

Multipurpose Attachment System for Ploughing, Spraying and Creating Ridges in Agriculture

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Abstract. Small-scale farmers would be benefited from versatile attachments that may be used to automate chores that would typically need both human and animal efforts in terms of cost and labor. Farming is made simpler and faster by mechanization. For practically every task in agriculture, there is a machine accessible. Various machines are used to do all the steps right from preparing the soil to crop harvesting and beyond, thus making chores not only easier to complete but also do them effectively. Modern agricultural equipment is more expensive and out of the reach of the majority of farmers with little resources. Due to their low-income levels, most farmers are unable to invest in the purchase of significant machinery. Given the aforementioned circumstances, it is necessary to create a piece of machinery that can be used for a variety of tasks, including ploughing, creating ridges, and Spraying. In order to address this issue the present paper reports the fabrication of a novel machine with multifunctional attachments to carry out above mentioned tasks efficiently and economically.

Keywords – Agriculture, Ploughing, Spraying, Ridges, Multifunctional Attachments.

1 Introduction

The backbone of the Indian economy is agriculture. Every nation's economy is built on its agricultural sector. In our country, the primary sector, or agriculture, employs over 60% of the workforce. This study presents a design proposal for a platform for the Internet of Things-based agricultural information services. Fieldwork, like ploughing, is quite prevalent in the agricultural industry. Due to their tremendous financial hardship, farmers in underdeveloped nations are unable to purchase tractors and other expensive farming equipments. They use conventional farming methods such as use of human and animal labour, which eventually reduces the yield. In India, many farmers also use bullocks and horses for this job. Due to this, India's agricultural productivity has lagged behind compared to that of other countries. The Agricultural field has witnessed many fluctuations since years, in terms of the way tasks are performed. Humans have always tried to decrease efforts & found a way to do tasks in a smarter & efficient way. There are machines available to perform almost all the different processes involved in farming.

M. Masood et.al. [1] developed centers around the automation of agriculture techniques. Y. Reddy et.al. [2] put efforts to integrate mechanical systems into agricultural fields for agricultural activities. Muruganantham S et.al. [3] fabricated a three in one agriculture machine which could be used to sow seeds into the land once the previous processes are completed. A. Nair et.al. [4] developed Multipurpose agricultural equipment used for tilling, ploughing, seeding, weeding and for leveling purposes. Mahesh Borbale et.al. [5] created a Multipurpose agricultural equipment that could be used for multiple processes in agriculture such as tilling, fertilizing, sowing, leveling along with weed removal purposes. Suyog Gaware et.al. [6] developed a working model of power tiller which is used to work in large area farms. V. Jayaseelan et.al. [7] fabricated a weeder machine which is used for removing weeds and is operated by battery. A multipurpose farming machine that will enhance crop productivity was developed by M. Sheikh et.al. [8]. P. Mahajire, H. Gola et. al [9] created a multipurpose electric agriculture vehicle. Trikeswar Pradhan et.al. [10] manufactured an electric powered machine with removable handle and wheel using solar energy. N. Mishra et.al. [11] manufactured a multipurpose machine which could serve many purposes like Ploughing, Leveling, Weeding, Seeding and Tilling. S. Lande et.al. [12] fabricated Multipurpose agriculture tiller which is used for pesticide sprayer, harvesting, seed sower, weeding. A. Kannan et. al. [13] manufactured a multi-utility agricultural machine for seed metering and soil leveling. Nachiketh R. et.al. [14] fabricated a harrowing machine of low cost that consumes less time, man power and thereby increases productivity. A special kind of seeder was developed to drill seeds with complete mulching of rice residue by Chaosu Li et.al. [15]. However it is found that most of the machine is reported here costly and design the specific task. R. Raut, S. Murkute [16] created a solar operated machine for agriculture purpose that can be driven by using BLDC. A. Kumar et. al [17] showed how the agriculture can be transformed into smart agriculture with the help of technology. R. Murali et. al. [18] manufactured multipurpose solar powered Agribot.

Considering the above mentioned points regarding the available machines, there seemed a need of designing a machine which would be better than the existing ones. Hence the machine that is designed, performs many tasks within a single system. It can perform tasks such as ploughing, spraying, & making ridges. It is essential to boost the productivity of farming and agricultural processes in order to increase yields and cost effectiveness. The objective is to create a machine that aids several agricultural tasks. The ridger is a tool that simultaneously slices and twists the dirt in two opposing directions to create ridges, while the spraying machine is used to spray chemicals on plants to protect them. All of these duties can be performed by this single device. This multipurpose agricultural tool has been designed as a piece of machinery with many functions, including ploughing, spraying, and creating ridges. Due to its low cost, the majority of people who are engaged in farming would be able to use it and eventually contribute to higher productivity.

2 Block Diagram

The design novel machine system mainly comprises of 4 main blocks: Control Unit, Spraying unit, Ploughing attachment, Driving unit.

