

# Design & Manufacturing of Multipurpose Agricultural Robot

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**Abstract**— This Research paper described here is quite useful in the agricultural fields. The aims on the design Agricultural Robot for Spraying water, seeding and cutting operation". More than 40% of the population in the world chooses agriculture as the primary occupation, in recent years the development of the autonomous vehicles in the agriculture has experienced increased interest. The idea of applying robotics technology in agriculture is very new. The idea of applying robotics technology in agriculture is very new. In agriculture, the opportunities for robot-enhanced productivity are immense - and the robots are appearing on farms in various guises and in increasing numbers. We can expect the robots performing agricultural operations autonomously such as ploughing, seed sowing, mud closing and water spraying.

**Key words:** Agricultural Robot

## I. INTRODUCTION

This project work described here is quite useful in the agricultural fields. The project aims on the design Agricultural Robot for Spraying water, seeding, Mulching and cutting operation". More than 42% of the total population in the world has chosen agriculture as their primary occupation. In recent years, the development of autonomous vehicles in agriculture has experienced increased interest. This development has led many researchers to start developing more rational and adaptable vehicles. In the field of agricultural autonomous vehicles, a concept is being developed to investigate if multiple small autonomous machines would be more efficient than traditional large tractors and human force. These vehicles should be capable of working 24 hours a day all year round, in most weather conditions and have the intelligence embedded within them to behave sensibly in a semi-natural environment over long periods of time, unattended, while carrying out a useful task. There are a number of field operations that can be executed by autonomous vehicles, giving more benefits than conventional machines.

As the number of labour availability is reducing day by day and their wages are increasing so there is requirement of higher productivity. Hence the device is to be designed which helps farmers to overcome the stated problem. Aimed at increasing the productivity and reducing the labour involved, the robot is designed to execute the basic functions required to be carried out in the farms.

## II. LITERATURE REVIEW

[1] D.A. Mada, Sunday Mahai, [2013], In this research paper author has mentioned importance of mechanization in agricultural by giving examples. The conclusion from the paper was need of multifunctional single axel vehicle for pre and post harvesting . We have taken this as base for our research and further production of our multifunctional agricultural vehicle.

- [2] V.K. Tewari, A. Ashok Kumar, Satya Prakash Kumar, Brajesh Nare[2012] In this research papers author have done case study on farm mechanization in west Bengal as being part of India it give clear status about availability and progress in India. This ensured us to take right steps compared to current steps.
- [3] F.A. Adamu, B. G. Jahun and B. Babangida [2014]In this paper authors draws our attention towards the performance factor of a power tiller. Among those demand for light weight power tiller was sought out most. Fuel efficiency and field capacity such parameters are also discussed. We took those points in consideration while designing a sustainable multifunctional agricultural vehicle.
- [4] P. Šařec, O. Šařec [2015] The lowest values of soil penetration resistance below the cultivated profile were determined with the cultivators equipped with chisel shaped shares i.e. in the case of Farmet and Köckerling. Cultivators Väderstad Top Down 400 and Farmet Turbulent 450 showed good capacity in embedding plant residues. These results have taken for our research basis.

## III. METHODOLOGY

The basic aim of this project is to develop a multipurpose machine, which is used for digging the soil, seed sowing, and leveler to close the mud and water sprayer to spray water with least changes in accessories with minimum cost. This whole system of the robot works with the battery and the solar power. The base frame is made for the robot with 4 wheels connected and driven the rear wheel is dc motor. One end of the frame, cultivator is fitted which is also driven by dc motor and design is made to dig the soil. Funnel is made by the sheet metal, to store the seeds and the seeds flow through the funnel through the drilled hole on the shaft to the digged soil. On the end leveler is fitted to close the seeds to the soil, and water pump sprayer to spray the water. Solar is placed on top of the robot and is connected to the battery for charging the battery. Thus the max efficiency is utilized from the sun by the solar panel and to the battery the whole robot requires the 12v battery to operate the system.

### A. DC Motor selection:

#### 1) Specification:

- Voltage =12v
- Current 7.5 A
- $V=I*R$
- $I=7.5/R$
- $R=1.62 \Omega$
- The major constraint on motor operation is thermal
- $P=I^2*R$
- $=7.5^2*1.6$
- $=90$
- Approximate load on motor= 10kg

- Force required to move
  - $F = 10 * 9.81$
  - $= 98.1 \text{ N}$
- 2) Torque required for motor
- $T = f * r$
  - Assuming wheel radius 150mm
  - $T = 98.1 * 0.15$
  - $T = 14.715 \text{ Nm}$
  - $P = 2 * \pi * N * T / 60$
  - $90 = 2 * \pi * N * 14.715 / 60$
  - $N = 58.40 \text{ rpm}$
- 3) Specifications:
- $Rpm = 100 \text{ rpm}$
  - 5 Nm torque – DC motor
  - Voltage -12v

