



Design & Development Of Smart Cultivation Machine For Special Purpose Farming

Sandeep Jadhav¹, Sakshi Sakhare², Neha Awate³, Harshada Alhat⁴, Swaranjali Kale⁵

¹Assistant Professor, Mechanical Engineering Department, JSPM's Rajarshi Shahu College of Engineering, Tathawade, Pune

²³⁴⁵Students, Mechanical Engineering Department, JSPM's Rajarshi Shahu College of Engineering, Tathawade, Pune

1. ABSTRACT:

This project explores the development of a semi-automated Mini Land Cultivation Machine utilizing a 99cc 4-S Champion two-wheeler engine. Designed to minimize manual labour in ploughing operations, this machine integrates basic mechanical components to overcome the lack of electricity and high costs associated with fully automated systems. By employing a gasoline-powered engine coupled with motors and power transmission equipment, the design aims to enhance efficiency in various crop cultivation environments. The feasibility study focuses on designing and fabricating a cost-effective ploughing solution that addresses the challenges faced by rural agricultural practices. This approach ensures accessibility and ease of use, striving to reduce manpower while maintaining affordability. **Key Words: Semi-automation, Fabrication, Cost-effective, Cultivation, Transmission.**

2. REASON FOR SELECTING PROBLEM:

- Lack of mechanization in farming
- Required excess efforts for different process.
- Required more man power.
- Excess time consumption for performing individual process.

3. SCOPE OF THE PROJECT:

The project will involve designing and developing a land cultivation machine through research, conceptualization, detailed design, prototyping, testing, and mass production. It includes creating detailed engineering drawings, building and validating a prototype, and planning for manufacturing and market deployment. Deliverables encompass design documents, prototypes, test reports, and final products. Assumptions include the availability of necessary technology and regulatory approvals, with constraints like budget and timeline limitations.

4. INTRODUCTION:

In India, many farmers still rely on hand tools for farming because they can't afford machines. But with the population growing, there's a need for more food. Traditional methods of planting seeds by hand are slow and tiring, limiting how much farmers can grow. So, there's a plan to make a low-cost machine called the Smart Cultivation Machine. It'll help farmers work faster and easier by preparing the soil for planting and getting rid of weeds. This machine could make a big difference by helping farmers grow more food

without working as hard. In addition to addressing the challenges faced by farmers, the Smart Cultivation Machine also aims to be environmentally friendly by reducing the need for chemical weed control.

5. LITERATURE REVIEW:

- D.A. Mada, Sunday Mahai, [2013], In this research paper author has mentioned importance of mechanization in agricultural by giving examples. The conclusion from the paper was need of multifunctional single axel vehicle for pre and post harvesting. We have taken this as base for our research and further production of our multifunctional agricultural vehicle.
- V.K. Tewari, A. Ashok Kumar, Satya Prakash Kumar, Brajesh Nare[2012] In this research papers author have done case study on farm mechanization in west Bengal as being part of India it give clear status about availability and progress in India. This ensured us to take right steps compared to current steps.
- Mr.Sheikh Mohd Shahid Mohd Sadik and Mr.H.A.Hussain published a paper on multipurpose farming machine which has a considerable potential to greatly increase productivity of crops.
- F.A. Adamu, B. G. Jahun and B. Babangida [2014] In this paper authors draws our attention towards the performance factor of a power tiller.Among those demand for light weight power tiller was sought out most. Fuel efficiency and field capacity such parameters are also discussed. We take those points in consideration while designing a sustainable multifunctional agricultural vehicle.

6. METHODOLOGY

- **Data collection-** Considering parameters like choose area of interest, topic selection, study of already existing research papers, etc.
- **Selection of Material-** Choosing the right and economical material from scrap available in workshop. Taking guidance of experienced people.
- **Cad Model Making-** Making Cad Model Prototype to design visual model. Finalization of design.
- **Fabrication-** Performing operations like welding, cutting, drilling, bending, fitting to fabricate the frame.
- **Assembly of components-** Gathering all the components together to make precise model. Inspecting condition of all components.
- **Inspection-** Testing and trial of model in farm land Inspection. Inspecting the parameters of model.
- **Results and Calculations-** Calculating efficiency and area covered in given amount of fuel.
- **Finishing-** Giving final touch to model such as painting, oiling.

7. OBJECTIVES:

The primary goal of this project is to create a multifunctional agricultural machine that can level land, plough, and sow. This machine plants seeds at a specific depth and in the correct row relative to other planted seeds. The parameters such as the distance between two seeds, the depth of the seed, and the planting rate vary depending on the shape and size of various seeds. The goal of this project is to provide farmers with multi-purpose equipment that complies with all scientific farming requirements for optimum yield and high-quality crops while requiring less labour and expenditure. To create seed-sowing equipment that only requires a single person. The objectives of the project are to design a system for material handling which is:

- To decrease the overall cost.
- Decreasing labor cost by advancing spaying, cultivating and seed sowing mechanisms.
- To design a machine in small operable land.
- To design such a machine that can perform all the 3 major functions at a low cost.

