tiller and the required force for the motor to rotor for losing the soil and the required power to start the motor. In this process, we can select the types of materials for structure or fabrication work. Also, we design its skeleton first and define its size. First of all, the selection of components as per the rating is difficult. At the initial stage, we identify the torque required for the cultivation of land. We select a high-torque motor and a suitable controller for that motor for the connection of the wire with the battery with the motor. At the time of motor selection, we compare the hub motor with a BLDC motor. In which we know that the hub motor has high losses as we require torque continuously, but the hub motor has a tendency to decrease torque as speed increases, so we can avoid it. The main issue with that hub is that the motor's foundation does not fit properly in our structure. As for high torque and higher efficiency, we select the BLDC motor, as well as its suitable size and weight. For proper connection, we crimp it properly, and for proper handling and maintaining acceleration, the throttle and lever are fitted to the handle. In the fabrication work. We weld the main skeleton of the power tiller with the help of iron bars, angles, pipes, and square tubes. In which we assemble the components like the controller, motor, battery, gearbox (transmission), throttle, etc. The skeleton or on the cheese of the electric power tiller and do the connection of it. After the completion of the assembly, we get to test it on the field. Methodology is a process of project planning wherein all the major and minor steps of the project whether it may be logical creative fabrication application steps are neatly explained. Methodology is one of the prime component in project planning where all the possible factors and their aftermath effects are relatively considered for

the optimum and effective project management. Journal papers are reviewed in order to study and understand the recent updates in the field of electric power tillers. Surveying of literature review helps in simple understanding of the overall activities in our topic. It also helps us to implement further upgradation of work in our research. In this step, we have fully designed the model of the electric tiller machine with fertilizer dispenser in Solid Edges software with actual dimensions which will be useful for us during the fabrication work. Designing of any machine is very crucial work. Because, every dimension that we give is very important and not every part is able to connect to each other during the assembly. Table 1 represents the design characteristics of electric tiller machine with fertilizer dispenser.

#### **FABRICATION OF SOLAR POWERED MINI ELECTRIC TILLER:**

The basic components needed to fabrication of Solar Powered Tiller machine where the detailed view of this project components where it contains 12 volt solar panel where solar energy plays an important role in this project solar energy is utilized as the primary power source where it absorbs energy and transfer the power to the battery where it act as a power source, Here we use 24V DC Wiper Motor to run the total tiller setup by using solar panel. Frame length, breath & width. Here we use low speed wiper motor to run the tiller. By rotating the tiller, the tiller blade will dig the soil in proper manner. High safety reduced human effort, improved soil tiller efficiency, decreased work load, less worker fatigue, and lower maintenance costs are all achieved by in this project. The square tubes are welded and form a required frame we need. The U-shape tiller blade is welded at bottom of the frame. The solar panel is fitted in clamp. When the sunlight light passes through the solar panel, the battery gets energized and



Fig-1 Fabrication of Solar Powered Mini Electric Tiller

power is stored. After the power is stored, the power is used in wiper to move the shaft. In shaft the tiller wheel is fitted. When the switch on, the wiper motor tends to rotate the tiller wheel. At back side of tiller wheel, the tiller blade is fitted and tends to stir the soil in proper manner. We can stir the soil up to 5 to 6mm depth. By using tiller we can reduce the man effort. The gear driven Direct Current motor with a 100rpm draws power from the intercultural blades. Unwanted plants are continually removed by tiller blades. With the aid of the screw rod, the depth is adjustable using the screw and nut mechanism.



Fig-2 Fabrication of Solar Powered Mini Electric Tiller

#### WORKING OF FABRICATED SOLAR POWERED MINI ELECTRIC TILLER:

The square tubes are welded and form a required frame we need. The U-shape tiller blade is welded at bottom of the frame. The solar panel is fitted in a lamp. When the sunlight passes through the solar panel, the battery gets energized and power is stored. After the power is stored, the power is used in wiper to move the shaft. In shaft the chain sprocket and reciprocating shaft of seed sowing is fitted. In chain one end is connected to the shaft and the other end is connected to the tiller wheel. When the switch is on, the wiper motor