**B. Selection of CHAIN DRIVE**

- $i = 1,$
- ANSI Chain number = 35
- Sprocket diameter  $D = 52 \text{ mm}$
- Roller diameter  $d = 5.08 \text{ mm}$
- Width  $w = 4.76 \text{ mm}$
- Breaking strength = 7830 N
- For single strand C.D = 240 mm
- Chain length = 641.925 mm

**C. Material and Dimension of FRAME:**

- Chassis – MS pipe : 660\*460\*26 mm- 14 gauge



Fig. 1:



Fig. 2:

**IV. ADVANTAGES**

- It was made of durable and cheap material affordable for the small-scale peasant farmers.
- Lesser maintenance cost.
- Requirement of labor also decreased.
- Provide proper compaction over the seed.
- Does not require any External Source of Energy Avoid the former being exposed to toxic pesticide vapour produced during spraying.
- Reduce the workload on the farmer and as it is easier to operate.
- The former need not spry in the hot sun, he can operate the device while standing in a cooler place.
- By the development of these robots lot of manual labor will also be decreased and the farmer life will save from chemical
- Improvement in planting efficiency. Increase in crop yield and cropping reliability.

**V. LIMITATION**

- Controlling motors are difficult
  - Large dc batteries required
  - Complex connections
  - Suitable for small Farms Only.
  - Difficult to operate in moist condition.
  - Seed Sowing for Cotton is Difficult.
  - Experimental Result
  - Speed of plantation machine depending upon moisture
- The speed of advanced seed plantation machine depends on certain moisture level of soil. as shown in fig we have taken various result to the advanced seed plantation machine .the standard level of moisture fix those seeds in shown in red column .it shown characteristics with good performance as explained below.

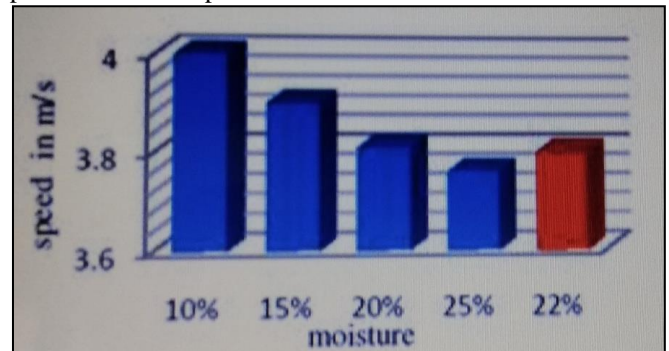


Fig. 3:

**VI. CONCLUSION**

The present commercial devices involve the working of all functions separately. It requires one day or more for loosening the soil and path forming for half acre land whereas the Multipurpose Farm Robot requires approximately 20 hours for completing

The whole process, which involves the three basic functions i.e. forming the path, sowing the seeds and back filling the soil in half-acre land. The robot covers 18 feet in a minute.

The product was tested by forming the required area. The ploughing tool forms a path of depth around 3

inches, which meets the stated objectives, and the seeds are sown simultaneously in a regular interval of time and distance of 9 inch along with the backfilling of soil.

In this work a robot, farm robot, has been designed, built and demonstrated to carry out ploughing in an agriculture field. It is expected that robot will assist the farmers in improving the efficiency of operations in their farms.

It is aimed at increasing the productivity and reducing the labour involved, this robot is designed to execute the basic functions required to be carried out in farms.

The robot performs the tasks like digging the ground, sowing the seeds and backfilling the soil automatically in a sequence without human intervention. Thus an effort is made so that the robot becomes an aid to the farmers. The design is accepted and unique compared to the existing robots.

## VII. FUTURE SCOPE

- Multifunctional agricultural vehicle mainly focuses on the basic problems faced by fellow farmers. i.e. Seed Sowing, fertilizers spraying ,cultivation and digging.
- This project objective is to fabricate a robot vehicle which can dig the soil, put the seeds, and close the mud and to spray water, these whole systems of the robot works with the battery and the solar power.
- To reduce human effort in the agricultural field with the use of small robot.
- To perform all 4 operations at single time, hence increases production and saves time.
- To complete large amount of work in less time.
- Farmer can operate this robot through remote by sitting at one side and he can operate easily.
- The usage of solar can be utilized for Battery charging. As the Robot works in the field, the rays of the sun can be used for solar power generation.
- To increase the efficiency, the solar power is used and the Power output can be increased. Moreover
- we will give examples of the economic potential of applying autonomous robotic vehicles compared to conventional systems. Focus will be put on potential labor cost savings, farm structure implications and sizes for operation, daily working hours, potential environmental impact, energy costs and safety issues.
- We are looking this project as revolution in small farms in India, which is most uncovered area in this sector is cost and more efficient way

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