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Development of drip pipe winder

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Abstract

Drip lateral pipe winding machine with bunching is a revolutionary system designed to streamline and optimize the rotating process of drip irrigation pipes. The existing method of manually rotating drip pipes is time-consuming and labour-intensive, resulting in increased costs and potential quality issues. It also reduce the physical effort of farmers and comparing to other mechanization it is very efficient and less time consuming This project presents a novel solution by introducing a machine specifically designed for winding drip lateral pipes with high precision and efficiency and with bunching technology. The drip lateral pipe winding machine incorporates advanced motor and drum control systems, enabling seamless and consistent rotating of drip pipes according to predefined specifications and enhanced product quality through standardized rotating techniques, and increased overall profitability. Additionally, the machine's minimizes human errors and ensures consistent winding quality across all produced drip pipes, the drip lateral pipe winding machine represents a significant advancement in rotating of the drip irrigation pipes.

Keywords: Precision control; Semi automated bunching; Winding and rotational motion; Reduce time and labour cost

1. Introduction

Irrigation is the practice of applying controlled amounts of water to land to help grow crops, landscape plants, and lawns. Irrigation has been a key aspect of agriculture for over 5,000 years and has been developed by many cultures around the world. In the agriculture sector lack of water to the plant roots is the major issue for the growing of the crops and plants. The goal is to apply the water to the plants as uniformly as possible, so that each plant has the amount of water it needs, neither too much nor too little. There are several methods of irrigation. They vary in how the water is supplied to the plants. In surface irrigation systems, water moves across the surface of agricultural lands, in order to wet it and infiltrate into the soil. In sprinkler or overhead irrigation, water is piped to one or more central locations within the field and distributed by overhead high-pressure sprinklers or guns. A system using sprinklers, sprays, or guns mounted overhead on permanently installed risers is often referred to as a solid-set irrigation system.

2. Literature Review

- KARLE D.S, (et.al.) 2021 "PERFORMANCE EVALUATION OF TRACTOER DRAWN DRIP LATERAL COILER" It was observed that the drip hose are winded by using tractor PTO and average field efficiency of the tractor operated PTO lateral coiler is 87 % and the cost of coiling operation in tractor operated lateral coiler was observed as Rupees 1500 / ha. From the Literature, Here drip hose are rotated by using tractor PTO system, which cannot be used by everyone and everywhere. So we modified it to small machine without tractor application and its is operated by using motor.
- FANZHAO MENG (et.al.) -2018- "DESIGN OF THE AGV TROLLEY FOR TRANSPORTING THE DRIP IRRIGATION BELT ROLL". The design requirements of AGV trolley for the transformation of drip irrigation belt production line, and on this basis, completes the structure design of AGV trolley for drip irrigation belt winding. This

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machine is used for the rotating the full drip hose of 500 meter roll in correct alignment. From the literature, here we have use the alignment mechanism for proper bunching by using special arrangement.

3. Methodology

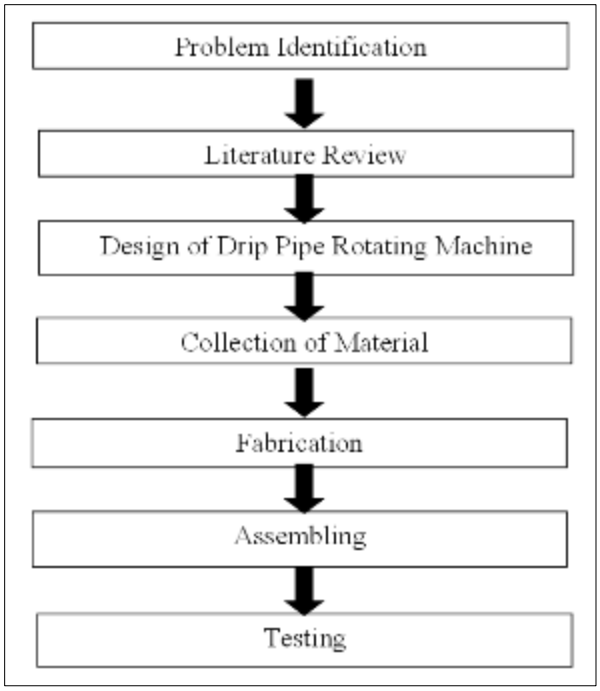

Figure 1 Methodology

3.1. Problem identification

- Rotating the drip pipe manually the pipe is got damaged due to folding and the nozzle of the drip tube also get damaged.
- Due to keeping the drip along the margin of the bunds the drip tube is bitted by the rodents like rat.
- Rotating the pipe manually the labor is physically stressed.
- Drip tubes are failed to line up properly by humans while coiling**.**