rotates the tiller wheel. At the back side of tiller wheel, the tiller blade is fitted and tends to stir the soil in proper manner. We can stir the soil up to 2-3mm depth. The stirring process is done the seed sowing operation is started. In seed sowing by reciprocating motion the seeds are planted under the soil. By using the tiller we can reduce the man effort. The gear-driven Direct Current motor with a 100rpm draws power from the intercultural blades. Unwanted plants are continually removed by tiller blades. With the aid of the screw rod, the depth is adjustable using the screw and nut mechanism. This contraption makes use of a bicycle power tiller. At this point, a motorized tiller with a manual push is in use. At the rear of the tiller, a shaver is employed with a steady static blade. However, we changed the tooling system in this machine, steadily into a rotating motion that is powered by an electric DC motor. 150rpm and 7.2 nm of torque. This engine contains a pack of batteries this rotary tool is rotated counter clockwise of the full mechanism that is efficient for moving soil in between two rows of agricultural crops. The solar energy is produced by the panel and used to power this device.

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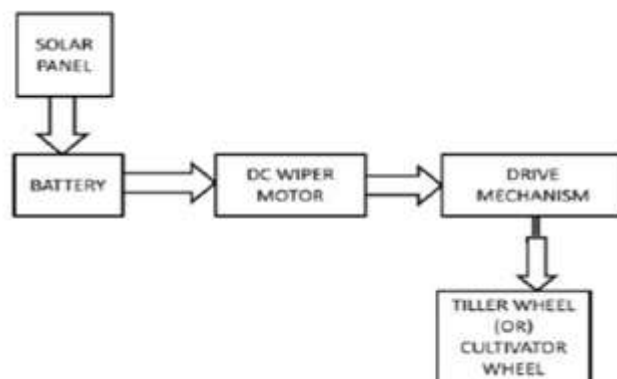


Fig-3 Working Diagram of electric tiller

The component mainly used for Natural Farming for soil Protection.

#### No/Low tillage

Tillage is a practice that is done generally to loosen up the soil to absorb rainwater and allow seeds to grow roots deeper. But this practice harms the soil in many ways as follows;

- (1) very 23 valuable soil carbon is escaped into the soil as a gas by means of oxidation process.
- (2) soil structure is destroyed and soil becomes powdery leading to sealing of pore spaces after rains leading to more compaction.
- (3) compact soils cannot support crop roots to grow deeper; and have less water holding capacity to support crop growth.
- (4) soil biology is affected as soil carbon is getting reduced.

#### The following results will be obtained if a soil is minimum tilled.

- (1) due to activity of crop roots, earthworm activity and other insects' activity, the tunnels will become strong if they are not destroyed by tillage.
- (2) the tunnels allow lot of water to absorb into soil and reduce run off
- (3) the tunnels will help crop roots to grow deeper very easily and - provides better anchorage to plants in times of floods, allows roots to access nutrients and water from deep layers. Deep summer ploughings are banned in APCNF. Every farmer will be encouraged to develop models that will be permanent and will not involve land preparation or intercultural operations that involve tillage.

#### Dynamo Installation:

While have to use the dynamo when the tiller is on working time the wheels are rotating the dynamo converts mechanical energy into electrical energy. It used rotating coils of wire and magnetic fields to convert mechanical rotations into a pulsing direct electric current. Where the power will be storage in battery. While uncharged time have to use the power. Where the time will save.

#### USES:

- Power tiller used for cultivation, sowing, weeding, and tillage.
- It used with attachments that enhance its priority use wing machine, Spray machine, router, and blood.
- Further, power tiller uses in Sugar cane farming, Rice cultivation, Wheat farming, and Paddy cultivation.

## IV PERFORMANCE ANALYSIS AND CALCULATIONS

### BATTERY CAPACITY:

- Battery type: SEALED LEAD-ACID BATTERY
- Voltage : 12V
- Model name/Number: 12V-7Amp
- The formula for calculating the energy capacity of a battery in watt-hours (W/h) is:  $\text{Energy (W/h)} = \text{Voltage (V)} \times \text{Capacity (Ah)}$

Using this formula, we can calculate the energy capacity of a battery with a capacity of 7Ah and a

- voltage of 12V as follows:
- $\text{Energy (W/h)} = 12V \times 7Ah$   
 $\text{Energy (W/h)} = 84Wh$

So the energy capacity of a battery with a capacity of 7Amp and a voltage of 12V is 84 watt-hours (W/h). This formula can be helpful in comparing different batteries with different capacities and voltages to determine which one has a higher energy capacity.

12V-7 Amp SMF/VRLA UPS batteries refer to Sealed Maintenance Free (SMF) or Valve Regulated Lead Acid (VRLA) batteries used in Uninterruptible Power Supply (UPS) systems. The 12V-7 Amp designation indicates that the battery has a voltage of 12 volts and a capacity of 7 ampere-hours. The capacity of the battery refers to the amount of energy that it can store and provide to the UPS system during a power outage.

