



Automatic Mulch Laying Robot

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Abstract: Mulching has a long history as a practice of increasing soil moisture, controlling plants, controlling soil temperature, and providing a microclimate for plants. To improve crop production, there are many ways to increase efficiency and reduce the amount of water needed to grow crops. But paper mulch (also known as agricultural film) is one of the best ways to cover the soil and provide necessary aeration around your crops.

There are many types of mulch, but plastic mulch is known to require less effort, so we decided to create an automatic mulch laying machine that also has a drip attachment. Moisture management in arid regions is important for crop growth. Covering the film close to the roots of the plant is to eliminate the growth of the plant and at the same time it can retain moisture and not lose soil, but this process will require spending a lot of money and time. Therefore, the "perforated mulch laying machine" will reduce labor costs and time and can complete the job of laying mulch and drilling holes in the ground at the same time.

Mulching film laying machine consists of body, main machine, cutting machine, punching machine, drip ring and punching machine. The machine spreads the mulch onto the prepared planting bed along with the drip line. This will place the cover on the mattress without damaging it and also ensure the hole is the correct size. This product can be widely used in agriculture to grow tomatoes, tomatoes, melons and other hybrid plants. Reducing investment costs and mulch placement time by using the simplest method will not cause trouble for farmers. We can control it via Bluetooth using the DC motor, Bluetooth module, ESP 32 and IoT audio to monitor the temperature, humidity and battery.

Keywords: Mulch Laying, Punching holes in one way, Moisture and Temperature Management, perforated mulch laying machine.

I. INTRODUCTION

Mulching is the process of covering the soil to create good conditions for the growth and development of plants. Mulching is the practice of spreading soil around plants to improve crop growth. Organic or inorganic materials can be used in the cover. Its purpose is to create a physical barrier by covering the soil, to stop the evaporation of the soil, to control vegetation, to protect the quality of the soil and to protect plants from diseases in the soil. Natural mulches are derived from animal and plant materials and, when used correctly, can provide all the benefits of plastic mulches.

Natural mulch helps preserve soil organic matter and provides food and shelter for earthworms and other soil-loving organisms. However, the amount of natural cover is not sufficient and the quality is not constant, more laboratories are needed for exposure. Natural mulches do not always provide adequate weed control; can carry weed seeds and slow down spring in the soil; This can delay growth and development in warm season vegetables.

To meet the needs of growing farmers and increase profits by using different types of machines at low capital costs, manual mulchers are the way to go. Benefits include increased soil temperature, easier plant management, moisture management, reduced pest control, higher yields and more efficient use of soil nutrients. Natural mulches such as straw, compost, straw and sawdust were originally used, but paper and plastic have been tried in the last 40 years. Paper is considered inferior and more expensive than plastic due to its poor wet strength and high cost. As a result, plastic mulches have become an important choice for agriculture. Plastic mulch is increasingly used on high-value crops such as tomatoes, melons, cucumbers, pumpkins, peppers and strawberries, and low-yield crops such as corn and ginger.

For arable land, the best protection to reduce water evaporation is to provide some surface protection to the soil. Mulching is best achieved by mulching or tillage methods that leave plant residues on the soil surface. Mulching is a long-standing practice among gardeners to prevent moisture loss and control weeds. It is also growing in popularity as cities restrict water use for lawns and landscapes. Mulch is a layer of organic or inorganic material that covers the root zone of plants to benefit the roots and soil.



II. LITERATURE SURVEY

1. M. Veerangowda Research focus on Development and evaluation of tractor operated plastic mulch laying in 20 March 2023 in that Designed an advanced mulching paper laying machine, which can lay the mulching paper on the beds of the soil as well as the drip pipe with it. This system does not need more human labour, mulching paper reduce the wastage of water and stops the growth of grass. Also in these method researchers uses some mechanical means so that working time is reduced compared to the conventional method.

2. The goal of the Research Focus on Advanced Mulching Paper and Drip laying Machine, led by U.Y. Siddha (June 2022-23), is to develop automatic mulching paper laying machine which also have attachment for the drip laying. They have prepared one working model in which drip line is guided below the paper by drip line director and at the same time mulch paper is placed over the bed by paper pressing rollers.

3. Prof. Amay Tipayale, Mayur S, Salunke, Samadhan U, Thete Tushar (2022) are conducting research on system that verifies a pair of methodology at a similar time. For each analysis procedures, the coordinates of the centre of the follower are required at very little increments of the cam angle. Every procedure is easily programmed and rely solely on the follower coordinates and not the follower sort.

