

AUTOMATED MULTI FUNCTION FARM ROBOT

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Abstract : This project work is focused on the design, development and the fabrication of the Automated farm robot which can dig the soil and put the seeds. That is for land preparation and sowing process. This machine has the capability of delivering the seeds precisely with uniform depth in the agricultural land, and also with uniform spacing between the seeds. thus whole systems of the robot works with the battery.

Keywords – Automatic, Agriculture, Farm, Robot, Machine, Land Preparation , Sowing purpose.

I. INTRODUCTION

Robotics is playing a significant role in agricultural production and management. There is a need for autonomous and time saving technology in agriculture to have efficient farm management. The researchers are now focusing towards different farming operational parameters to design autonomous agricultural vehicles. Till date the agricultural robots have been researched and developed principally for harvesting, chemical spraying, picking fruits and monitoring of crops. Robots like these are perfect substitute for manpower to a great extent as they deploy unmanned sensing and machinery systems. The prime benefits of development of autonomous and intelligent agricultural robots are to improve repeatable precision, efficiency , reliability and minimization of soil compaction. The robots have potential for multitasking, sensory acuity, operational consistency as well as suitability to odd operating conditions. The proposed idea implements the robot to perform the functions such as ploughing, seed sowing and water irrigation. These functions can be integrated into a single robot and then performed.

In India there are 70% people dependent on agriculture. So we need to study agricultural demands. The Innovative idea of our project is to automate the process ploughing, seed sowing and water irrigation.

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, water spraying and pesticide spraying. The applications of instrumental robotics are spreading every day to cover further domains, as the opportunity of replacing human operators provides effective solutions with return on investment. This is especially important when the duties, that need be performed, are potentially harmful for the safety or the health of the workers, or when more conservative issues are granted by robotics. Heavy chemicals or drugs dispensers, manure or fertilizers spreaders, etc. are activities more and more concerned by the deployment of unmanned options.

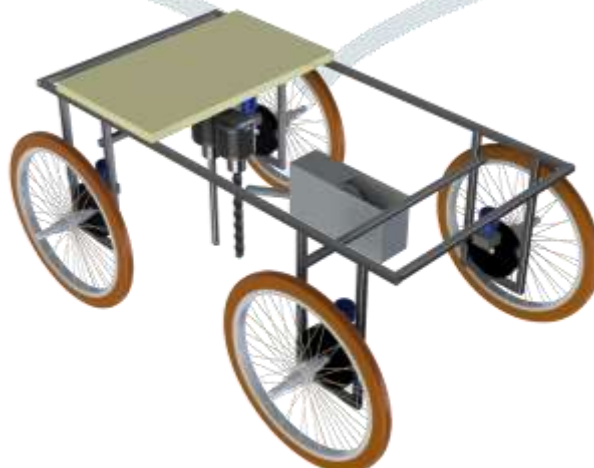


Fig:1 – 3-D Model

II. OBJECTIVES

- To Fabricate a robot which can dig the soil and sow the seeds, where the robot works with the battery.
- Maintains the same distance between two seeds at the time of sowing process.
- This robot is fully automated thus provides ease in handling the machine.

III. LITERATURE SURVEY

1. Dr. V. Srinivas Viswanath, S. Hemanth Kumar, Sk. Salauddin, A. Sandeep, B. Suresh published the paper on the “ design and fabrication of a multi-purpose agriculture machine ” on 2020.
 - From this paper we get the knowledge on the multi-purpose agriculture machine which is controlled by the Bluetooth Arduino Transmitter.
 - Works in both direction both forward and backwards with the help of motors, and also performs ploughing operation on the field with the help of the plough tool.
 - Their model has been designed in an adjustable and portable manner, where the seed sowing can be directly controlled with the help from motor.
 - The motor rotates and the shaft attached to it has holes so that the seed placement is done. The project will carry out the groundnut threshing operation, seed sowing, and fertilizer spraying simultaneously.
 - The key innovative perspective of the project is that the complete machine can be controlled remotely due the integration of Bluetooth facility.

2. Ajesh A, Anandhu K S, Jelvin Raju, Jerin Saji published the paper on the “ Bluetooth Controlled Farm Robot ” on Apr 2020.
 - From this paper we get the knowledge on the Bluetooth controlled robot.
 - This project strives to develop a robot capable of performing operations like automatic ploughing, seed dispensing, fruit picking and pesticide spraying.
 - For manual control the robot uses the Bluetooth pairing app as to control device that helps in the navigation of the robot in the field.
 - The working and controlling of this robot is done with the help of following components:
 - i. Arduino Uno
 - ii. Bluetooth Module HC-05,
 - iii. Motor Driver (L298N)
 - iv. DC Gear Motor.

