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Model and Fabrication of Electric Cultivator

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ABSTRACT: This is an attempt to bring out new modified cultivator. Now a days tilling is done with the help of diesel tiller. Presently farmers are facing financial problems which makes them difficult to afford diesel tiller. To solve this problem we have developed an electric cultivator which is cheaper and less running cost. It is customized tiller which has single wheel which makes it easy to rotate move easily in small lands. In this machine the plough is placed at the end of the machine which is fixed to the machine. The DC motor is used to rotate the wheel, which helps the tiller to move in its required direction the wheel is complete made out of metal with extra grip which helps the machine to move easily. When the cultivator moves the plough attached to the cultivator digs the soil and cultivate the soil. The slower you move the more accurately it can cultivate the soil with the help of plough used.

KEYWORDS _ Electric Cultivator, Tiller, Farming

I. INTRODUCTION

Introduction of cultivator to enable good soil gripping, the machine uses a wheel with welded angles. The wheel design was created to offer to grip on the soil that would allow cultivator prongs to dragging during the tilling process. The machine is turned on and off using switch on the handle. The machine is powered by the electric dc motor that drive the pulling wheel using a sprocket chain configuration.

The motor is powered by the batteries and has the enough force to draw the enough force to draw the forks through the soil. The three cultivator forks allows for precise and easy tilling which is ideal for farming the machine direction can be easily controlled because it is made up of single wheel. It is portable lightweight construction. For carrying the machine, it can be easily carried around another vehicle or by hand. As a result, electric powered tiller offers a smart working and fuel free mechanism for farm and garden tilling. To enable good soil gripping, the machine uses a wheel with welded angles. The wheel design was created to offer to grip on the soil that would allow cultivator prongs to dragging during the tilling process. The machine is turned on and off using switch on the handle. The machine is powered by the electric dc motor that drive the pulling wheel using a sprocket chain configuration. The motor is powered by the batteries and has the enough force to draw the enough force to draw the forks through the soil. The three cultivator forks allows for precise and easy tilling which is ideal for farming the machine direction can be easily controlled because it is made up of single wheel. It is portable light weight construction. For carrying the machine, it can be easily carried around another vehicle or by hand. As a result, electric powered tiller offers a smart working and fuel free mechanism for farm and garden tilling.

II. LITERATURE SURVEY

Prof. Prashant Rahat et al [1] Published in International Journal of Advanced Research in Science, communication and technology (IJARSCT). Design "portable electric power tiller machine" In this paper researcher studied the portable battery charged electric power tiller machine. Farming practises used in traditional agriculture. To provide maximum soil grip, the machine uses a wheel with welded angles. The wheel design was created to offer a strong grip on the soil that would allow the cultivator prongs to drag during the tilling process. An electric motor drives the pulling wheel through a sprocket chain arrangement. By adopting a motorised tilling system, it minimises human effort at a very low cost. Using a unique portable design, the electric power tiller reduces the time and cost of tilling, enhancing agricultural output and efficiency

Zakariya et al [2] Published in Journal of Engineering Research and Reports perform Modification of Portable Power Tiller for Small Scale Weeding Operation. After preliminary study, it was found out that power tiller could be adopted



for weeding. As a result, the study sought to improve its performance by altering some essential components, such as weeding blades and depth blades. Three sets of four, six, and eight blade gangs were fabricated from 3 mm mild steel sheet metal. The fabrication took place at Ahmadu Bello University's Department of Agricultural and Bio-Resources Engineering in Zaria. The redesigned machine was tested in the maize field at the Institute for Agricultural Research, IAR, and Ahmadu Bello University, Zaria research farm during the 2017/2018 irrigation season for weeding effectiveness, field capacity, plant damage, and fuel consumption. There were four levels of blade types 'B' and three levels of weeding depth 'D.' At two (2) weeks, the field was put out in a 43 randomised

Mr Mahesh Gavali et al [3] published in International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) design In India, a comparison of portable welders and power tillers was conducted. In this study, the author investigates in this article, a comparison of portable welders and power tillers in the Indian market is examined. Various weed-removal procedures for crops are also mentioned. The examination of various equipment used for mechanical weed removal is the main focus of this project. According to this survey, the majority of Indian farmers, the majority of whom are small-scale farmers, can only afford portable welders. As a result, mechanical weed management is not used by these small-scale farmers. These small-scale farmers primarily utilise chemical and manual weeding methods. Portable welders are less expensive to operate and maintain, according to the literature review, but they are also less adaptable. Power tillers are more expensive, but they are more efficient.

Prof. Vishal M. Metkari et al [4] This report details a student's design, manufacture, analysis, control, and testing operations for a motor-powered tiller for agricultural labour. 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. To meet the future food demands, the farmers have to implement the new techniques which will not affect the soil texture but will increase the overall crop production. Its primary goal is to minimise personnel, which is difficult to come by in today's market, as well as to shorten working hours. Because it has the potential to be significantly superior to the traditional methods of cultivating land using labour or a bull. One of the greatest roadblocks to increasing agricultural output is a lack of mechanisation or automation. 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. I would report on the design, manufacture, analysis, control, and experimental work in this project, which is considered suitable engineering education.