8. CONSTRUCTIONAL DETAILS:

Our model consists of following components:

- A. Bajaj 4-S Champion's engine
- B. Silencer
- C. Frame
- D. Front Wheel
- E. Sprocket
- F. Ball bearing
- G. Rotavator
- H. Fuel Tank

- I. Chain
- J. Shaft
- K. Handle
- L. Adjuster

➤ **Bajaj 4-S Champion's engine specifications:**

1. Engine Displacement:- 99.35 CC
2. Engine Type:- Air cooled, 4 stroke
3. Bore-stroke:- 50*50
4. Compression Ratio:- 1:1
5. Number Of Cylinders:- 1
6. Valves Per Cylinder:- 2
7. Max Power:- 7.1 PS @8500 rpm
8. Max Torque:- 8.1 Nm @5500 rpm
9. Bore-Stroke:- 54.0. x 45.0 Mm
10. Fuel Type: - Petrol
11. Starter:- Kick
12. Ignition System:- Capacitor Discharge Ignition (CDI)
13. Ignition Timing:- 28-2 BTDC

The electronic ignition has a higher secondary voltage output that fires at all speed even if the spark plug is worn out or fouled. It is not affected by moisture. Spark plug erosion is reduced and longer plug gap is possible. The new design also provides a 3 degree retarded at 5000 rpm to further enhance ignition.

➤ **Silencer**

Silencer may refer to Muffler, a device for reducing the amount of noise emitted by the exhaust of an internal combustion engine Suppressor, a device attached to or part of the barrel of a firearm which reduces the amount of noise and flash.

➤ **Frame**

Frame is constructed from angles made up of iron which are cut as required length and are then welded together with the help of welding torch (Arc welding). Frame acts as a load carrying part and mounting for all the parts of machine including engine, wheels, transmission system, tools, etc. It keeps all the part assembled together. A frame is a structural member that supports other components of a physical construction. A Frame, a basic structure designed to bear a load in a lightweight economical manner.

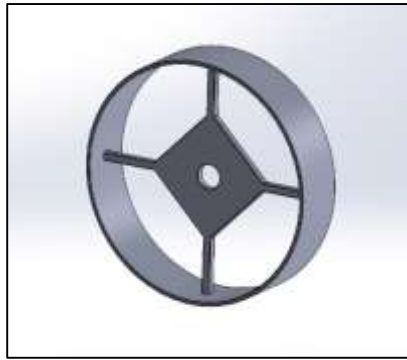
- Length: 58 cm
- Breadth: 32 cm



➤ **Front Wheel**

A wheel is a circular component that is intended to rotate on an axial bearing. Wheels, in conjunction with axles, allow heavy objects to be moved easily facilitating movement or transportation while supporting a load, or performing labor in machines. Wheels are also used for other purposes.

- Diameter: 30 cm



➤ **Sprocket**

A sprocket or sprocket-wheel is a profiled wheel with teeth, cogs, or even sprockets that mesh with a chain, track 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, and differs from a pulley in that sprockets have teeth and pulleys are smooth.

- Total Nos:- 07
- 5 Nos :- 50 mm
- 1 Nos:- 120 mm
- 1 Nos:- 117 mm



➤ **Ball bearing**

The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. It achieves this by using at least two races to contain the balls and transmit the loads through the balls. In most applications, one race is stationary and the other is attached to the rotating assembly (e.g., a hub or shaft). As one of the bearing races rotates it causes the balls to rotate as well. Because the balls are rolling they have a much lower coefficient of friction than if two flat surfaces were sliding against each other.

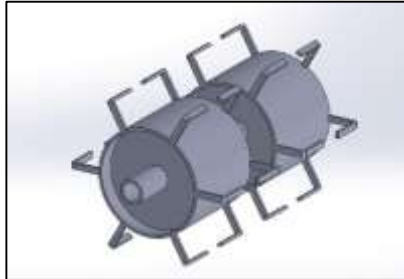
- Wheel bearing:- 3 Nos (6204)
- Side bearing:- 4 Nos (6204)
- Ball bearing:- 2 Nos (6204)



➤ **Rotavator**

A rotary 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. Rotary teeth work near the surface, usually for weed control, whereas chisel plow shanks work deep beneath the surface, breaking up hardpan. Consequently, cultivating also takes much less power per shank than the chisel plowing.

- Diameter:- 17.5 cm
- Length:- 37 cm



➤ **Fuel Tank**

A fuel tank (or petrol tank) is a safe container for flammable fluids. Though any storage tank for fuel may be so called, the term is typically applied to part of an engine system in which the fuel is stored and propelled (fuel pump) or released (pressurized gas) into an engine. Fuel tanks range in size and complexity from the small plastic tank of a butane lighter to the multi-chambered cryogenic Space Shuttle external tank.

- Fuel Capacity:- 9.3 Liters

➤ **Chain**

A chain is a series of connected links which are typically made of metal. A chain may consist of two or more links. Chains are usually made in one of two styles, according to their intended use: A. Those designed for lifting, such as when used with a hoist; for pulling; or for securing, such as with a bicycle lock, have links that are torus shaped, which make the chain flexible in two dimensions (The fixed third dimension being a chain's length). Those designed for transferring power in machines have links designed to mesh with the teeth of the sprockets of the machine, and are flexible in only one dimension. They are known as roller chains, though there are also non- roller chains such as block chain.

