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Design and Fabrication of Multifunctional Agriculture Vehicle

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Abstract: ***A vehicle reduces human efforts and carries out the many tasks accurately is defined as multifunctional agriculture vehicle. Hence, we designed and manufactured a vehicle from raw materials, which is affordable and easy to use which reduces the efforts of farmers and increases the accuracy in seed sowing, irrigation and harvesting. This machine can be used to plant various types and different sizes of seeds. This also increased the planting organization and exactness. Any novice farmer or worker can use this machine in an effective way, as it working is simplified. Also, its adjusting and maintenance method is made easy. Maintenance cost required for the machine is very low and thus it is affordable for all farmers from large scale and small scale.***

Keywords: Latest inventions in Agriculture, Seed sowing device, Automatic, Cost efficient, Multifunctional.

I. INTRODUCTION

Agriculture activities such as planting, sowing, harvesting, irrigation and many more are significant and tedious activities for every farmer. Thus this multifunctional agriculture vehicle is developed to reduce the human efforts and increase efficiency. Problems such as less accuracy during seed plantation, inaccuracy in spacing between seeds, irrigation problems such as water supplied to the seed varies due to human errors and many more can be limited by using this vehicle. This also limits the problems faced by humans such as back problems, fatigue due to continuously working outdoors in high temperature. Hence for best results from an advanced technological multifunctional vehicle, the above limits should be optimized. Therefore by designing and manufacturing an agriculture vehicle we hope to reduce the human efforts, it works efficiently in reducing the above mentioned limits and also is suitable for various crops.

Most of the states in India rely on agriculture for financial stability. Thus visiting various states where agriculture is carried on large scale helped us understand how to design the vehicle and why technological advancement in agricultural field is necessary. People here where still using the old traditional methods to carry out their day-today activities in farm. Manual planting is popular in villages of India. These people were unaware of the technology used in modern countries such as Israel, USA and japan. The farms in such villages require longer time in planting and harvesting. The time required to do this work can be reduced to half if this technology was implemented in such villages. This could help farmer by saving his time, money, and area used for farming which might ultimately improve the economy by increasing agriculture production. Hence there's need of developing such a machine.

The machine built and how it works is explained, also how the hardware is implemented, selection of components and controllers. This technique is nothing but 4wheel robot system on which seed tank, sowing mechanism, weed cutter and water spraying mechanism are arranged and fixed in such a manner that it is light in weight and also robust to use.

By manufacturing such machine we hope to which has 4wheels, operates on DC motor and has multifunctional abilities we hope to help the farmers in villages where such machines are helpful. This machine will harvest, sough and water plants simultaneously reducing the efforts taken by the farmers and increasing the accuracy of seed plantation.

II. LITERATURE SURVEY

Factors affecting seed germination and emergence:

A. Consistency of the depth for plantation of seeds.
B. Placements of every seed should be uniform with one other
C. Transverse displacement of seed from the row.
D. The soil beneath the seed placed within the dugout isn't loose.
E. Every row of seed planted is sprayed with water uniformly.
F. The seeds are covered uniformly with soil.

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By satisfying the factors mentioned above we will get the best performance from the multifunctional vehicle. Its design is simplified, and components are selected to suit the necessity of the corps. In the working of the robot seed drill or planter also plays vital role in manipulating the physical environment. The tank in which the seeds are placed allows metered or required quantity of the seed within the farm. The machine we designed allows only one seed to flow through the pipe for plantation in one rotation, this will reduce the wastage of seeds. Various mechanisms have been studied for minimizing the human efforts and also reduce the cost of this vehicle so that it can be affordable for farmers. The automation made in this vehicle is easy to understand and even an unskilled person can operate this vehicle on daily basis. It's safe to use and the maintenance required for the machine costs less. This system also serves the seed in order that seed shouldn't be damaged while working.

III. WORKING PRINCIPLE AND DESIGN

It works on reciprocating mechanism, a battery-operated D.C. motor is used to transmit the rotary motion to the shaft with the help of spur gears, and there is another connection of motor to the seed meter for the rotary motion. When the farmer puts seeds into the seed storage tank, seed drops into the seed sowing disc which is control by the arrangement mounted on the assembly. When the seed disc rotates, seed is picked and dropped in the seed pipe, which is connected to the furrow opener for the seeding; there is furrow closer for covering the seeds by soil. Water tank is connected at rear end which helps in irrigation.

