
DESIGN AND FABRICATION OF SEMI-AUTOMATIC MULCHING MACHINE

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ABSTRACT

The agricultural industry has made significant strides in autonomous control of various systems during the last few decades. The traditional method of spreading mulch paper results in a high labor requirement and increased costs. Therefore, we created a semi-automatic mulching system that uses less labor and costs less money.

The traditional way of placing mulch paper is expensive, time-consuming, and labor-intensive. There are already agricultural devices on the market that serve multiple purposes, but they come at a very high cost. Small-scale farmers are therefore unable to afford these machines. The main focus of this project is to lay mulching paper and drill holes in it.

Keywords: Semi-Automatic Mulching Machine, Mulching Paper Lying Machine.

I. INTRODUCTION

In this day and age, automation is generally understood to mean the substitution of mechanical power for human labor in all levels of automation. As the level of mechanization increases, the operation still plays a crucial role in the system, but the demands on physical input change accordingly. By eliminating labor-related issues, the automated system reduces costs, improves accuracy, and lessens human error.

This will be one of the techniques used to help fulfill the growing demands of farmers who want to consistently increase the profitability of their farming by using more efficient materials and machinery. A device that simultaneously lays mulching paper and creates holes in it will be able to do both tasks.

Making holes and laying mulching paper take a lot of time, money, and work. Farmers will experience less effort since it will take less time and money to lay mulching paper using the most practical technique, and the machine will create holes in the paper with just one pass. Mulching is the process of covering the soil surface with various materials to improve the condition of agricultural soils. It is used by farmers and horticulturists. Complexity and change are dealt with in software engineering. It necessitates putting knowledge into practice.

This research suggests a tailored supervised machine learning strategy for semi-automatic assessment. The system picks up on the right and wrong model elements during the manual evaluation of the first models that are submitted. It can then suggest similar model elements for future assessments. When reviewing new submissions, reviewers have the option to manually evaluate all remaining model pieces and either accept the automatic suggestion or modify it based on the model's context.

II. LITERATURE SURVEY

1) "Advance Mulching Paper Laying Machine" by Prof. Amay Tipayale, Mayur S. Salunke, Samadhan U. Thete, Tushar S. Thete, Sandip B. Thete.

In this literature author explain about mulching paper laying machine. Mulching the plastic paper film near the root area of plants is for eliminating the rise of weeds also to retaining water and avoid de-moisturizing the soil but this process requires lots of capital and time. So „Drip irrigation pipe and Mulching paper laying machine“ will reduce the labour cost and time, it will do both the jobs i.e., laying irrigation pipe and mulching paper on the ground at a time. By using various mechanisms, this machine will lay the irrigation pipe and mulching paper at the same time it will make the holes on the paper to provide plantation area after laying the drip irrigation pipe and mulching paper.

To meet the growing needs of the farmers who wish continuously to improve the profitability of their farming by using more efficient materials and machineries this will be one of the methods which will help for improving

it. „Drip irrigation pipe and Mulching paper laying Machine“ will be able to do the laying the irrigation pipe as well mulching paper simultaneously. “A pneumatic dibbling machine for plastic mulch”, American society of agricultural and biological engineers, applied engineering in agriculture.

In this paper, author designed a “Advance Mulching Paper Laying Machine” application which is in an Agriculture, which is going to Laying a paper with reducing human effort and also cost required for employee for laying Mulch Paper on Bed. This system does not need more human labour, Mulch paper avoid the waste water, and Stop the growth of grass. Also, this method we use some Mechanical Mean so the working time is less as compared to the conventional method.

2) “Development of a dual action planting and mulching machine for vegetable Seedlings” by Z.M. Khazimov, G.C. Bora, K.M. Khazimov, M.Z. Khazimov, I.B. Ultanova, A.K. Niyazbayev.

A mechanical mulching of soils during planting seedlings is becoming popular due to the shortage of labour. Evaluation of the dual action equipment for mulching soils along with planting of vegetable seedlings has been undertaken for qualitative performance of operations and productivity. The device was evaluated in production conditions for receiving its operational indicators. The deviation from a longitudinal axis line of planting seedlings was 5 cm and depth of planting seedling was 12 cm. The average field capacity of the combined machine in planting seedlings of vegetables was about 0.405 ha/hr. The average forward speed of machine was 2.03 km/h and thus average quantity of the planted seedlings was 271 seedlings/min.

The most significantly important areas for the development of intensive fruit and vegetable production in Kazakhstan are Almaty, Zhambylsky, South Kazakhstan and Pavlodar. The estimated area of introduction of intensive technologies in four specified areas is 43,200 ha. Kazakhstan is lacking adequate amounts of water for irrigation. Mulching of soils with plastic film in the field is one of a few agro-technical means of impacting on complex factors on which plant growth and development depend. Plastic film as a material for mulching soils is used in field conditions and on protected ground for increasing yield capacity and quality of valuable food crops. The new machine for mulching soils at planting of vegetable seedlings developed by department of machinery use and vocational training of the Kazakh National Agrarian University was tested on research site of the Kazakh research institute of potato and vegetable growing on planting of tomato seedlings.