It is important to ensure that the UPS system and batteries are properly matched to provide the necessary backup power for the intended load. Proper maintenance and periodic replacement of batteries are also important to ensure reliable backup power.

### WIPER MOTOR CAPACITY:

- Motor type : Wiper motor
- Motor voltage : 24V
- Motor Amp : 10AMP
- Torque : 7.5Nm
- Motor Wattage : 30W
- Load : 75
- The motor power (wattage) can be calculated by multiplying the voltage (V) by the current (I) and the power factor (PF). Assuming a power factor of 1 (i.e., unity), the motor power can be calculated as follows:

$$\begin{aligned} \text{Power (P)} &= V \times I \\ &= 24V \times 10A \\ &= 240 \text{ watts} \end{aligned}$$

Since you have specified that the motor wattage (power) should be 30W, you may need to consider a motor with a lower current rating. To calculate the required current rating for a motor with 30W power .

• Output, you can rearrange the above equation as follows:

•  $Current(I) = P/V$   
 $= 240 \text{ watts} / 24V$   
 $= 10 \text{ amps}$

• Therefore, you may want to consider a motor with a voltage rating of 24V and a current rating of around 10amps to achieve a power output of 30W.

**SOLAR PANEL CAPACITY:**

- Solar panel voltage : 10W
- Solar panel wattage : 12V

**EXPERIMENTAL POWER CALCULATION:**

The torque of electric motor T is given by a product of the armature current I, and torque constant K;

Power consumed by motor = 30w, Rotational Speed N = 50 rpm,

Input voltage  $V_i = 24$  volts,

The 10Watt solar panel will be able to fully charge the battery in about 6-7 hours, which means it should be capable of charging the battery fully on a regular basis.

Power consumption by Wiper motor:

Drive Motor Voltage (V) :  
 24v Expected current draw (I) :  
 10amps Torque (T) : 7.5

Total Power consumption by motor:  $(V * I) * T = 32$  watts from the above data we can see that it takes Solar Powered motor, work around 2-3 hours.

Based on load variations the calculations must be changed.

Motor power = 30 W = 0.03 KW

Motor Speed = 50 rpm  
 $30 \text{ W} = 0.0402307 \text{ Hp}$

1. Machine Torque =  $9.5488 \times \text{Power} / \text{Speed}$   
 Machine Torque =  $9.5488 \times 0.03 / 50$   
 Torque = 5.7 N/m

2. Power (KW) = Torque X Speed / 9.5488  
 Power =  $5.7 \times 50 / 9.5488 = 0.03 \text{ KW}$

Efficiency ( $\eta$ ) =  $0.745 \times \text{Hp} \times \text{load} / \text{Pi}$   
 3. =  $0.745 \times 0.0402307 \times 90 / 0.03$   
 Efficiency = 89.57%

Based on above calculations due to the load variations the Torque and Efficiency will be changed.

Its gives the less torque and more efficiency.

**V COST ANALYSIS OF SOLAR POWER TILLER**

**ESTIMATED COST ANALYSIS:**

The various components are purchased in local market for installation of solar powered mini electric tiller and the details are given below with cost analysis.

Table 3 Estimated Cost Analyses

S.No	Components	Cost (₹)
1.	Square tube	₹ 1950/-
2.	Bearing	₹ 70/-
3.	Wheels	₹ 350/-
4.	16MM Rod	₹ 200/-
5.	Battery	₹ 2750/-
6.	Wiper Motor	₹ 1300/-



7.	Solar Panel	₹ 1200/-
8.	Tiller Component	₹ 1500/-
	Total Cost	₹ 9320/-

**OVERALL COST ANALYSIS:**

The various components are purchased in local market

and the details of installation of solar powered mini electric tiller and their details are given below with cost analysis.

