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Design and Fabrication of Automatic Seed Sowing Robot using Solar Power

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ABSTRACT: Agriculture is a most important field in life of human being. It is a backbone of Indian economy system. In this project work we have focused on seed sowing processes and tried to solve the problem. About half of the total population of our country has chosen agriculture as their chief occupation. In the farming process, regularly utilized customary cultivating activity takes additional time and more work. The present period is walking towards the fast development of all areas including the farming area. For this machine we can plant various sorts and various sizes of seeds likewise we can differ the space between two seeds while planting.

KEYWORDS: Agriculture robot, Seed sowing robot, Automatic robot, solar powered robot

I. INTRODUCTION

The major occupation of the Indian rural people is agriculture and both men and women are equally involved in the process. Agriculture has been the backbone ^[1] of the Indian economy and it'll still remain so for an extended time. Recently numbers of changes are happening in agriculture technology like plugging, seeding, fertilizing, weeding, harvesting, spraying etc. Sowing is the most important ^[1] process in farming. It is a really tiring and time consuming process that needs tons of human effort. In current world, every process is getting automated and other people are becoming wont to adopt smart techniques to need their work done.



Figure- 1 Seed sowing robot

As the population of India is rising, demand of food is additionally grow which results in higher crop production per hectare. So, to repair these problems farmers should use latest ^[2] technological advancements for the varied agricultural practices like digging, sowing, irrigation etc., which are more efficient and fewer time consuming. The main work of sowing operation is to sow seed at required depth with specific spacing between the two sowed seeds. ^[2]

II. HISTORY OF AGRICULTURE TECHNOLOGIES

Agriculture innovation suggest to innovation for the creation of machines utilized on a farm to help with cultivating. ^[3] Farming machines are intended for essentially every phase of the agricultural interaction. They incorporate machines for pillowing the dirt, planting seeds, flooding the land, developing yields, shielding them from vermin and weeds, collecting, sifting grain, domesticated animals taking care of, and arranging and bundling the things. ^[4] An agriculture robot is additionally called as an agribot. This is often a robot which is self-ruling and is beneficial in cultivating. It causes the farmer to boost the harvests proficiency and furthermore decreases the need for physical work to the farmer. Within the coming ages, we will anticipate that the plowing, planting, gathering and various other ranch works are going to be finished by these farming robots independently. ^[6]



III. AVAILABLE TECHNOLOGIES

Some of the most common robots in agriculture are used for:

- | | |
|---------------------------------|------------------------------|
| 1- Harvesting and picking | 2- Shepherding and Herding |
| 3- Autonomous Tractor | 4- Crop Weeding and Spraying |
| 5- Crop Monitoring and Analysis | 6- Weed Control |
| 7- Nursery Planting | |

IV. BENEFITS OF AGRICULTURAL ROBOTS

- **Protection of Human Workers:** By taking up errands like herbicide and pesticide showering, robots do shield human representatives from potential damage that might be brought about by breathing in or dealing with ranch synthetics by hand. A farming robot can either be intended to finish showering undertakings from a raised point or nearer to the objective utilizing ^[5] an uncommonly planned mechanical robot arm.
- **Reduced Wastage of Farm Inputs:** Robots can convey mistake free result inside a more limited work-time contrasted with human laborers. On account of showering synthetics, for example, farming robots can have the option to zero in on the specific part that should be splashed. Like there are a few herbicides that should be showered on the roots, some on the leaves, etc.
- **Reduced Cost of Farming:** Homesteads and rural fields are a bee colony of exercises. In crop cultivating, there is a requirement for work to set up the land, plant the seeds, water, prune, weed, and to reap among different exercises. Creature fields need ordinary support; the creatures should be taken care of and went to on the whole the fundamental ways. Keeping an adequate human ^[7] labor force to do every one of these exercises can be extravagant. In different cases, a few undertakings may not pull in human representatives.
- **Collaborative Robots for Agricultural Sector:** The agricultural area has seen a positive effect from the development of community oriented robots. Robots are human-accommodating robots. Their plan sets up a tangible innovation. This empowers them to react appropriately (easing back down or halting) contingent upon the nearness of a person ^[8].