3) “Performance of Mechanical Plastic Mulch Laying Practices: A Review” by Mr. A.V. Rangbhal, Dr. S.V. Pathak.

The plastic mulch applications in the agriculture are based on type, source and degradability. There is increasing interest in the use of plastic mulching for fruit and vegetable crops in the Agriculture field. Globally the mulching area has increased about 50 per cent since 1991. Mulching can make effective change to increase horticulture crop production in the water scarcity regions. Plastic mulching using black polyethylene paper is recommended for vegetables and has advantage for earliness production, better fruit quality and greater total yield.

This review has covered the major concerns about the plastic mulch application in the Agriculture like its type, source and degradability. There is increasing interest in the use of plastic mulching for fruit and vegetable crops in the Agriculture field. Globally the mulching area has increased about 50 per cent since 1991. Mulching can make effective change to increase horticulture crop production in the water scarcity regions. Plastic mulching using black polyethylene paper is recommended for vegetables and has advantageous for earliness production, better fruit quality and greater total yield. Manual or mechanical techniques are used for mulch laying among that mechanical mulching practices has greater efficiency and uniformity which reduces human efforts. Mulching maintains moisture content level of soil also it helps in weed and insect control.

III. METHODOLOGY

PHASE I

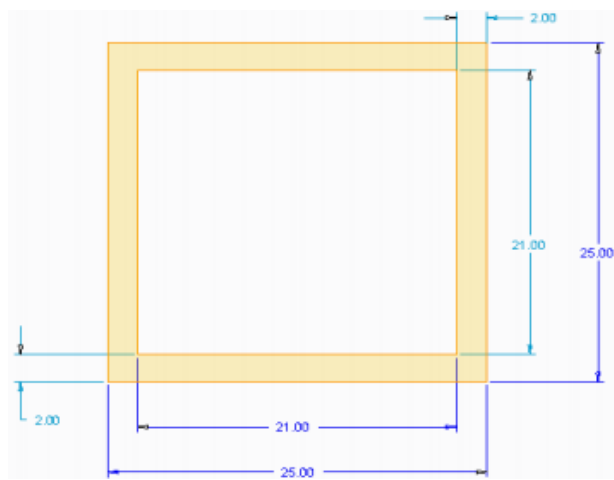
- We started our work with literature survey.
- Search many research papers from various articles and published journal papers.
- Then we collected all the topic related data from these research papers and studied them in detailed manner along with the standard reference books and academic books.

PHASE II

- Worked on diff. Mechanisms that can be useful for our project.
- We have done a rough 3D model in Solidworks.
- After the final analysis and material selection we go out in the market to purchase the required components with required specifications.
- In this purchasing process we approximately estimated the cost required to purchase the components and for machining.
- We selected standard components.
- Finally, our product will be manufactured and results and testing will be carried out.

IV. DESIGN & CALCULATION

Design of Body:-



Material selected for body Mild steel or low carbon steel, Square hollow pipe Size of section: 25x25 mm

Thickness of section: 2 mm

1) Total weight of act on body: 30kg
 = 30kg x g
 = 30 x 9.81 N
 = W = 294.3 N

Now, Distance from Neutral axis is, $x = y = 12.5\text{mm}$

2) Area of cross-section of hollow square pipe is given by
 = $(H \times B) - (B - 2t)^2$
 = $(25 \times 25) - [(25 - 2 \times 2)^2]$
 = Area of C/S = 184mm^2

(where H= height, B= breadth, t=thickness)

3) Moment of Inertia of Hollow square is given by
 = $BH^3/12 - bh^3/12$

Where B = outer breadth = 25 mm

H= outer height= 25mm

b=inner breadth= 21mm

h= inner height =21mm

$I = [25 \times (25)^3/12] - [21 \times (21)^3/12]$

$I = 16345.33 \text{ mm}^4$

4) Maximum bending moment of hollow Square pipe

$M_b = WL^2 / 8$

Assume $L = 1$

$$M_b = 294.3 \times 1^2 / 8 = 36.78 \text{ N-m}$$

$$M_b = 36787.5 \text{ N-mm}$$

$$M_b / I = \sigma_b / y$$

$$\sigma_b = 36787.5 \times \frac{12.5}{16345.33} = 28.13 \text{ N/mm}^2$$

Induced Bending Stress $\sigma_b = 28.13 \text{ N/mm}^2$

Now, theoretical bending stress is given by the equation.

