



# Design and Analysis of Battery Powered Weeder

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**Abstract:**

A weeder is a machine used in the agricultural field to remove weeds. The power weeder is to be converted to an electrically operated system. For the purpose of conversion of the machine into a completely electrical operated system, a new machine is designed and given to fabrication. The machine to be fabricated is designed for each part individually. The data taken into account is from the average readings of the weeders available in the market. For the ease of use, accessibility and handling the modifications for the electrical attachment is made. So here the existing gasoline engine is replaced with a motor for drive and batteries for power source. The machine is driven with the help of belt and pulley, for the ease of providing drive to the system. The design of the machine is then analyzed for stress, strain and deformation to detect the withstanding ability of the system at the earliest. The parameters such as load, force and speed is varied. On analyzing the machine the maximum possible weight that the frame could bear is 210kgs and after further loading the frame begins to deform.

**Key words:** weeder, analysis, drive, belt, electrical system

**I. INTRODUCTION**

The weeder is agricultural equipment which is employed in the removal of weed. A weeder is any of several types of farm implement used for secondary tillage. One sense of the name refers to frames with teeth (also called shanks) that pierce the soil as they are dragged through it linearly. Another sense refers to machines that use rotary motion of disks or teeth to accomplish a similar result. The rotary tiller is a principal example. Cultivators stir and pulverize the soil, either before planting (to aerate the soil and prepare a smooth, loose seedbed) or after the crop has begun growing (to kill weeds—controlled disturbance of the topsoil close to the crop plants kills the

surrounding weeds by uprooting them, burying their leaves to disrupt their photosynthesis, or a combination of both). Unlike a harrow, which disturbs the entire surface of the soil, cultivators are designed to disturb the soil in careful patterns, sparing the crop plants but disrupting the weeds.

**II. MATERIALS AND METHODS**

The materials which are suitable for the fabrication of weeder is taken into account and other materials which are required for the propulsion of the machine is selected. The materials and quantities required are stated in table 3.1

**Table 2.1 Material specifications**

S.No	Title	Specification	Number's used
1	Brushless DC motor	2-hp, 1.5 kw,48v, 3000 rpm	1
2	Battery	12v, 50ah	4
3	charger	48v, 25amps, constant current type	1
4	Belt	V-belt, b-type	1
5	pulley	standard type, 3,7 inch, 1 way	2
6	Frame setup	Mild steel	1 unit
7	Blades	Mild steel, j-type tine, 12 blades, split into 3 blades on each set, 4 sets	1 unit
8	Gearbox	1-unit, with 2-forward and 1-reverse gear. Spur gear.	1 unit
9	Connecting rod	Mild steel, split connection to rotavator and wheels.	1

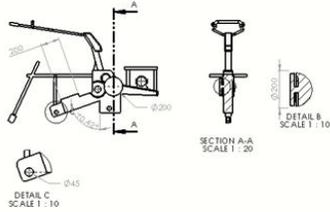
**a)Main frame**

The main frame is the skeletal structure of the machine. It acts as the chassis for the system. All the loads applied are distributed over the frame. Components and attachments are affixed to the

main frame for support and balance. The main frame is strong and rigid to withstand vibrations and tilts produced during the operation. The main frame is manufactured by arc welding process. The design of main frame is shown in Fig.1.



**Figure.1. Main frame**



**Figure.2. Main frame (2)**

### b) Rotavator blade

Soil preparation can be time consuming. However, with the right tools and equipment you can increase the efficiency of your business. A rotavator is a useful piece of machinery when it comes to soil preparation. These versatile pieces of farming equipment is a motorised machine which uses rotating blades to turn soil. In their essence rotavators are earth turning equipment which perform a similar function to cultivators and tillers. While all rotavators perform a similar function, different models offer different capabilities