V. BACKGROUND

- In the current situation the vast majority of the nations don't have adequate gifted labor in farming area and that influences the development of agricultural nations.
- The farmers need to utilize redesigned innovation for development action (burrowing, seed planting, treating, showering and so on)
- It's an opportunity to mechanize the area to beat this difficult which thus will likewise dispense with the prerequisite of Labors and furthermore stay away from the wastage of seeds.
- As we are keen on Embedded Electronics based undertakings and there are numerous benefits of the implanted framework too despite the gadgets based ventures.

VI. APPLICATIONS OF AGRICULTURAL ROBOT

Agricultural robots automate average, dreary and dull undertakings for farmers, permitting them to zero in additional on improving generally speaking creation yields. The absolute most regular robots in agriculture business are utilized for:

- Harvesting and picking
- Weed control
- Autonomous mowing, pruning, seeding, spraying and thinning
- Phenotyping
- Sorting and packing
- Utility platforms

Gathering and picking is perhaps the most main stream automated applications in farming because ^[1] of the precision and speed that robots can accomplish to improve the size of yields and decrease squander from crops being left in the field.

VII. LITERATURE REVIEW

We zeroed in on the fundamental necessities for limited scope trimming machines are, they ought to be appropriate for little homesteads, straightforward in plan and innovation and adaptable for use in various ranch tasks. A physically worked layout column grower was planned and created to improve planting proficiency and diminish drudgery engaged with manual planting strategy. Seed planting is likewise feasible for various size of seed at variable profundity what's more, space between two seed. Likewise it expanded seed planting, seed/compost position correctness's and it was made of strong and modest material moderate for the limited scale laborer ranchers. The working, changing and keeping up standards were simplified for compelling dealing with by untalented administrators. ^[9]

The fundamental point of planting activity is to put the seed and compost in lines at wanted profundity and seed to seed separating, cover the seeds with soil. The column to push dividing, seed rate, seed to seed separating and profundity of seed situation change from one harvest to another and for various agro climatic conditions to accomplish ideal yields. The examination between the customary planting strategy and the new proposed machine which can play out various synchronous activities is done and has various benefits. As the work accessibility has turns into the incredible worry for the ranchers and henceforth work cost is more, this machine lessens the endeavors and complete expense of planting the seeds and compost position. ^[11]

VIII. IMPORTANT TERMS IN ROBOT AND ENGINEERING

- Axis/degrees of freedom
- Hand guiding
- End effector
- Tool changer
- Repeatability
- Grip force
- Payload
- Force limiting
- **Collaborative**
- Reach

IX. COMPONENTS AND MATERIALS

During fabrication the following parts are used-

1- Dc gear motor-



Figure- 2 DC gear motor



This 12V DC Motor can be utilized altogether landscape robots and an assortment of automated applications. These engines have a 3 mm strung drill opening in the shaft accordingly simplifying it to interface it to the wheels or some other mechanical gathering.

2- Robot chassis - Chassis is extremely fundamental in robots just as numerous mechanical gadgets. It helps in offering help to PCB, extras and different parts which are associated with it. Robot suspension is especially intended for robots and other mechanical gadgets.



Figure- 3 Robot chassis angle

3- Robotic wheels- Wheeled robots will be robots that explore around the ground utilizing mechanized wheels to drive themselves. This plan is more straightforward than utilizing tracks or legs and by utilizing wheels they are simpler to configuration, fabricate, and program for development in level, not-so-tough landscape.



Figure- 4 Robotic wheel

4- Lead Acid battery (12 volt)- 12V 1.2Ah Rechargeable Lead Acid Battery is normally use for robots in competition. Wired or Wireless Robots run for a long time with high speed with this type of battery. Seal Lead Acid (SLA) Rechargeable battery is the most common general purpose battery.



Figure- 5 Battery

5- Solar panel - The term sun powered board is utilized casually for a photograph voltaic (PV) module. A PV module is a get together of photograph voltaic cells mounted in a system for establishment. Photograph voltaic cells use daylight as a wellspring of energy and create direct flow power. An assortment of PV modules is known as a PV Panel, and an arrangement of Panels is an Array. Varieties of a photovoltaic framework supply sun oriented power to electrical gear.



Figure- 6 Solar panel

6- Seed storage tank- Capacity gadget is one of the significant gadget of the framework. Also, is planned by weight supported by the robot just as the necessary limit with respect to planting. This part is fixed. To the lower part of this tank seed planting plate is orchestrated.