A. Designing of Model

Model is designed to sustain all impact occurring in field. We have considered weight distribution of components such as Gear, Motor mounted on the frame. Various methods were discussed and tried before confirming this method. Seed sowing mechanism consists of a disc with a capsule attached at one end. The disc rotates anticlockwise direction and, on every cycle, it collects seeds from the seed storage tank. When the capsule is perpendicular to the axis the seeds are dropped into the funnel due to effect of gravity. These seeds flow through the channel to the drop point. A digger is attached to another disc whose rotational speed is same as seed collector disc rpm. The digger digs a hole into the soil and at same time seed gets sowed into the soil. The rpm of disc is controlled with help of gears. The gears are attached to motor of 60 rpm which reduces rpm to 20.

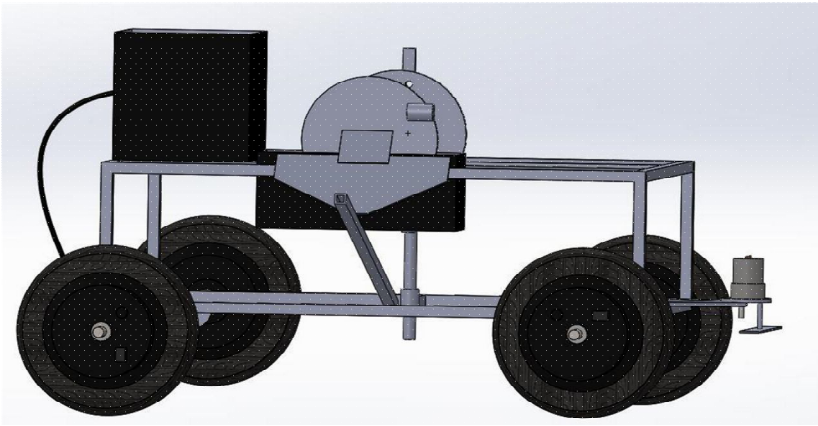

Fig.1 Side view of vehicle

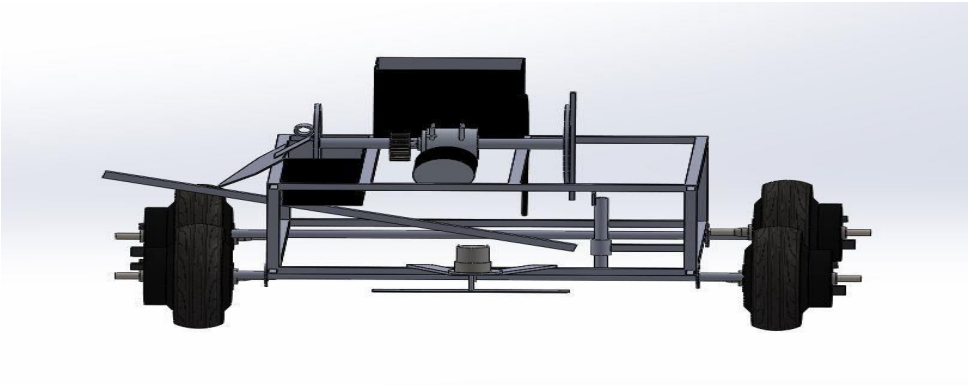

Fig.2 Front view of vehicle

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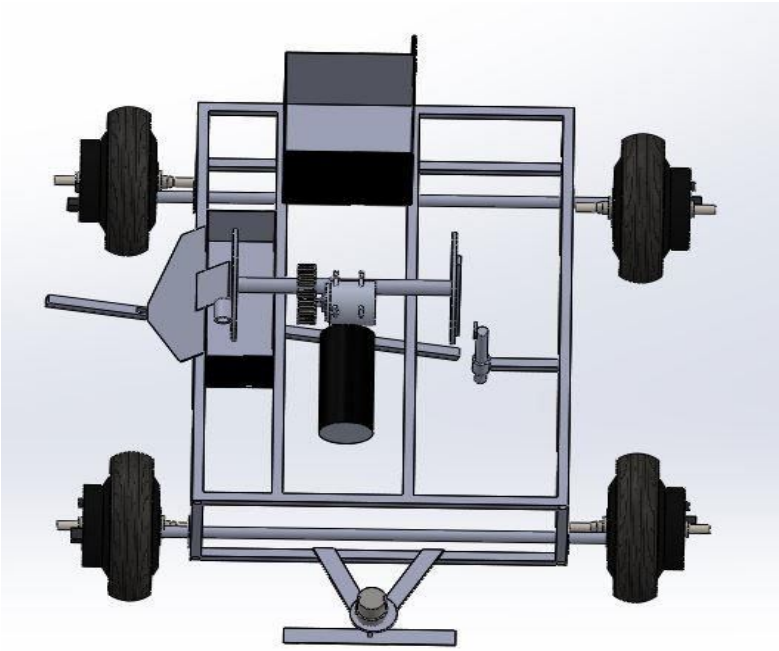

Fig.3 Top view of vehicle

B. Weed Cutting Tool

Weed cutter is attached at front end. It helps to cut the unnecessary weeds or grass which grow on field. The height of cutter can be adjusted by loosening the wire lock. A small DC motor of 12V is attached to cutter blade. This blade rotate in clockwise direction and help cut the unnecessary weeds.