4. Mr. Deokar A, Mr. Hivrekar P. D, Mr. Rakshe P.R, Mr. Tajane O.K focus on Automatic Mulching Paper Laying Machine in 2018 in that We know that avoiding growth of the weed on farm is very costly and time-consuming task. Also, in dry areas maintaining moisture in soil is very important for crop life.

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 labor cost and time, it will do both the jobs i.e. laying irrigation pipe and mulching paper on the ground at a time.

III. OBJECTIVES

1. Develop a machine which reduce cycle time of laying mulch film.
2. To reduce human efforts required for drip line plotting, mulch paper laying and hole punching.
3. To reduce number of workers required.
4. To minimize the production time. and miss-operations.
5. The laying of plastic mulch, drip pipe and hole punching will be done in one pass.
6. Reducing the investment of the small farmers.

IV. METHODOLOGY

1) The mulch roll is wrapped/fixed on rollers supported on the frame. The two connecting lines will be installed one by one, connected to the wheel of the chain drive and the connecting rods will be placed on the rollers.

2) Applying force to the punching machine using tools such as cams and followers will put more weight on the paper than punching the cutting machine using a circle beater.

3) After passing to the other line to call the paper roller, it is placed in the soil, and the soil is covered on the side of the paper, and the metal plow is added on the side.

4) The paper is fed by the working process of the roll and the coating material is ensured to be distributed smoothly and evenly on the bed. There is a paper punch on the front wheel of the machine.

5) As the machine speed changes, the speed of the cutting disc also changes, resulting in drilling to length regardless of machine speed. The cutting wheel works by using its own weight, using gravity to punch holes into the paper. This will help keep the cover tight and prevent it from coming loose. The ploughing depth can be adjusted to keep the paper at the desired height, usually between 7 and 10 centimetres.

6) The model's components include an ESP 32, a relay, a DHT 11 temperature and humidity sensor, a Bluetooth module HC-05, a 12-volt battery, two motors for moving the paper, one for punching, and a grass cutter for controlling weeding. The machine's primary function is to apply the mulching paper.



Poking holes in the dirt and on its beds. By employing the most practical techniques and completing the entire procedure in a single machine pass, it might assist to lower the initial cost and time required to lay the mulching paper. when the machine is moved forward and towards the bed by the operator using the handle. Even so, paper is positioned beneath the front wheels because of the wheels' simultaneous rotation.