Prof Vasantha Kumar et al [5] This paper focuses on the conception and production of an electric tiller machine for arecanut and coconut plantations that includes a fertiliser dispenser. When designing the electric power tiller, a software application called Solid Edge was used. Following the findings of our research, electric power tiller was fabricated in a manner that was compatible for engineering applications. 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.

Prof. A J Rane et al [6] Agriculture starts from human existence. It is important part in human life as it feed us and thereby it runs the ecosystem though. It is extreme important section for living beings. But modern farming techniques are heavy-coughed and very intensive. Modern tractors which runs by fuel are detrimental to environment and not affordable to farmers. Tilling in farming is main step and traditional techniques were time consuming and very intensive and modern ones are non-affordable and hazardous to environment. Portable Electric power tiller machine uses battery-powered mechanism to serve the tilling purpose at minimum cost, time in tilling and thereby increasing productivity, efficiency to enhance healthy environmental purpose too.

Prof Shabbir J. Karjatwala et al [7] published in open access international journal of science and engineering Design development and fabrication of mini cultivator and tiller. In this paper researcher studies Farmers used to use traditional farming methods, which are time-consuming, labour-intensive, and expensive, therefore they introduced new technologies. Machines are commonly employed for farming purposes in India, which is at a higher level. They are



creating this model in order to solve this challenge. This document discusses the operating machinery that would be used to till one and a half hectares. With this new technology, the plough will be able to go ahead and the base wheel will rotate with blades that provide traction.

Prof. Prashant Rahate et al [8] 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. The machine is use of a wheel with welded angles to provide maximum gripping on soil. The wheel design is developed, to provide a firm grip on soil strong enough to drag the cultivator forks while tilling process. The machine is driven by an electric motor which uses a sprocket chain arrangement to drive the pulling wheel.

Prof Srinidhi Campli et al [9] Agriculture has always been an important aspect of the human ecology. Traditional agricultural methods, on the other hand, need a lot of human labour and take a long time. Even in 2020, the majority of Indian farmers still utilise conventional farming implements like the plough and sickle. As a result, there is a waste of energy and personnel, as well as a lower yield per capita labour force. Farm tilling is one of the most labour-intensive agricultural procedures. Field tiling by hand is a difficult work, and tractors require a large investment as well as a lot of gasoline. Despite the massive mechanisation of agriculture in some regions of the nation, the majority of agricultural activities in the country's bigger areas are carried out by hand utilising 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 practises by reducing human labour at a very cheap cost through the use of a motorised 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 minimise the time and expense required in tilling, consequently enhancing agricultural output and efficiency. Power tiller equipment is two-wheeled agricultural equipment outfitted with a rotary tiller that conducts all farm activities effortlessly. It prepares the soil, plants, and sows seeds, as well as sprays fertilizer.

Prof Kumar Swamy.R et al [10] The main objective of the project is development and fabrication of a multipurpose agricultural tiller which will perform a wide range of operations such as rotary, ploughing, seeding, pesticide spraying, harvesting, weeding at a reasonable cost to overcome the challenges faced by the farmer. The multipurpose agricultural tiller has been fabricated on a rigid chassis frame which holds a universal shaft on which rotary and wheels can be mounted. This universal shaft derives 8 BHP of power from a 4-Stroke IC engine placed firmly on the chassis frame. The mechanism used is such that the same engine drives the wheels, rotavator, harvester, pesticide sprayer, seeder, leaver, plough and trolley. The reciprocating motion provided to the harvester cuts the crop precisely, consuming less time as compared to conventional techniques of harvesting. A power sprayer is used which will facilitate spraying of pesticide at different heights of crop cultivation. A multi-way adjustable plough is also used whose position can be adjusted on a slide through frame according to the requirement of the farmer. A multi variety seeding operation is also setup. Multipurpose agricultural tiller can be easily afforded by average and marginal class of farmers.

III. PROBLEM STATEMENT

Agriculture has been an integral part of the human ecosystem. Farm tilling is one of the most labour-intensive operations in agriculture. Now a days tilling is done with the help of diesel tiller. Farmers are facing financial problems which makes them difficult to afford diesel tiller. In February 2022, the Lok Sabha informed that over 17,000 farmers between 2019 and 2021 committed suicide in different parts of the India. To solve this problem, we have developed an electric cultivator which is cheaper and has less running cost.

IV. METHODOLOGY

Conduct a literature review to determine the existing designs and technologies for electric cultivators. Define the design and technical requirements for electric cultivators, including its weight, size, tilling depth, and materials. Based on the performance of diesel tillers and specifications, create a model. Based on the design requirements and specifications, create a conceptual design for the tiller that meets the identified needs and preferences. Create detailed engineering drawings and specifications for the tiller. Conduct simulations and tests to



validate the design and ensure that it meets the functional and technical requirements. Based on the engineering design, fabricate a prototype of the tiller. Evaluate the performance of the tiller based on relevant parameters such as ease of use, safety, durability, and cost-effectiveness. Conduct usability testing with volunteers to gather feedback and identify areas for improvement. Use the feedback to make any necessary changes to the design and functionality of the tiller. Prepare a report documenting the design, fabrication, and evaluation of the tiller, including the results of usability testing and any modifications made to the design.