So, Mild Steel as an Approximate Yield Strength is 250 mpa

$$\sigma_b = \frac{syt}{f.o.s} = \frac{250}{1} = 250 = \text{N/mm}^2$$

So the theoretical bending stress is more than the induced bending stress so the design is safe.

5) Motor Calculations

We will select the motor from the availability in the market.

Motor Specifications: Voltage = 24V

Power = P = 150W

Speed = N = 30 Rpm

We know that, $P = 2 \times \pi \times N \times T / 60$

T = 47.12 Nm .

V. MODELING AND DRAFTING

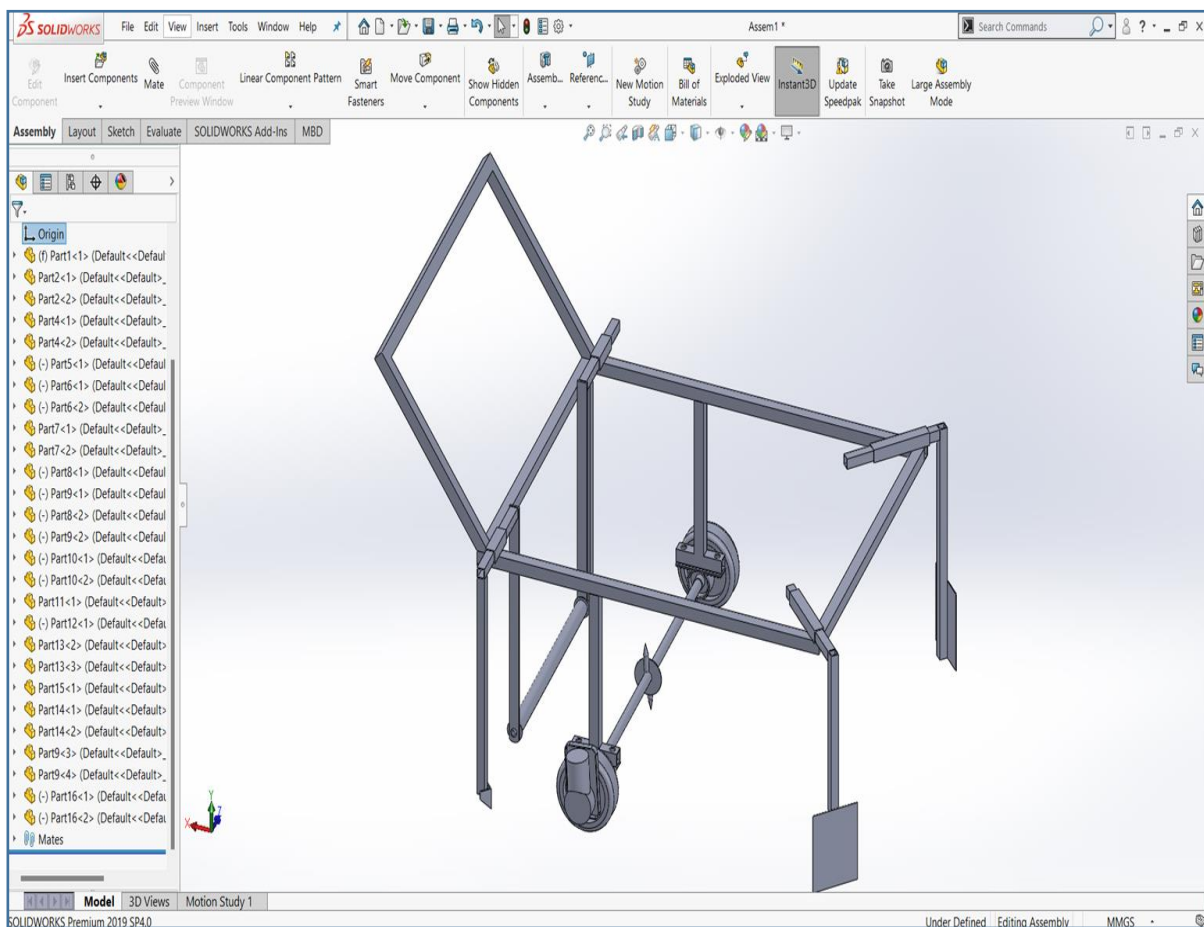


Figure 1: 3D CAD Model .