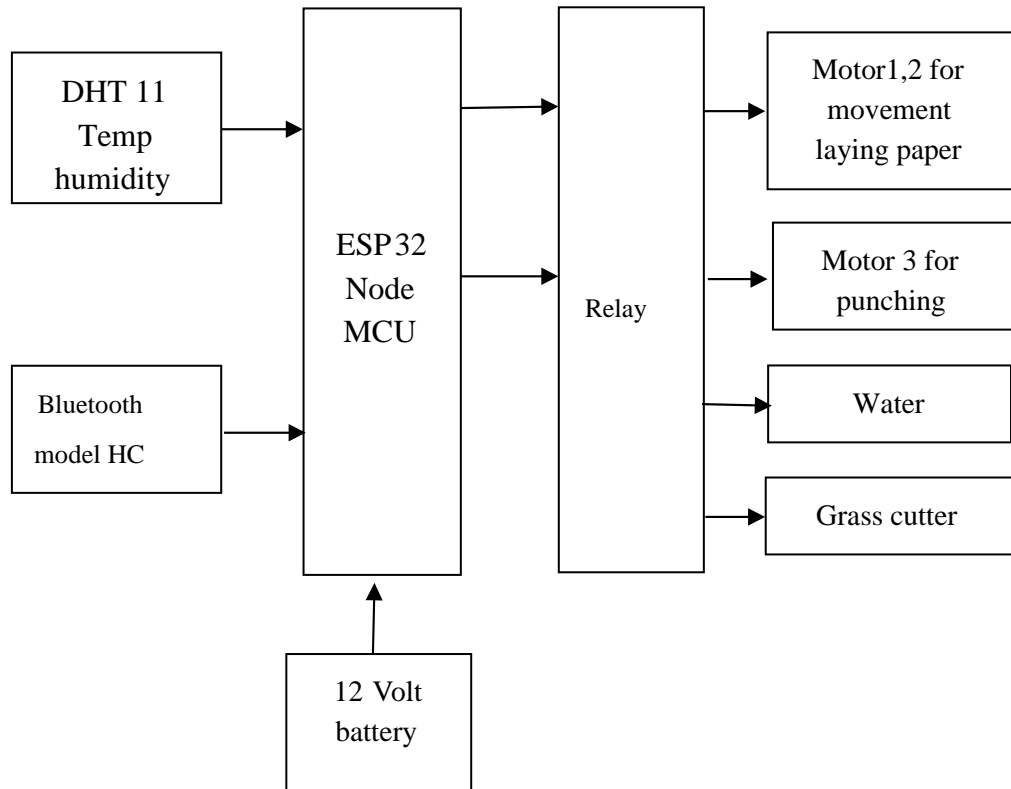


Fig.1: Block diagram

V. HARDWARE AND SOFTWARE REQUIREMENTS

5.1 HARDWARE SPECIFICATIONS

1. ESP32 Node MCU
2. Relay module
3. Bluetooth Module
4. DC Motor
5. Battery
6. DHT 11 Temperature Humidity Sensor

5.2 SOFTWARE REQUIREMENTS

1. Embedded C
2. Arduino IDE

VI. APPLICATIONS

1. It can be the part of smart agriculture automation.
2. It is mainly used in Agriculture fields such as growing tomato, potato, brinjal etc.,
3. It is also widely used in field of horticulture and fruits.



VII. ADVANTAGES

1. Increase in Crop Yield.
2. Reduction in Weed growth.
3. A good alternative to Costly Machines.
4. Multifunction like Drip and Hole Making attachment.
5. Good crop yield in low water availability areas.
6. Simple working and easy to use and even unskilled worker can use it.
7. We can monitor the field Temperature, humidity and battery volt through the IOT.
8. Prevents soil erosion.
9. Manipulate light, temperature and moisture.
10. Protects the crops from insects.
11. Warms the soil for Optimum Growth of Crops.
12. Controlling through the Bluetooth

VIII. RESULTS AND DISCUSSION

By automating both the mulch laying and hole punching processes, the robot significantly reduces the time and labor required to prepare planting beds. This efficiency allows farmers, gardeners, and landscapers to cover larger areas in less time, increasing overall productivity. Mulch paper helps suppress weeds, conserve moisture, and regulate soil temperature, promoting healthier plant growth. By accurately punching holes in the mulch paper at predetermined intervals, the robot ensures proper spacing for planting seeds or seedlings while maintaining these beneficial properties. Mulch paper, combined with accurately punched holes, provides effective weed control by preventing weed growth in the planting rows while allowing crops to thrive. This reduces the need for manual weeding and herbicide usage, contributing to sustainable and environmentally friendly agricultural practices.

The robot's precision in punching holes at predetermined intervals ensures uniform plant spacing, which is crucial for maximizing yield and optimizing plant growth. Consistent plant spacing also facilitates mechanical cultivation and harvesting operations. Mulch paper helps conserve water by reducing evaporation from the soil surface, allowing for more efficient water usage in irrigation. Additionally, the use of mulch paper and automated hole punching minimizes the need for chemical weed control methods and reduces overall resource consumption. The robot can be programmed to accommodate various planting configurations and spacing requirements, making it suitable for a wide range of crops and planting applications. This versatility enhances its usefulness across different agricultural and landscaping contexts. By automating the mulch laying and hole punching processes, the robot reduces labor costs associated with manual preparation of planting beds. It also helps minimize the need for herbicides and irrigation water, leading to potential cost savings for farmers and gardeners.

Overall, the result of integrating mulch laying with hole punching in mulch paper using an automated robot is a more efficient, sustainable, and cost-effective method of preparing planting beds, ultimately contributing to improved crop yields and environmental stewardship.

IX. CONCLUSION

In conclusion, the integration of mulch laying and punching holes in mulch paper through an automated robot represents a significant advancement in agricultural and landscaping practices. This innovative robot offers numerous benefits, including increased efficiency, improved plant health, enhanced weed control, consistent plant spacing, resource conservation, versatility, and cost savings.

By streamlining the process of preparing planting beds, the robot reduces the time, labor, and resources required for these tasks, while also promoting sustainable and environmentally friendly practices. Its ability to automate both mulch laying and hole punching ensures precision and uniformity, leading to better crop yields and healthier plant growth. Overall, the mulch laying and hole punching robot represents a valuable tool for farmers, gardeners, and landscapers seeking to optimize their operations, increase productivity, and minimize environmental impact. Its versatility and effectiveness make it well-suited for a wide range of applications, contributing to more efficient and sustainable agricultural and landscaping practices now and in the future.



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