V. MATERIALS USED

- A. FRAME:**A vehicle historically known as its chassis is the main supporting structure of a motor vehicle to which all other components are attached, comparable to the skeleton of an organism. Structural steel is the classic material for the load bearing structures of our agricultural machinery. In the past load of this machine was high and now we have decreased with some modification.
- B. BATTERY:**A battery is a device that stores chemical energy and converts it to electrical energy. The chemical reactions in a battery involve the flow of electrons from one material (electrode) to another, through an external circuit. The flow of electrons provides an electric current that can be used to do work.
- C. WHEEL:**Wheels for rotary tiller are able to provide stability and better grip on any soil. Available with metal rims to improve the grip of rotary tiller on hard surface. This rotating wheel tiller is easier to use than a hand tool because the action of the star-shaped tines have a rolling motion that is faster than a simple hand
- D. PLOUGH:**A plough or plough is a farm tool for loosening or turning the soil before sowing seed or planting. Ploughs were traditionally drawn by oxen and horses, but in modern farms are drawn by tractors. A plough may have a wooden, iron or steel frame, with a blade attached to cut and loosen the soil. Here we have used fixed the plough to the frame of the vehicle at the end. Three triangle like structured teeth we have used to loosen the soil.
- E. THROTTLE:**Electronic throttle control (ETC) is a technology which electronically "connects" the accelerator pedal to the throttle, replacing a mechanical linkage. The throttle regulates the speed of motor. it increases and decreases the speed of motor with help throttle present in the handle.
- F. DC MOTORS:**A DC motor is any of a class of rotary electric motor that converts direct current (DC) electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor. This motor is operated by using DC supply therefore we have used battery as a source of power for the motor to run.
- G. CHAIN SPROCKET:**A sprocket or chain wheel is a profiled wheel with teeth that mesh with a chain tracker or other perforated or indented material. The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly.
- H. BEARING:**A bearing is a machine bearing that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around free axis; or, it may prevent a motion by controlling the vectors of normal force that bear on the moving parts.
- I. CONTROLLER:**Simply put, a DC motor controller is any device that can manipulate the position, speed, or torque of a DC powered motor. There are controllers for brushed dc motor, brushless dc motor as well as universal motors, and they all allow operators to set desired motor behaviour even though their mechanisms for working.
- J. ON/OFF SWITCH:**A key switch (sometimes called a key switch or lock switch) is a key operated switch. Key switches are used in situations where access needs to be restricted to the switch function.

VI. DESIGN OF MODEL



Fig 2. 3D Model of electric cultivator

VII. FUTURE SCOPE

Addition of direct motor breakings can be applied to the existing controller for motor stoppages in emergency. And also plough can be changed for the convenience and requirements. The front wheels also can be changed to tires for better performance but we have focused mainly on hilly regions hence we have used metal wheels for better grip. The other major problem that is the charging and battery run time can be further increased by using recharging technique with dynamo or the bigger methods like solar etc. And instead of 4 lead acid batteries we can use lithium ion batteries, which would be light in weight and also good in efficiency. The controller used in the tiller is capable of undergoing many operations such as emergency motor breaking, reverse action, crawl mode, high output mode for emergency rescue, temperature detection etc which can be added according to the need of the respective individuals.

VIII. CONCLUSION

The Cultivator is in development stage. This machine is economy in design but with further improvement it can be compact in design. This machine is economy in cost compare to diesel cultivator. This machine can help large number of small-scale farmers. The power tiller is most suited for usage in hilly locations, moist conditions, and on small farms because it can do both primary and secondary tillage operations. The power tiller, with the correct set of tools and attachments, can handle most of the field operations in intensive cultivation. The power tiller's small weight makes it ideal for working in both wet and dry situations. In general, seeds should be planted at a depth twice their width, or diameter. For example, if you have a seed that is about 1/16 inch thick, plant it about 1/8 inch deep. Large bean seeds (up to 1/2 inch wide) can need to be planted an inch deep. Our tiller can till the land for up to 20 centimetres by using proper force and technique. And also, after fully charging all the batteries, the estimated work time is around 3-4 hours depending on the work type. And also the tilling depth can be controlled using manual technique I.e, lifting the tiller slightly to adjust the depth which would come in handy for soil which are soft and also less fertile. Soft soils can be tilled easily with less force and will be vice versa for hard soils. However, the weight of the batteries will give the necessary down force for the ploughs to go down to the required space. The controller used to control the acceleration works in both ways that is one to increase or decrease the acceleration and the other is to



save the battery wherever the torque required is less. When the batteries and the motors are detached, the weight of the frame is so less that it can be used as mobile.

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