

# Design and Fabrication of Electric Portable Tiller for Agricultural Purpose

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## ABSTRACT

*In Indian Agriculture, Generally tractors or cultivator machines are commonly used for ploughing. Before this method farmers uses the traditional method this is time consuming and hardworking and costly. Despite the massive mechanization of agriculture in some regions of the nation, the majority of agricultural activities in the country's bigger areas are carried out by hand utilizing rudimentary and traditional equipment and implements such as a wooden plough sickle, and so on. This low-cost portable battery-powered electric power tiller machine is a one-stop contemporary solution to improve traditional farming practices by reducing human labor at a very cheap cost through the use of a motorized tilling mechanism. Because design and manufacture are the keys of engineering, mechanical engineering education requires real design and production. Using a clever portable design, the electric power tiller helps minimize the time and expense required in tilling, consequently enhancing agricultural output and efficiency.*

**Key Words:** Blade, Cutter, Electric Battery, Tiller.

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## 1. INTRODUCTION

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. This project deals with design and development of the portable battery charged electric power tiller machine, the conventional agriculture methods of farming, as it reduces the human effort, at a very low cost using motorized tilling mechanism. The electric power tiller helps to reduce the time and cost involved in tilling using a new portable design thereby increasing the productivity and efficiency in agriculture. To enable good soil gripping, the machine uses a wheel with welded angles. The machine is powered by an electric motor that drives the pulling wheel using a sprocket chain configuration. The motor is powered by a battery and has enough force to draw the forks through the soil. The three cultivator forks allow for precise and easy tilling, which is ideal for farming

## 2. LITERATURE SURVEY

The different existing systems for robotic inspection were looked into to analyse the gaps and find objectives for the current system.

Mr. Patil digvijay pandurang and his group published “Mechanical Power Weeder Design and Development” They found that the plants growing when not required will affect the life of the other plans as a result turns in to the failure of the farmer. In India, major percentages of people are dependent on the farming for even their day to day expenses. Every stage of the farming has several reasons for failure and must be completed in the specified time for effective cultivation. The complete design stages of the machine have been discusses in this paper[1].

Auti Omkar, Thorve Snehal, Unde Akshay, Wakchaure Suchit, Kolse Chandrashekar published “Design and fabrication of Power operated tiller machine”. They found that weed control is one of the difficult tasks on an agricultural field. They researched about different types of weed control and their effects on the field. It was found that only biological and mechanical methods of weed control had less to no effects on field. Mechanical type not only removes weed, but also loosens soil surface, ensuring better water intake capacity and water aeration properties. [2]

Sonu Yadav, Harshal Deshmukh, Chetan Dhapodkar, Ashish Singh Parihar published “Portable Electric Tiller Machine”. In this paper, they discussed and completely explained about electric power tiller which was simple and portable, it’s design, materials used and all other important aspects which were necessary to build a successful model[3].

Sandesh Sawant, Abhisheak Gawade, Yadnyesh Salgavkar, Khemraj Naik, Akshay Khumbhar published a review paper on “Portable Electric Power Tiller”[4].

Shilkumar Patil, Nikhil Chahande, Prashant Dharme published “Design and fabrication of Portable Electric Tiller and Cutter machine”. This paper discussed about construction of an electric powered tiller machine which was both cost effective and time saving [5].

## 2. OBJECTIVES

The objective of the research are,

- To replace the use of non-renewable energy source and make use of other renewable energy source.
- To develop this project at budget-friendly price.
- These make farming more effective and easier.
- Design Power Operated Tiller Machine.
- Fabrication of Power Operated Tiller Machine.

## 3. MATERIALS and METHODOLOGY

### A. BATTERY

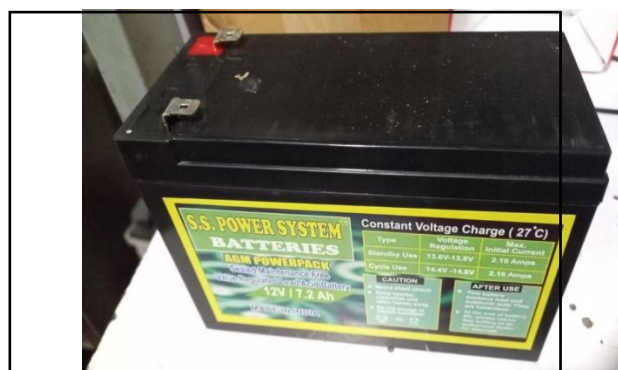


Fig 1: Battery

- Type: Lithium-Ion batteries.
- Voltage: 12V (DC).
- Current: 12.5 A/hr.
- Dimension: 118 x 92 x 70 cm.