3.2. Collection of materials

We collected the material like Dc motor, mild steel, sheet metal to design the drum and the out frame of the machine, battery to provide power supply, solar panel to recharge the battery, spur gear.

3.3. Fabrication

Fabricating the drum for rotation, automatic bunching mechanism for bunching the pipe for proper arrangement for making the machine.

3.4. Assembling

Joining the drum with motor for rotation, spur gear is used to reciprocating motion, attaching the bunching mechanism in the drum and the solar panel are given wire connection with the battery for recharging purpose.

3.5. Testing

We test the time taken efficiency of this machine with manual method in the field.

4. Components and its properties

4.1. Components used

- Mild steel
- Spur gear
- Shaft
- Bearing
- DC Motor
- Inverter
- Battery
- Wheel
- Timing pulley
- Motor speed controller
- Accelerator

4.2. Mild steel

Mild steel, also known as low carbon steel, is a type of carbon steel with low carbon content, typically around 0.05-0.25%.

4.3. Spur gear

Spur gears are a type of cylindrical gear with straight teeth that are mounted on parallel shafts. They are one of the most common types of gears and are used to transmit motion and power between parallel shafts.

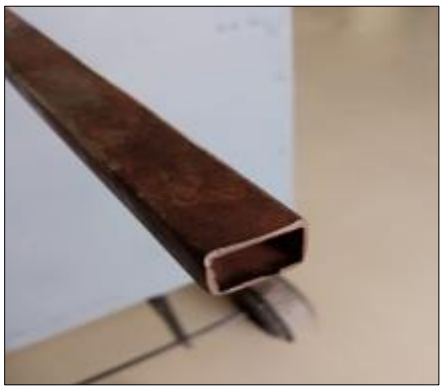

Figure 2 Mild steel

Figure 3 Spur gear

4.4. DC motor

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields.

4.5. Bearing

A bearing is a mechanical component that reduces friction between moving parts, enabling them to rotate or move with less resistance.

Figure 4 DC Motor

Figure 5 Bearing

4.6. Shaft

A shaft is a long, cylindrical, and rotating component used to transmit power or motion between different parts of a machine or system. It plays a crucial role in various mechanical applications, such as engines, gearboxes, and conveyor systems. Shafts can be made from different materials like steel or aluminium.

4.7. Specifications

- Shaft diameter: 12mm.
- Material: mild steel
- Length: 26 inches

Figure 6 Shaft

4.8. Inverter

An inverter is an electronic device that converts direct current (DC) electricity into alternating current (AC). It is commonly used to power AC devices and appliances from DC sources like batteries or solar panels. Inverters are crucial for off-grid systems, emergency backup power, and renewable energy installations

Figure 7 Inverter

4.9. Battery

Figure 8 Battery

A 12V DC (Direct Current) battery is a rechargeable energy storage device that provides a constant voltage output of 12 volts. These batteries are commonly used in a wide range of applications, from automotive and marine systems to portable electronics and backup power supplies.

- **Voltage:** As the name suggests, these batteries provide a consistent 12-volt output, which is widely used to power low-voltage electronic devices and systems.
- **Capacity:** The capacity of a 12V battery is measured in ampere-hours (Ah) or milli ampere-hours (MAH), indicating how much charge it can store. Capacity varies depending on the specific battery type and size.
- **Rechargeable:** Most 12V DC batteries are rechargeable, allowing them to be used repeatedly with a charger. Lead-acid batteries and lithium-ion batteries are popular choices for rechargeable 12V power sources.

4.10. Wheel

Figure 9 Wheel

A plastic wheel is a wheel made from various types of plastic materials, such as polyurethane, nylon, or polypropylene. These wheels are lightweight, durable, and resistant to corrosion and moisture, making them suitable for a wide range of applications.