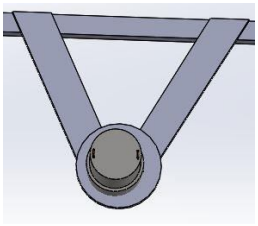

Fig.4 Top view of weed cutting tool frame

C. Watering system

Water tanker is attached at the rear end. The water outlet is adjusted in line with the digger point. The flow of water is controlled using the nozzle. The setup helps the farmer to automatically pour water to seeds without manual effort or wasting time and human energy.

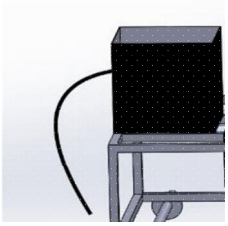

Fig.5 Watering system side view

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D. Locomotion of Machine

Locomotion of machine is controlled by single drive shaft. DC Motor is connected to the rear end shaft. Rear wheels are connected to each other by a shaft which is attached to motor by coupling. The motor provides torque to machine to move in forward direction. The wheels chosen are special type of wheels which help in locomotion of machine in soil. These wheels don't get stuck in moist soil and don't get harmed due to rocks or other obstructions.

IV. COMPONENTS SPECIFICATION

A. Spur Gear

Spur gears or straight gears are the simplest type of gears. Though the teeth are not straight-sided (but usually of special form to achieve a constant drive ratio, mainly involute but less commonly cycloid), the edge of each tooth is straight and aligned parallel to the axis of rotation. These gears mesh correctly as long as fitted to parallel shafts, no axial thrust is made by the tooth loads. Spur gears are excellent at moderate speeds but tend to be noisy at high speeds.

1) No. of Teeth – 21
2) Pitch Diameter – 5.25 cm
3) Diametric Pitch – 4

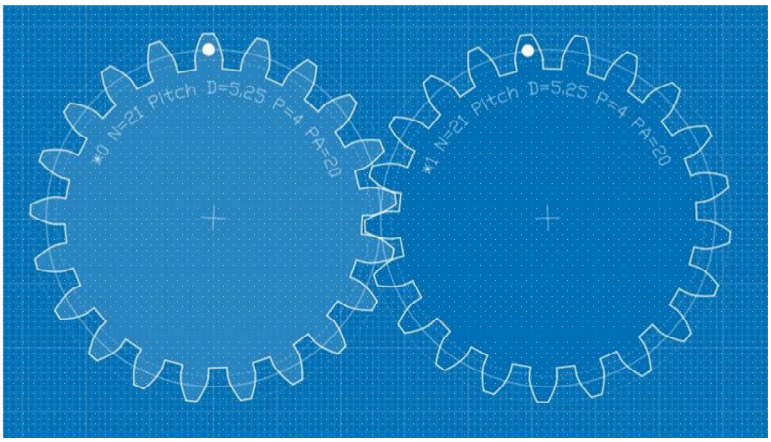

Fig.6 Spur Gear alignment

B. DC Motor

DC Motor is top quality low-cost DC geared motor. It has steel gears and pinions to make sure longer life and better wear and tear properties. The gears are fixed on hardened steel spindles polished to a mirror finish. The output shaft rotates in a plastic bushing. The whole assembly is roofed with a plastic ring Gearbox is sealed and lubricated with lithium grease and need no maintenance. The motor is screwed to the gear box from inside.

1) DC Motor specification 60 rpm, 90V

Fig.7 DC Motor

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C. DC Motor at weed cutter

This is 12V DC motor which has a gearbox of 32mm diameter. The planetary type gearbox of this motor has 100:1 gearhead which produces 60 RPM with the torque value of around 67 N-cm.

Fig.8 DC Motor (12v)

D. Cutter Blade

Cutter is made up of Mild Steel. Sharpen at other seed.