Two 12V batteries were used in this project so that it can power the DC motor to run and drive the chain sprocket assembly which made the bicycle rim to move forward.

## B. DC MOTOR



**Fig 2: DC motor**

- Type: Electric Hub
- Power: 250 Watt.
- Voltage: 24V.
- Dimension: 18 x 13.2 x 12.1 cm.

Geared DC motor is a reduction dc motor and most commonly used for scooters, bikes etc. This motor possesses rated speed of 300 rpm and operates at a power of 24 Watt.

## C. CHAIN and SPROCKET



**Fig 3: Chain and sprocket**

- Driving sprocket: diameter= 58mm; No. of teeth= 13.
- Driven sprocket: diameter= 155mm; No. of teeth= 39.
- Chain length = 134 cm.

Combination of DC motor and chain sprocket assembly system that uses the rotational power of the motor to drive the chain and transfer motion to bicycle rim with welded angles so as to make it move forward along with which, J shaped tiller blades are carried forward thereby ploughing the land. Lubrication is necessary for chain and sprocket.

## D. SQUARE PIPES



**Fig 4: Mild steel square pipes**

Mild steel square pipes are hollow tubes made from low-carbon steel, which is an affordable and durable material. They provide high stability and structural support, therefore helpful in projects where load bearing capacity is a requirement.

## E. BICYCLE RIM



**Fig 5: Bicycle rim**

Bicycle rim used in this project is made from aluminium material having approximate diameter of 28 inches and width of 35 inches. Rim is welded with steel angles so that it can move forward with tight grip holding capacity.

## F. STAINLESS STEEL ANGLE



**Fig 6: Stainless steel angles**

Stainless steel angles are 90 degree L- shaped metal profiles made from stainless steel. They are used in various

projects involving construction, manufacturing and architectural use. They are available in different sizes, thicknesses and finishes which should be considered before selecting one for a particular project.

**3.2 Bill of materials table:**

Component name	Specifications	Price (in RS.)
DC motor	Power = 250W Speed = 300 rpm Dimensions = 30x40x20 mm	3000
Lithium battery	Output voltage = 24v Current = 7.5 ampere/hour	3900
Bicycle rim	No. of spokes = 28 Material = Aluminum	600
Chain sprocket	Chain length = 134 cm Driver sprocket diameter = 58mm Driven sprocket diameter = 155mm	920
Toggle switch	-	100
Mild steel bars for body frame	2''X2'' Square pipes (5mm thickness) 4 feet long. (x5)	2400
Stainless steel angled bars (201 grade)	4 feet long (x2)	800
Shaft	Material: Mild steel	880
Bolt and nut	Material: Mild steel (x12)	300
Connecting wire		400
Miscellaneous	Equipment rental Travelling cost	1000 800
TOTAL		15,120

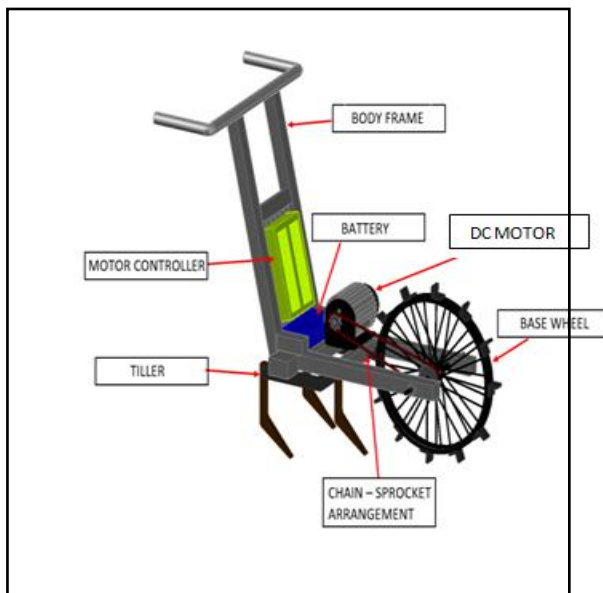
**4METHODOLOGY**

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. 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. Following is the methodology used to design and fabricate our portable electric tiller and cutter machine:

- Development of the new concept.
- Literature review Dynamic analysis and mechanical design.
- Comparison between working model and other active machines in present.
- Fabricate the actual machine by using the machine components.
- Cost analysis.