4.11. Timing pulley

Figure 10 Timing pulley

A timing pulley is a mechanical device used to transmit rotational motion between two parallel axes, typically with the help of a toothed belt or chain

4.12. Motor speed controller

Figure 11 Motor speed controller

A motor speed controller is a device or system designed to regulate the speed of an electric motor by controlling the amount of power supplied to it.

4.13. Accelerator

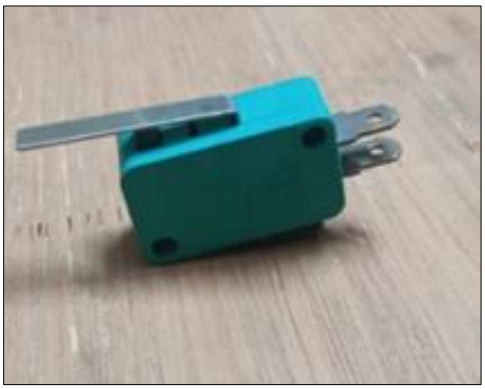

Figure 12 Accelerator

A motor accelerator is a component or system designed to control and manage the acceleration of an electric motor.

5. Design and fabrication process

5.1. Design

Design is the process of creating a plan or specification for the construction or creation of something. It involves a variety of activities, such as researching, brainstorming, sketching, prototyping, and testing, to arrive at a final product or solution that meets specific objectives and requirements. The goal of design is to solve problems, improve functionality, and create a better user experience. Design plays a vital role in evolving field that requires creativity, innovation, and adaptability to keep up with changing trends and technologies. Once initial ideas are formed, sketching and prototyping come into play. Sketching allows designers to visually represent their concepts, while prototyping involves creating tangible models or mock-ups to test and refine ideas. These prototypes are then subjected to testing and evaluation to identify any issues or areas for improvement. Feedback obtained from testing is used to iterate and refine the design further, until a final product or solution is achieved.

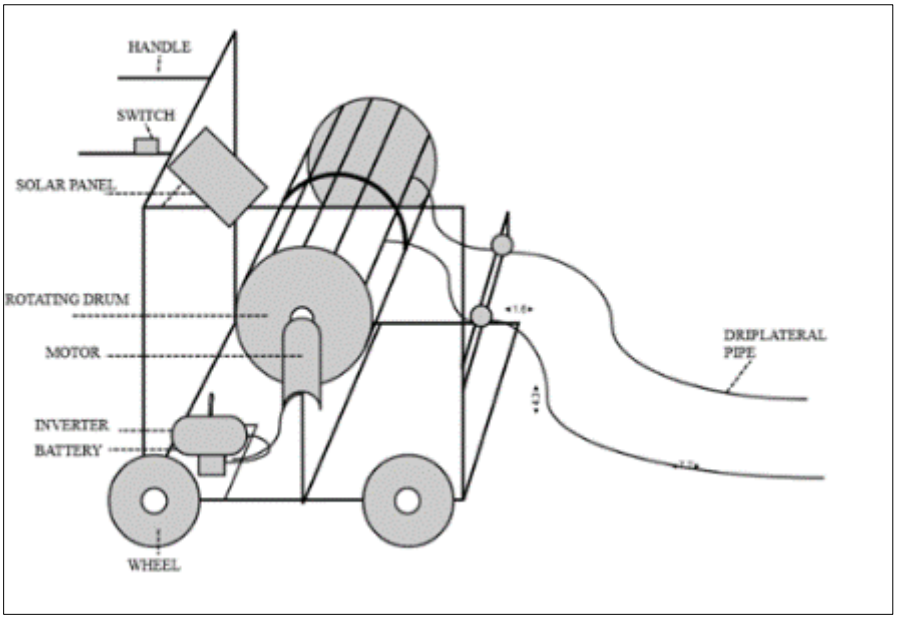

Figure 13 2D Design

5.2. Fabrication process

Fabrication refers to the process of manufacturing or building something, typically using raw materials or pre-manufactured components. Fabrication can involve a wide range of techniques, tools, and processes, depending on the

type of material being used and the desired product. In industrial manufacturing, fabrication often involves the use of specialized machinery, such as lathes, milling machines, or CNC routers, and join materials. This can include cutting and welding metal or forming composite materials. The goal of fabrication is to create a finished product that meets specific requirements in terms of functionality, durability, and aesthetics. Fabrication can involve a high level of precision and attention to detail, particularly when working with complex components or materials with specific PROPERTIES.