- 3 Nos:- 102 cm, 176 cm, 97 cm



➤ **Handle**

Handle is used to guide the vehicle in desired direction. Also, it is used to vary the speed of machine as desired as accelerator is provided on handle. Handle is designed according to human comfort in height and handling of machine.

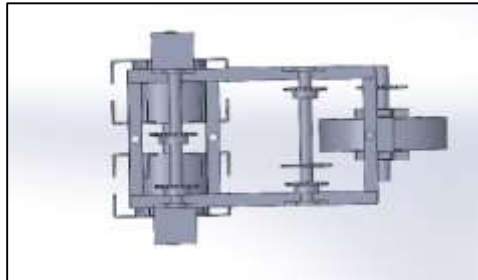
➤ **Adjuster**

It is used to set the level of rotary and it is used to avoid the vibrations of frame

➤ **Shaft**

Shaft is made up of cast steel. It is used to support wheels and provide motion to them with the help of proper transmission system. One sprocket is attached to the shaft which receives motion from engine with the help of chain.

- Supporting shaft Length:- 38 cm, Angle:- 110 degrees
- Steering shaft Length:- 52 cm
- Horizontal shaft 2 Nos Length:- 32 cm



9. Working of Machine

▪ Power Transmission:

- The engine generates mechanical power, which is transmitted via the chain and sprocket system.
- The sprocket attached to the engine shaft drives the chain, which in turn drives the rotavator or wheels.

▪ Soil Tilling:

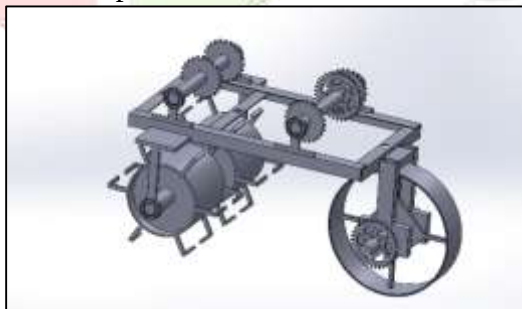
- The rotavator, connected to the shaft, rotates to break up the soil. The depth and aggressiveness of tilling can be adjusted using the adjuster.
- Ball bearings in the rotavator assembly ensure smooth rotation and reduce wear.

▪ Machine Movement:

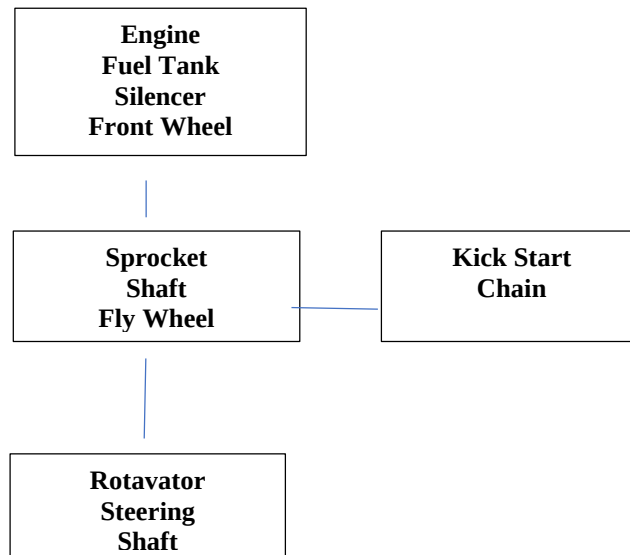
- The front wheel allows the operator to steer the machine.
- The engine power can also be transmitted to the wheels for propulsion, making it easier to move the machine across the field.

▪ Control and Operation:

- The handle allows the operator to control the direction and operation of the machine.
- The fuel tank provides the necessary fuel for continuous operation, with the engine burning the fuel and driving the machine components.



10. Block Diagram



11. Future Scope

- We can interface sensors to this Machine so that it can monitor some parameters.
- We can add Wireless Technology to Control Machine.
- We Can add More Drill for different crops
- There are to be proper provisions are needed to couple the machine with the tractor.
- We can add solar panel for spraying system.

12. Conclusion

After the design and fabrication of the “Smart Cultivation Machine” conclusion which we made are as follows:

- Based on the overall performance of the machine we can definitely say that the project will satisfy the need of small-scale farmer, because they are not able to purchase costly agricultural equipment.
 - The machine required less man power compared to traditional methods, so if we manufacture it on a large scale its cost gets significantly reduce and we hope this will satisfy the partial thrust of Indian agriculture.
 - So, in this way we solve the labor problem that is the need of today’s farming in India.
- The design and development of the land cultivation machine have successfully concluded with a robust, user-friendly, and efficient tool that meets all performance and regulatory standards. Rigorous testing and feedback integration have ensured its reliability and effectiveness in various agricultural conditions. The machine is now ready for production, promising significant benefits in productivity and sustainability for farmers. Continuous improvement and strong customer support will be crucial for its long-term success.

13. References

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