### 5. RESULTS

The virtual model is created by using AUTOCAD 3D modeling software to analyze the model. The dimension is considered as per the physical model and a rough diagram of the portable electric tiller and cutter machine is drawn. A lithium-ion battery is used to power the hub motor with a force capable of pulling the tiller blade through agriculture soil. The tiller machine is running on DC motor which uses a chain and sprocket mechanism arrangement to drive the bicycle rim. The machine makes use of a bicycle rim with welded angles. The three J Shaped tiller blade allow for simple, easy and narrow tilling exactly as needed for farming. The light weight and portable design of tiller machine makes it easy to handle and control the direction.



**Fig 9: Isometric view of project**

The machine works on motor which gives power to overall system to run the object. The machine is drive by electric motor which is in contact with belt drive which ultimate helps to run the working of wheels of tiller during operation. For tiller machine the neat and accurate modification of supporting frame is provide For tiller machine the neat and accurate modification of supporting frame is provided which gives output voltage.

The machine makes use of a wheel rim with welded angles to provide efficient gripping on agriculture soil. A switch is provided on the right side of handle is used to switch on or off the machine. The machine is run by a DC motor which uses a chain and sprocket mechanism arrangement to run the pulling wheel rim.

A lithium-ion battery is used to power the hub motor with a force capable of pulling the tiller blade through agriculture soil. The three J Shaped tiller blade allow for simple, easy and narrow tilling exactly as needed for farming. The light weight and portable design of tiller machine makes it easy to handle and control the direction of machine around in any vehicles or by hand for transporting the machine.



**Fig 10: Electric Power Tiller model**



**Fig 11: Working of the tiller**

## 6. CONCLUSIONS

Today in the world fuel prices and environmental pollution increases step by step So to manage environmental pollution, to save fuel this project is designed. This model requires less investment but its gives more energy output with low maintenance. The tiller that we have fabricated is best suitable for soil having high moisture content. This project can be used either for ploughing or removing unwanted plants. Here in our project we conclude that our project performed its desired work successfully and by using this machine we can reduce the farming cost, animal use, manpower.

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## REFERENCES

- [1] *Mr. Patil digvijay pandurang, Mr. Mujawar Babalal Babasaheb, Mr. Savekar Swaroop Dattatray* published “Mechanical Power Weeder Design and Development”, ISSN No:2581-4230 VOLUME 4, ISSUE 4, Apr. -2018.
- [2] *Auti Omkar, Thorve Snehal, Unde Akshay, Wakchaure Suchit, Kolse Chandrashekhar* published “Design and fabrication of Power operated tiller machine”, 2019 JETIR February 2019, Volume 6, Issue 2.
- [3] *Sonu Yadav, Harshal Deshmukh, Chetan Dhapodkar, Ashish Singh Parihar* published “Portable Electric Tiller Machine”, ISSN (Online) 2581-9429, Volume 7, Issue 1, July 2021
- [4] *Sandesh Sawant, Abhisheak Gawade, Yadnyesh Salgavkar, Khemraj Naik, Akshay Khumbhar* published a review paper on “Portable Electric Power Tiller”, ISSN No:-2456-2165, Volume 7, Issue 3, March – 2022
- [5] *Weide, R. Y. V. D., P. O. Bleeker, V. T. J. M. Achten, L. A. P. Lotz, F. Fogelberg, and B.Melander.* “Innovation in mechanical weed control in crop rows”, 2008, Weed Research 48 (3): 215-224.
- [6] *Meheta S.K and MaitHli A.* 2011. Development and Performance Evaluation of Portable Electric Power Tiller. In Proc. Of Conference on Machines and Mechanism, NaCoMM 2011. IIT Madras, India, pp 319-325.
- [7] *R.Magesh Kumar and M.Mayakannan,* “Design and Fabrication of Battery Operated Weeder Machine” International Research Journal of Engineering and Technology, vol. 07, no. 05, IRJET-2020, May-2020.