**Figure.3. Rotavator blade**

### c) Brushless DC motor

An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and winding currents to generate force in the form of rotation. Electric motors can be powered by direct current (DC) sources, such as from batteries, motor vehicles or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators. An electric generator is mechanically identical to an electric motor. The motor provides the drive necessary for the displacement of the machine. Motor is mounted on the front of the machine which is placed on the mainframe. The motor used is a "Brushless DC motor", along with a controller for precise motion and speed control. The rated speed of the motor is 3000rpm at no load condition, and has a rated capacity of 1.5kw, with a rated current of 30-45 amps



**Figure.4. BLDC Motor**

### d) Drive shaft

The drive shaft connects the wheels with the gearbox. Drive shaft is made of mild steel. There are 2 connecting rods. One is placed in contact with the gearbox, and coupled to the wheels. The other shaft is placed in connection with the gearbox which is connected to the rotavator shaft. The gearbox when given drive, splits the drive into 2 paths. One is to drive the wheels and the other is to drive the rotavator.



**Fig.5. Drive shaft**

### e) Lead acid battery

The battery used is lead acid battery. It provides the necessary power to drive the motor, and the battery acts as the power source for the machine. Lead acid batteries are more affordable and have a better efficiency of about 80-85%. Amount of heat generated is also less and the capacities of the batteries available are also wide. The battery is of constant 12V. The amps rating selected is 50AH. Batteries are mounted on the tray, which is placed on the mainframe with the help of welding. The batteries are connected in series to build a voltage of 48V that is suitable to drive the motor with more power and torque.

### f) Belt

The is used to steer the vehicle, which drives the wheel by connecting two pulleys. The belt is connected at one end to the motor and it is connected at the other end to the pulley, that is connected to the gearbox shaft. The belt is checked for tension for better drive ability. The belt use is V- belt that is of b-type. The V- belt avoids slip and has a better transfer efficiency.

### g) Pulley

The pulley transmits the rotatory motion between two rotating ends. Pulley rotates about its own axis. Two pulleys are employed in the process. One pulley is fixed to the motor shaft and the other pulley is fixed to the gearbox shaft. The pulley's are connected to each other with the belt.

### h) Charger

The charger is used to recharge the lead acid batteries. The charger used is of 48V and 20-25amps capacity. The charging method is constant current type, which is an efficient method and quick process. The charging process does not overheat the battery. By using this type of charger the life of the batteries is also to be longer. Time taken by the charger to charge 4 batteries connected in series is estimated to be 4-5 hours.

### i) Cut-off converter

Cutoff converter is a device coupled with the controller of the motor. When both accelerator and brake are actuated at the same time, the current from the battery to the motor is cutoff in order to prevent the overload on the motor. It acts as a circuit breaker and relieves the motor from excess loading.

### j) Secondary wheel

The secondary wheel supports the weeder from the back and aids the user to turn in the desired direction. It is rotatable in multi

direction which makes the turning process an easy one. The wheel is basically a composition of nylon and other mixtures. It usually has a longer life and withstands hard soil conditions. It is the leveler of the weeder to adjust the depth of the blade. It has slots on the bar and a pin to lock at the desired position which holds the height of the blade steady.

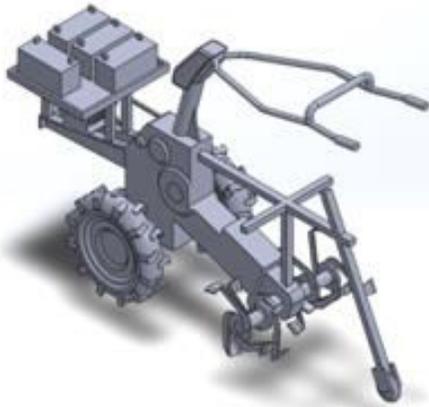


Figure.6. Conceptual Design (Left side view)



Figure.7. Conceptual Design (isometric view)