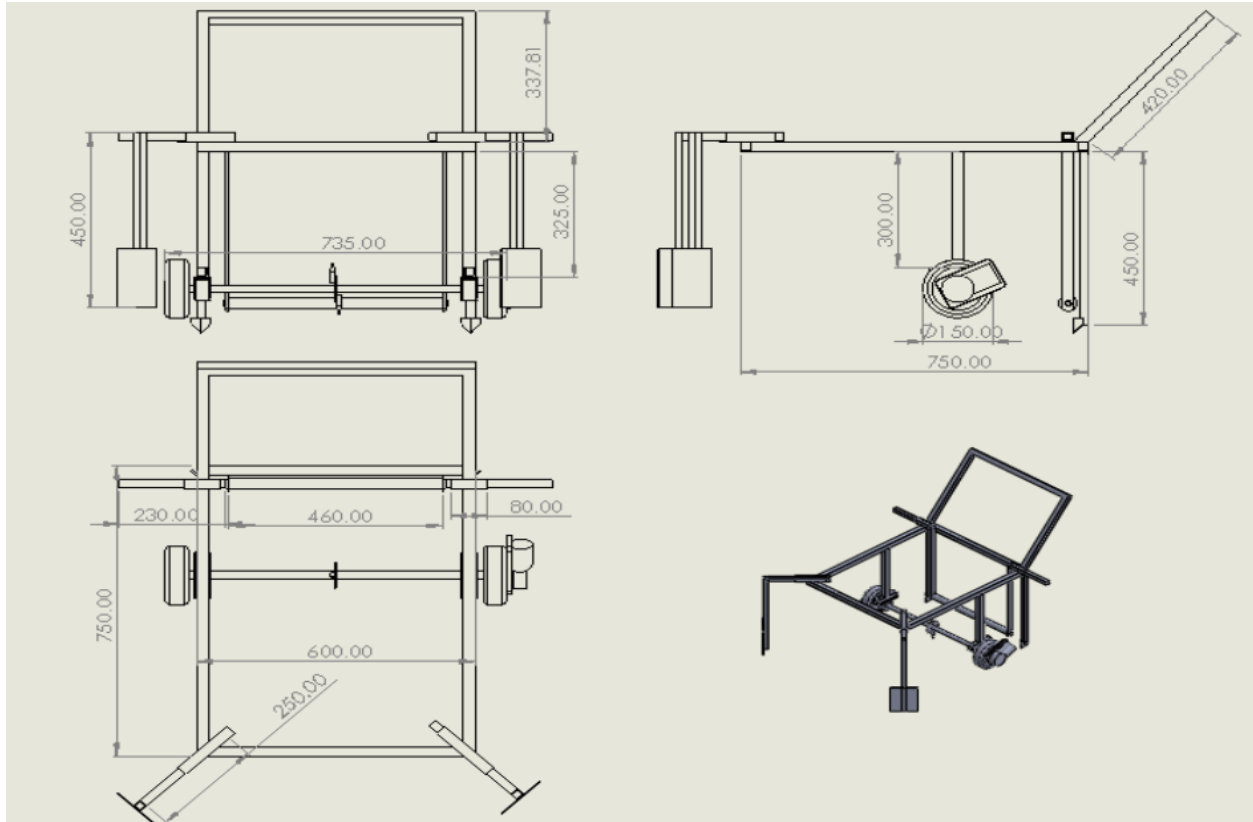


Figure 2: Drafting

BILL OF MATERIAL

SR NO	DISCRIPTION	QTY
01	Wiper Motor (12V)	01
02	Battery (12 V) & 5 (amp)	01
03	Sand Pouring Jaw	02
04	Wheels	02
05	Roller For Mulching Paper	01
06	Wheel to Key Holes	01
07	Shaft	01
08	Tiller	01

VI. RESULTS

The final result or output of a semi-automatic mulching paper laying machine project typically involves a functional machine capable of efficiently laying mulching paper over designated areas in agricultural fields or gardens. The key components of the final output may include:

1. Functional Machine: The machine should be able to perform the task of laying mulching paper effectively and efficiently.
2. Mulching Paper Roll Handling: The machine should have mechanisms for handling mulching paper rolls, including loading and unloading them as needed.
3. Semi-Automatic Operation: While it may not be fully automated, the machine should have semi-automatic features, such as manual controls or timers, to aid in its operation.
4. Precision and Accuracy: The machine should be capable of laying mulching paper with precision and accuracy, ensuring proper coverage and alignment.

5. Reliability and Durability: The final output should be reliable and durable, capable of withstanding the rigors of agricultural environments and frequent use.
6. Safety Features: Safety features should be incorporated into the design to ensure safe operation for users and prevent accidents or injuries.
7. Efficiency: The machine should improve the efficiency of mulching operations, saving time and labor compared to manual methods.
8. User-Friendly Design: The machine should be designed with user convenience in mind, making it easy to operate, maintain, and troubleshoot if necessary.

VII. CONCLUSION

We effectively developed and selected the materials for this project. We utilized the Solidworks software. The design and fabrication of Semi Automatic Mulching Machine Offers a compelling solution for efficient And labour-saving Mulching in agricultural Practices.

VIII. REFERENCES

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