7- Copper wire: Copper is the electrical channel in numerous classifications of electrical wiring. Copper wire is utilized in power age, power transmission, power dissemination, broadcast communications, hardware, and incalculable sorts of electrical gear.

CALCULATION

The below calculation for the various parts which will be used during the fabrication of the automatic seed sowing robot.

Summarizing all the values:

- Robot weight (m_R) = 6 kg
- Nominal speed (v_N) = 1 m/s
- Max slope (k) = 15%
- Diameter of the wheel (D_w) = 0.1m

❖ **Calculate the wheel rotation speed**

It is very simple to compute the required wheel turn speed. All you need is wheel breadth and the ostensible robot speed. Allow us to accept a wheel width of 10mm, and ascertain wheel rotation speed:

$$\begin{aligned}
 N_T &= 60v_N/\pi D_w \\
 &= 60 \times 1/3.14 \times 0.1 \\
 &= 191 \text{rpm} \approx 200 \text{rpm} \\
 N_T &= 200 \text{rpm.}
 \end{aligned}$$

where:

- $D_w = 0.1\text{m}$ - diameter of the wheel
- $v_N = 1 \text{ m/s}$ - nominal robot speed

❖ **Calculate the motor power/ torque**

In the event that we preclude contact, we can gauge the engine force expected to get on the recently determined greatest incline. The push power, expected to beat gravity on the slant, is the accompanying:

$$\begin{aligned}
 F_T &= g k \times m_R \\
 &= 9.81 \times 0.15 \times 6 \\
 F_T &= 8.829 \text{ N}
 \end{aligned}$$

Where:

- $g = 9.81 \text{ m/s}^2$ - gravity
- $k = 0.15$ - max slope
- $m_R = 6 \text{ kg}$ - max robot weight

Power

In the event that we need to move the robot uphill with the ostensible speed, the mechanical force expected to do it is:

$$\begin{aligned}
 P_U &= F_T v_N \\
 &= 8.829 \times 1 \\
 P_U &= 8.829 \text{ W} \\
 \text{For 1 motor,} &= 8.829/4 \\
 &= 2.207 \text{ W}
 \end{aligned}$$

Where:

- $F_T = 8.829 \text{ N}$ - thrust force
- $v_N = 1 \text{ m/s}$ - nominal robot speed

Torque

It is a mechanical force for the whole robot, so we have 2.207 W per one footing engine. The comparing force for the footing wheel, per one foothold wheel is the accompanying:

$$\begin{aligned}
 T_T &= 1/2 \times D_w/2 \times F_T \\
 &= 0.5 \times 0.5 \times 0.1 \times 8.829
 \end{aligned}$$

$$= 0.2207 N_m$$

$$T_T = 0.25 N_m$$

Motor Power

In an electric motor, the mechanical power is defined as the speed times the torque

Power of 1 motor,

$$P = \tau \omega \dots (\text{where } \omega = 2\pi N/60)$$

$$P = \tau \times 2 \times \pi N/60$$

$$= 0.25 \times 2 \times 3.14 \times 200/60$$

$$P = 5.23 \text{ W}$$

Total power of 4 motors,

$$= 5.23 \times 4$$

$$= 20.92 \text{ W}$$

The motor used for rotating the wheel is 120 rpm motor.



Based on the speed of the robot, and considering the distance at which the seed would be sown the following motor rpm is calculated (distance between two successive seed = 10cm. and the speed of the robot is 1 m/s.).

FUTURE PROSPECT: Advanced mechanics innovation supposedly coordinates calculations with sensor innovation to carry computerization to lettuce cultivating and grape plantations. In particular, PC vision permits robots to produce 3D guides and models of zones of interest and afterward to finish different errands inside those boundaries. The undertaking can be improved concerning the quantity of arms we are utilizing to plant the seed.

X. CONCLUSION

Agricultural robot are changing the look, feel and speed of customary cultivating rehearses. In each total revolution of pivoting wheel there is a seeds tumble from this seed drum and seed manor measure occurred easily and without wastage of seeds. The planting circle is turn in the seed chamber, the seeds are falls in the seed chamber through seed capacity tank. The seed box are gather the seeds from the chamber and it sow in the ground as required profundity with the assistance of furrow.

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