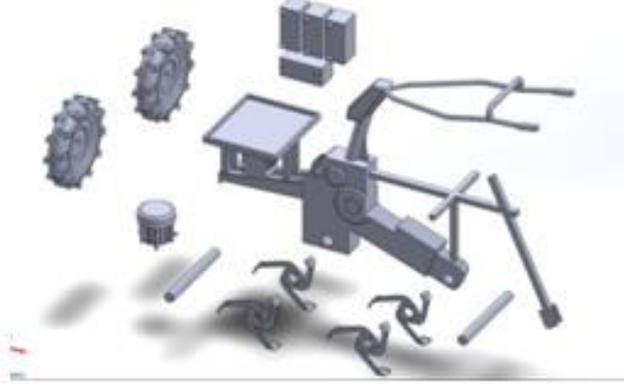


Figure.8. Conceptual Design (Exploded view)

### III. RESULTS AND DISCUSSION

#### Analysis

##### 4.1.1 Geometry file

The geometry deals with the deduction of the properties, measurement, and relationships of points, lines and angles and figures in space from their defining conditions by means of certain assumed properties of space

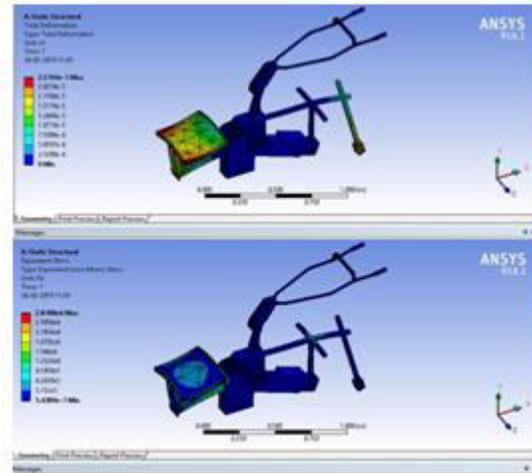


Figure.9. Stress analysis

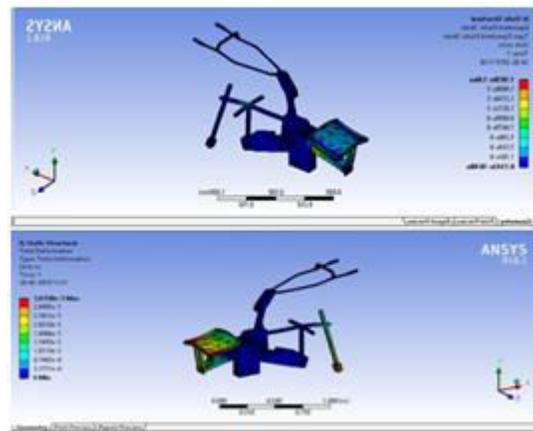


Figure.10. Strain analysis



Figure.11. Deformation analysis

### IV. CONCLUSION

Comparing between electrical power weeder and normal weeding machine, after testing in the field for about five times, based on the tests the efficiency is calculated to be 80% which is almost equal to the normal existing weeder, which is much efficient while a single person operates the machine. Deeper working depth and a slow travel speed can achieve a good weed control. Weed removing machine add the modernization and advancements in the agricultural field. This machine will make the farmer independent and not rely on the laborers for removing weed.

## V. REFERENCES

- [1].Albert Francis.A, Aravindh R, Ajith M, Barath Kumar M (2017) “Weed removing machine for agriculture” IJESRT – International Journal of science and research technology ,ISSN: 2277-9655 , Impact factor:4.116, CODEN: IJESS7.
- [2].ChelpuriRamulu (2016) “Some studies on wear characteristics of rotary blades” Department of farm machinery and power engineering, Roll no-20141520471, Id no-220114013.
- [3].Deepak Chandran ,Madhuwathijoshi (2016) “Electric Vehicles and Driving Range Extension” Iris Energy LLC Edison, New Jersey, USA AdvAutomobEng 2016, 5:2 DOI: 10.4172/2167-7670.1000154.
- [4].Stephen Heckerroth (2010) “Electric Tractor” United states Patent , Patent Number: US 7828,099 B2
- [5].WeerachaiArjharn (2001) “Preliminary Study on the Applicability of an Electric Tractor” Journal of JSAM 63(3) :130-137, 2001.