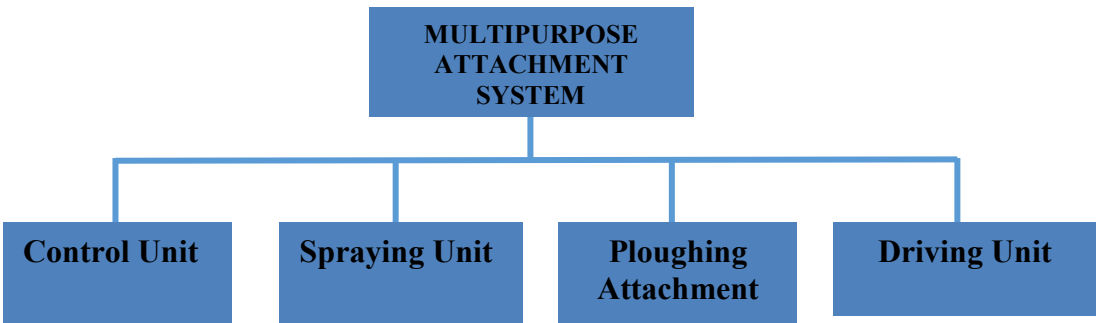


Fig. 1. Block Diagram

3 Componets

The Components used to fabricate the machine include :

- Motor
- Iron Rods
- Iron Wheel
- Wheel Angles
- Chain
- Chain Sprocket & Bearing
- Iron Claws
- Spray Tank
- Accelerator

4 Material Selection

The most practical material is chosen for the fabrication of the portable ploughing and spraying equipments after research on various material qualities. The properties that are taken into consideration are, durability, strength, weight, availability, and material cost. To ensure that the frame of the portable Ploughing, Ridger, and Spraying equipment does not break under the pressure applied, a material with appropriate strength is used. The machine is constructed using a variety of materials, including rectangular iron rod.

5 Modelling

Before constructing the real model, the virtual model is evaluated using Fusion 360 modelling software. A virtual 3D model of the Machine was first built and studied by using fusion 360 model. Based on the specifications measurements for the machine a 2D sketch of the machine was created and then it's 3D model was subsequently built. Fig. 3 shows the final 3D model of the machine. Fig. 2 shows the final 3D model of the entire system along with the parts labeled. Fig 3,4,5,6,7 shows the machine from different view points.