5.3. Working principle

When the switch is on the power from the battery the motor starts to rotate , the drum which is attached to the motor also starts to rotate , while the rotates the hose is placed in drum rotated and the reciprocating mechanism plays on major roll to avoid rotating of pipes in same place after rotating the plate is get removed and the tubes are get bunched by the semi-automated bunching mechanism and placed in safe place**.**

6. Results and discussion

6.1. Efficiency testing

We successfully created a model. Our subsequent step is to test the functionality of the drip pipe rotating machine within the primary field of drip irrigation field. We aim to observe its performance and efficiency, with the goal of developing a cost-effective and time-saving mechanism that perfectly rotates the lateral drip hose lines. To evaluate the efficiency of the drip pipe rotating machine, we test the drip pipe rotating machine on drip irrigation field. From these results, the manual method of rotation it takes 2:30 minutes to rotate a single hose line of 15 meter at the same time it also causes damage in lateral pipes. In drip pipe rotating machine it can rotate 13 hose line in 10 minutes without causing any damage in the lateral pipes. It indicates that the drip pipe rotating machine is significantly more efficient and protective compared to the manual method, as it can rotate almost twice the number of lateral pipelines at the same time. The use of the drip pipe rotating machine scan greatly enhance the speed and effectiveness of the drip lateral pipe rotating process.

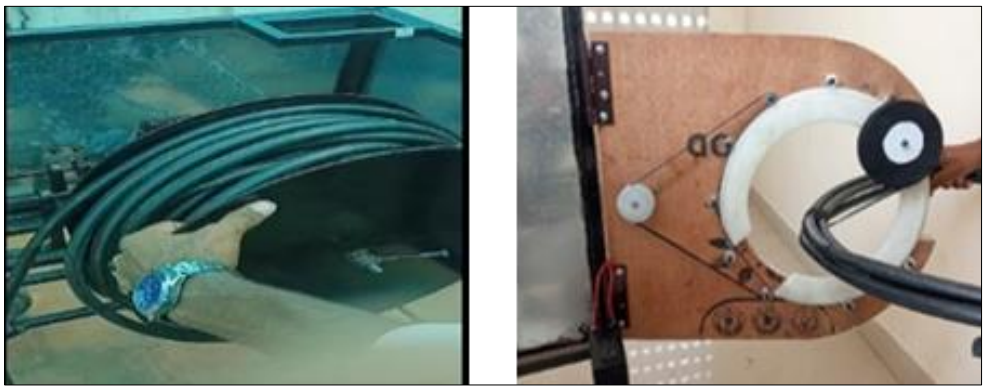

Figure 14 Efficiency testing

6.2. Efficiency

Table 1 Efficiency of the Drip pipe winder

S. No	Method	Length of hose	Time taken for rotating 1hose	No of drip hose rotated in 10 minutes
1.	Manual method	15meter	2.30 min	4
2.	By using machine	15meter	1 min 30sec	26

Figure 15 Schematic View of Drip Pipe Winder

7. Conclusion

Drip irrigation had play an important role on agriculture in India. As a country that relies heavily on agriculture, India has faced many challenges, including water scarcity, poor irrigation practices, and soil degradation. Drip irrigation technology has helped to address these issues and improve the efficiency and productivity of agriculture in India. Our drip lateral pipe winding machine in drip irrigation can bring several advantages compared to manual rotation and bunching. It reduces damages during winding process comparing to manual method. Our machine can save time and increase efficiency, especially for larger fields where manual rotation can be time-consuming and labor-intensive. Additionally, our machine can help to ensure a consistent rotation of the lateral pipes, which can improve the effectiveness of the irrigation system. Overall, our drip pipe winding machine can bunch the lateral pipes and lead to optimize the process, cost savings, and better irrigation outcomes compared to manual rotation methods

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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