3. Kalash Singhal, Gaurav Prajapati published the paper on the “ Solar Powered Seed Sowing Machine ” on 2018.
 - From this paper we get the knowledge on the machine which can carry out various farming activities simultaneously.
 - This machine uses Solar Energy as an eco-friendly energy source of power.
 - Solar Panel is used to convert solar energy into electrical energy and then power a DC Motor that converts this electrical energy into mechanical energy to rotate a cutter for digging operation.
 - Seed Hopper and Water Tank are used for seed sowing and irrigation operations.
 - This machine maintains seed to seed spacing and row to row spacing as per requirements.
 - It also decreases the cost of sowing the seeds and requirement of labour.

4. Kunal A. Dhande, Omkar R. Sahu, Megha S. Bawane, Achal A. Jiwane, Priyanka S. Chaware , published the paper on the “ Design and Development of Automatic Operated Seeds Sowing Machine ” on 2017.
 - From this paper we get the knowledge that this machine replaces complicated gear system by hall effect sensor for easier seed sowing that reduces need of labour.
 - The Hall Effect sensor convert rotation into distance for which seed sowing can be done at particular distance. Also, there is adjustable system for sowing seeds at different distance.
 - By using this machine, the sowing can be done row by row and uniformity in distance can be maintained.
 - After putting the seeds and in the box as per its capacity. When the machine is going in forward direction, the motion is transmitted to the fluted roller seed cup from sprocket at ground wheel through the chain.
 - The fluted roller seed cup is having the arrangement of seed cut-off and controlling flap to control the amount of seeds.
 - The seeds will get placed in the furrows through the guide pipes. In this way the seeds are placed in the furrows at proper distance and this machine maintains the proper row spacing.

IV. METHODOLOGY



Fig:2 – Methodology Flow Chart.

The aim of our project is to design, development and the fabrication of the robot which can dig the soil and put the seeds. That is for land preparation and sowing process. In this machine electricity is used to charge 12V battery, which then gives the necessary power to a shunt wound DC motor. This power is then transmitted to the DC motor to drive the wheels and even supply power for operations such as ploughing and seed sowing operations. Thus whole systems of the robot works with the battery. Here the complete machine is programmed and functions automatically. This machine has the capability of delivering the seeds precisely with uniform depth in the agricultural land, and also with uniform spacing between the seeds.

V. WORKING PRINCIPLE OF THE MACHINE

The power for working of the farm robot is supplied by Lead acid battery. The program has been coded in a micro-controller and with the help of relays the different motors can be controlled which has be fixed to different components. As the machine switch is set ON, then the motor starts functioning by driving power from the battery. Initially the motors namely M1, M2, M3 & M4 is started, which has been connected to all four wheels of the machine. thus these four motors starts performing at a single time and make a forward movement of the machine for the period of 4 seconds which covers a distance of 1 feet over the agriculture field. Then these four motors connected to the wheels is stopped, thus the machine is stopped and the drilling operation is started. Then motors namely M5 & M6 which has been connected to the screw rod and drill bit respectively is started which makes the vertical movement of the plough tool in the bottom direction for a period 4 seconds, drilling up to a depth of 3inches (7.5cms). Then after the ploughing operation using drill bit is performed, later the vertical movement of the plough tool in the upward direction at its initial position is performed for a period 4 seconds. Then the M5 & M6 motors is stopped. Then lastly the seed sowing operation is performed by M7 motor which is connected to the seed metering machine (feeder pulley) to deliver the seed. The seed sowing operation using the feeder pulley is performed in the clock-wise rotatory motion for a period of 4 seconds. After the working of M7 motor one cycle of the farm robot is completed taking a period of 16 seconds.

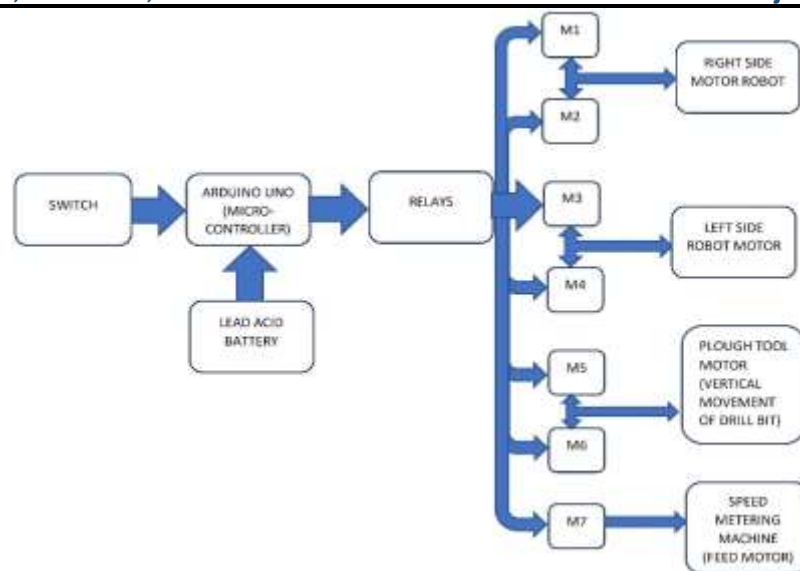


Fig:3 – Working Flow Chart.

VI. CONSTRUCTION OF MACHINE

1. FABRICATION OF FRAME

Here fabrication work for the basic frame has been completed, where the components for wheel control has been mounted on machine frame by using bolts, nuts and welding operation.