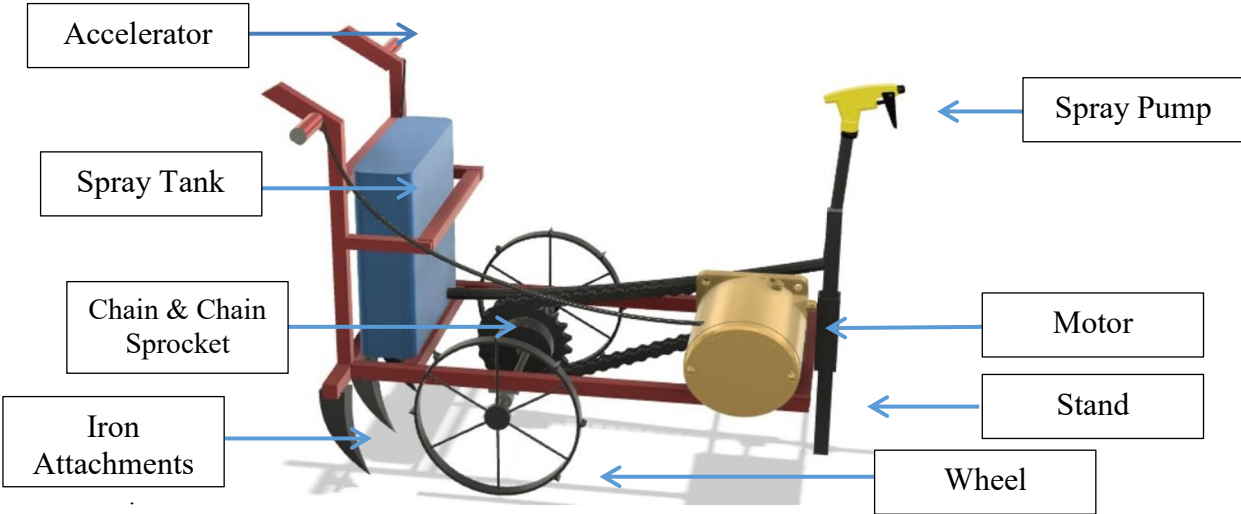


Fig. 2. 3D Model

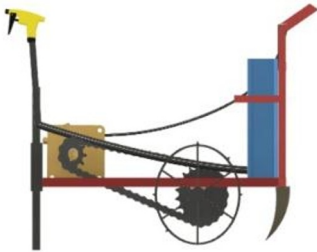


Fig. 3. Right Side Viewpoint

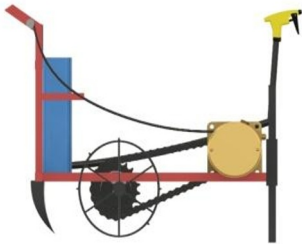


Fig. 4. Left Side Viewpoint

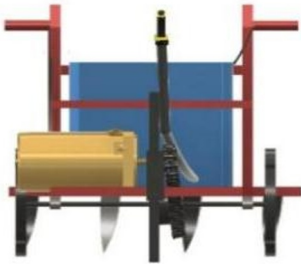


Fig. 5. Back Viewpoint

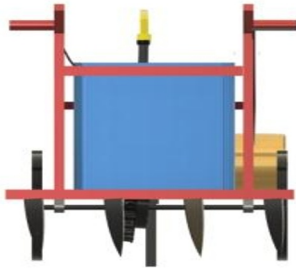


Fig. 6. Front Viewpoint



Fig. 7. Top Viewpoint

6 Fabrication

Choosing materials that are lightweight, reliable, and actually accessible, like a rectangular iron rod, was the next step. On the material, various machining operations were carried out. Different machine parts such as handles, stands, supports, and rectangular iron frames were made. Welding and shaping procedures were performed during fabrication. All the Different parts hence produced were assembled together to fabricate the actual machine. Fig 8. shows the final fabricated machine along with the labeled parts of the system. Fig 9,10,11,12,13 show the final fabricated machine from different view points.

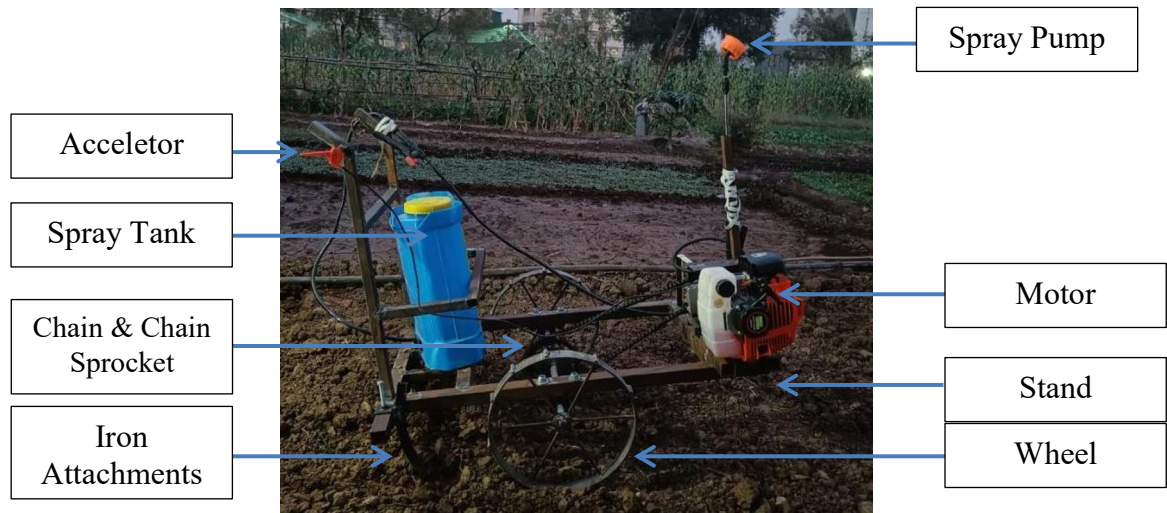


Fig. 8. The actual Machine



Fig. 9. Right Side viewpoint



Fig. 10. Left Side viewpoint



Fig. 11. Back viewpoint



Fig. 12. Front viewpoint



Fig. 13. Top viewpoint

7 Result & Discussion

This Innovative Agricultural Multifunctional machine was successfully fabricated according to its 3D design and implemented in fields. It's Testing in the fields was successful and appreciated by the farmers. The machine is less bulky than the other multipurpose machines because all the pieces are connected so that it is possible to rearrange or quickly assemble with fasteners. For farmers, the project is tremendously beneficial. Anyone working in the field may buy the machine at lower costs and easily run it in the fields. Fig 14 shows the machine performing ploughing task while Fig 15 shows spraying. Fig 16. is a picture of farmers using the machine practically in their fields.



Fig. 14. Ploughing



Fig. 15. Spraying



Fig. 16. Farmers using the machine

8 Conclusion

A novel machine with a multipurpose attachment system useful in agriculture is successfully designed and demonstrated. This machine can be used for ploughing in fields. Ploughing arrangements of the system can be changed to cover a wider area or to only apply in a short area. The Range of spraying system is wide and can be used from longer distances. It is attached to spraying system for fertilizer spraying. The Machine is light, low cost, and versatile compared to other machines. The Attachment system can be attached or detached

as per the requirements. Multiple tasks can be performed effectively by using this. It is easy to assemble or dismantle the machine.

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