Table 4 Overall Cost Analysis

S.No	Components	Cost (₹)
1.	Square tube	₹ 2850/-
2.	Bearing	₹ 80/-
3.	Wheels	₹ 1000/-
4.	16MM Rod	₹ 400/-
5.	Battery	₹ 2850/-
6.	Wiper Motor	₹ 1600/-
7.	Switch	₹ 30/-
8.	Wires	₹ 100/-
9.	Solar Panel	₹ 1400/-
10.	Multimeter	₹ 200/-
11.	Battery Charger	₹ 850/-
12.	Tiller Component	₹ 450/-
13.	Paint	₹ 750/-
14.	Wood sheet	₹ 200/-
15.	Tags	₹ 60/-
16.	Iron Sheet	₹ 200/-
17.	Lathework	₹ 300/-
18.	Bolts and Nuts	₹ 40/-
	Total	₹ 13360/-

**RESULT:**

Electric power tiller loosens the soil by digging in a certain area and

removes weeds with roots. The tilling depth is adjustable with the help of front wheel, tilling depth up to 1–2 inch.

Calculating the efficiency of a solar-powered electric tiller involves considering the conversion of solar energy into mechanical work. Here's a simplified formula to estimate efficiency:

Efficiency (%) = Mechanical Work Output / Solar Energy Input × 100.

- **Mechanical Work Output:** This refers to the work done by the tiller, typically measured in joules or watt-hours.

- **Solar Energy Input:** This represents the solar energy captured by the solar panel and converted into electrical energy, usually measured in joules or watt-hours.

Mechanical Work Output: Wiper Motor Watt-hours = 30 Watt × 2 hours

= 60 watt-hours  
 Solar Energy Input: Panel Input = 10 Watt × 8 hours

= 80 watt-hours

Efficiency (%) = Mechanical Work Output / Solar Energy Input × 100

Efficiency (%) = 60 watt-hours / 70 watt-hours × 100

= 85.714 %

The fully charged battery runs for 2 – 3 hours. Fabrication of the body frame is successfully completed and runs efficiently. It is easy to drive and control. The project is successfully implemented to emphasize on the minimization of harmful efforts of using the manual rotavator. The newly developed battery-powered rotavator is operated.

**ADVANTAGES:**

- Battery Powered no fuel needed.
- Portable and easy to operate.
- Cost-effective as compared to a tractor.
- Replacement for animal power and human effort.
- Simple in design.
- Easy to maintain.
- Cheap in cost.
- Pollution free.
- Eco-friendly
- User friendly
- It has a low running cost.
- Used for Natural Farming to protect the soil.

**DISADVANTAGES:**

- It needs charging when the battery runs out. (without Dynamo installation)

- Clean after every use.

**APPLICATION:**

- For Ploughing.
- Weed removal.
- For softening land.
- For harvesting small crops.
- For cultivation of soil.
- Soil preparation for seed sowing.
- A number of common weeding tools are redesigned to ease the task of removing weeds from gardens and lawns.

**PROBLEM DEFINITION**

• From literature review we can understand researchers work on the parameters of power tiller machine in India. But to take it to the next generation as a solution was a less attentive part.

• Researchers proposed their studies and different aspects.

• We have given focus on increasing efficiency, vibration control to avoid wear and tear thereby increasing the life span of the machine, weight, portability, etc.

Our research will be carried out on an electric power tiller machine on the field of agriculture to test the parameters of the machine. On the field, the soil and other weeding factors could affect efficiency or any other parameters which reduce the efficiency. So it is necessary to use other active machines and analyze the properties of the respective parameters.

**FINAL APPEARANCE OF FABRICATED SOLAR POWERED MINIELECTRICTILLER:**



Fig- 4 Final Appearance of Fabricated Solar Powered Minielectric Tiller

**VI CONCLUSION**

Solar power tiller is capable of crushing soil properly in agricultural processes. Mainly in small-scale agricultural processes. Using solar power cultivators, we can remove unnecessary

plants from flow. All types of soils we crushing properly and Make the soil soft. The greatest way to reduce emissions is to use renewable energy. The utilization of different non-renewable energy sources. Various references lead to the conclusion that solar. Compared to other energy sources, energy consumption has more advantages. Solar power is taken in by solar panels, stored in batteries, and then used to power a variety of devices.

We consequently made the decision to create the solar-powered blade harrow machinery, which is useful for farmers in their agricultural operations.

### VIII FUTURE SCOPE

The Solar Tiller can be modified with 24V to 36V motor for better torque, speed compare to present tiller (24V). The Present Solar tiller can perform ploughing, it can be included with seed sowing, and fertilizer sprayer. It can be attached with trolley for some storage purpose. The solar-powered mini electric tiller is a promising innovation in the combination of technology, sustainability, and efficiency. With continuous improvements and widespread adoption, it has the potential to revolutionize small-scale agriculture. Mainly used in Natural Farming for to protect the soil.

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