Fig:4 – Fabricated Model

2. MOUNTING OF AGRO EQUIPMENTS

Here fabrication work is completed by mounting plough tool (drill bit & screw rod) and seed metering machine. And the basic wire connections has been made from the individual motors and covered by the plastic wire loom, so that the wires are safe from environmental conditions.

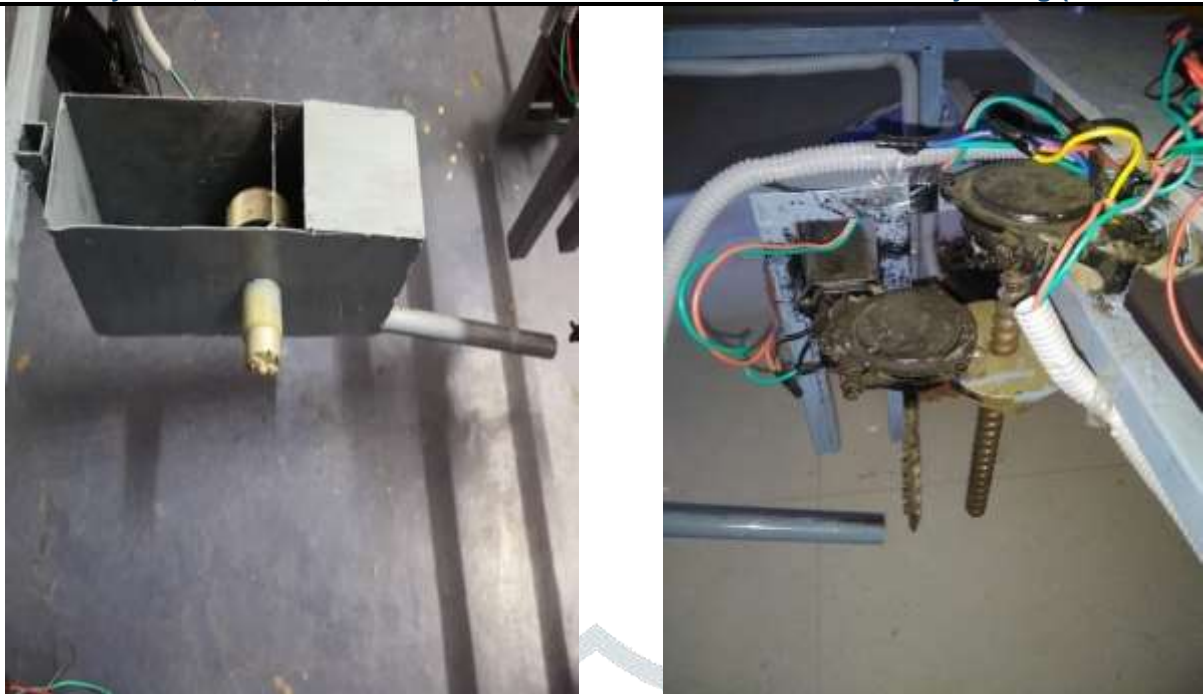


Fig:5 – Farm Robot.

3. ASSEMBLED MODEL

The mentioned figures are the final assembled model with all the electronic connections done on the machine making it fully automatic.





Fig:6 – View of Farm Robot.

VII. RESULTS

Hence stated above all the two mechanisms ploughing and seed sowing is achieved on Irrigated land.

- Maximum achieved depth is 7.5cm using drill bit.
- Each seed will fall at the interval of 30cm or 1feet.
- Under prescribed Boundary Condition:
 - Total Deformation of machine: Min = 0m, Max = 0.28m.
 - Equivalent Stress on machine: Min = 6.1979e-003 pa , Max = 1.2994e+012 pa.
 - Equivalent Elastic Strain on machine: Min = 1.9679e-013, Max = 7.2656.
- Torque of Motor: 1720 N/mm.
- Speed of Machine: 0.075 m/sec.
- Time taken for sowing of one seed machine takes: 16sec.

For final check-up & testing of prototype, any type of software testing is not required but to check the wear out of components we need its manual testing on field.

VIII. CONCLUSIONS

- Automated multifunction farm robot is used to fulfill the tasks like ploughing and seed sowing by using non-conventional energy sources. Thus it will help the farmers of those remote areas of country where fuel is not available easily.
- As whole systems of the robot works with the battery, they can also perform their regular cultivation activity as well as save fuel up to larger extent.
- At the same time by using electricity environment pollution can also be reduced. Thus aiming to save the revenue of government & also most demanded fossil fuel.
- Automated agriculture machine is designed and fabricated with ease and simple to utilize.
- This agro machine is fully automated as the title of our project goes by.
- Less manpower needed to operate this machine i.e. 1 person to operate. Therefore, the cost of production of crops also goes down.
- Designed and fabricated at affordable price for small farmer.
- This automated farming machine can be readily made from local components in workshops. This machine is more beneficial to small farmers who cannot afford farming equipment at higher cost.

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