1) Blade Length – 20 cm

Fig.9 Cutter Blade

V. CONCLUSION

A. The device helps to increase the output to input (effort of farmer) ratio of farmer.
B. Development of this technology will benefit low budget farming with better outcome.
C. Accuracy of automatic plantation is achieved.
D. Easy to adapt to new technology with any technical background.
E. Human efforts are reduced.
F. With help of such machines width between seed sowed can be controlled

VI. FUTURE SCOPE

We can convert it in total autonomous by installing remote control systems. Detection of pH of soil by installing various sensors can advance the technology. To make it more affordable solar mechanisms can be implemented in this vehicle. To predict the weather many sensors can be installed which will eventually profit the farmers.

VII. ACKNOWLEDGMENT

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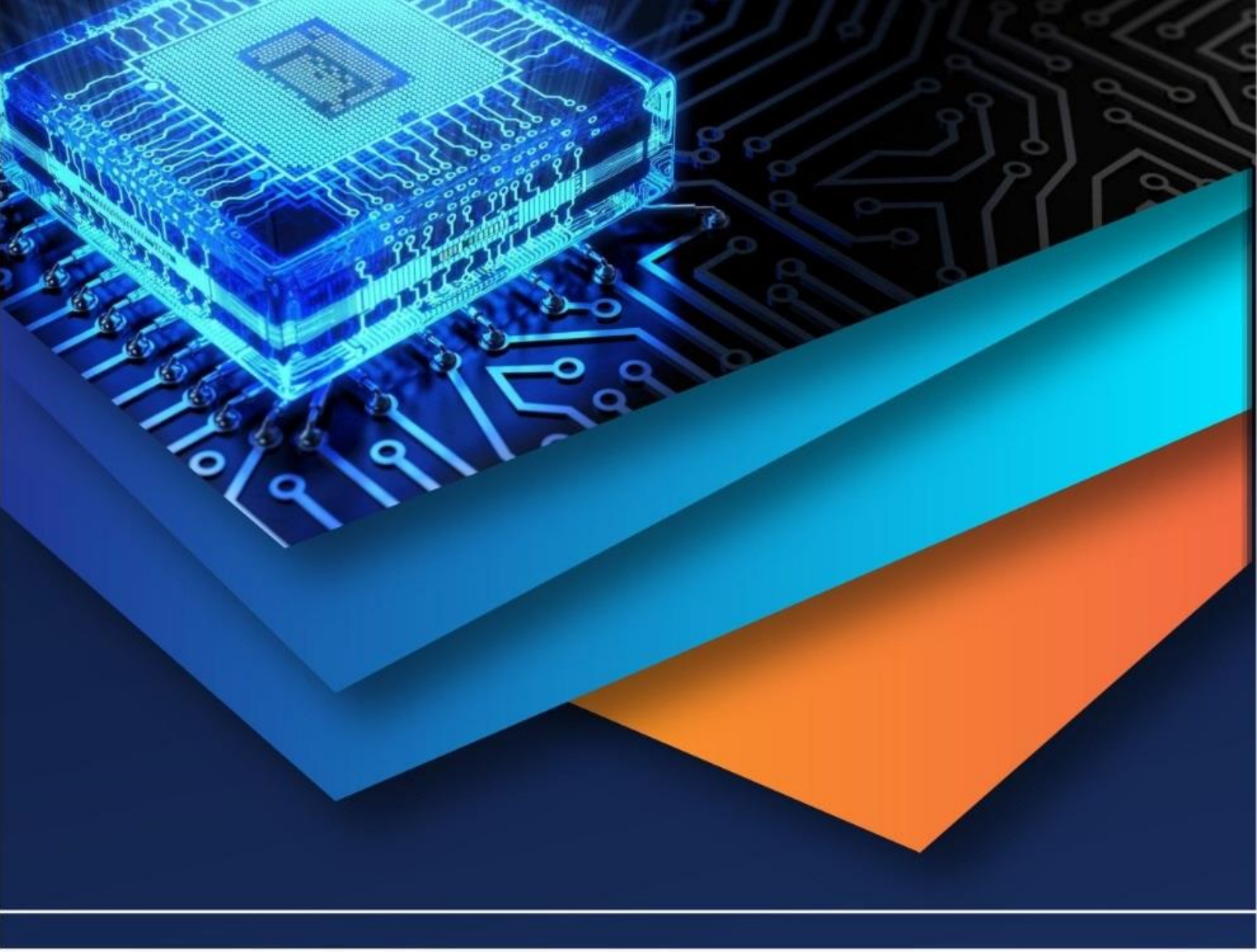

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