Development of an Autonomous Seed Sowing Robot for Agricultural Applications in Rural Areas

*G. Shanmugasundar, G. Manoj Kumar, S. E. Gouthem, V. Surya Prakash, R. Vijai Karthik
Associate Professor Mechanical Engineering, Sri Sai Ram Institute of Technology, Chennai, Tamilnadu, India.
Department of Mechanical Engineering, Sri Sai Ram Institute of Technology, Chennai, Tamilnadu, India.
*Corresponding author Email: shanmugasundar.mech@sairamit.edu.in

Abstract. In this era of technological revolution, we can implement new technologies in the field of agriculture for increase in the overall production of agricultural commodities. One of the most significant component in agricultural procedure is seed sowing machine. Nowadays, the agricultural activities are performed by using tractors, which uses fossil fuels for functioning. Harmful gases are released throughout the process, which cause a lot of damage to the environment. Our project make use of solar power to which overcomes this problem and is also cost efficient. In this project, the solar power is collected by using solar panels and then the power is saved in batteries with the help of charge controllers. A DC shunt motor is connected to the rear wheel of the machine by using a transmission system. This DC motor is powered by the batteries. We make use of IR sensors to get the tract of the path, the machine should go through. A ploughing machine is attached to the machine, which digs the soil for sowing and then, seeds are sowed on the basis of the revolution of the wheel. The ploughed then covers it back with the soil after sowing the seeds. Fertilizers are also sprayed along the way. All these functions of the machine are controlled by a MCU (Micro controller unit).

1. Introduction

Among the top producers of agricultural products, India always stands at the top. It is the second largest producers of rice and wheat (the world's major food staples) after China. There are many challenges in the process of farming, which includes the availability of water resources, climatic changes, the availability of agricultural lands, and environmental challenges. We focus on overcoming the environmental challenges during the process of agriculture. The agricultural sector guarantees a sustainable environment, but the problem is only with the method of implementation. By using the conventional method of the farming, which is making use of the tractor for various agro activities, releases carbon di oxide along with some other harmful gases. This leads to air pollution, noise pollution, water pollution and it may lead to energy crises in few coming years. We have designed an automatic seed sowing machine which is powered by solar energy, which overcomes these environmental challenges. The main advantages of using our machine are that, it reduces the pollution, the time consumption, and saves lot of money when compared to the use of tractors.

2. Materials and Features of the System.

Materials in this project we use three types of materials such as Low carbon steel, medium carbon steel and high carbon steel. Low carbon steel is used to construct the farm machinery and medium carbon steel used to construct the shafts connecting rod etc. The high carbon steel is used to construct the transmission system. Features of the System Ploughing Seed Sowing Sand Leveller Fertilizer Sprayer.

FIGURE 1. Intergration of The Manual Seed Sy
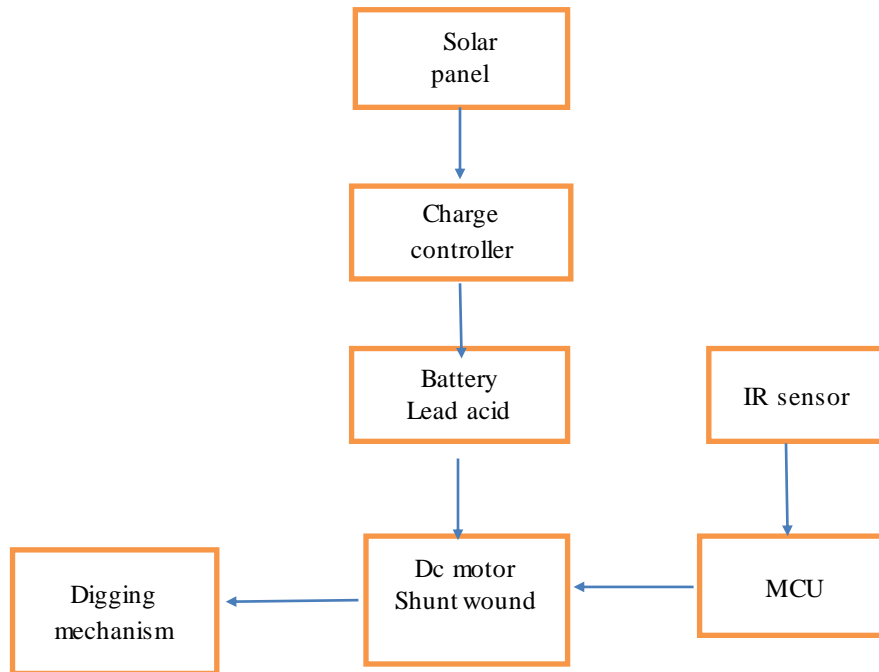
3. Workflow Diagram

FIGURE 2. Workflow Diagram

4. Materials used in the System

In this project many components are used they are MCU (micro controller unit), IR sensors, Solar panel, Battery, Charge Controller, DC Shunt Motor, Seed Storage tank, Soil plough, Soil cover, Seed Disc. MCU (micro controller unit) The Micro Controller Unit is a compact integrated circuit design to give specific operation in embedded system. Micro controller unit is key component in this project the IR sensor gives the output signal to the micro controller unit based on the IR sensor output the Dc Motor is controlled by the Micro Controller unit. The Micro Controller used in this project is Arduino Nano V3 micro controller... IR Sensor IR sensor is used in this project to control the motion of the machine and path of the machine and sense the obstacles in the path. IR sensor is an electronic device that measures and detects infrared radiation. It is used in this project to control the motion of the machine. It shows a path for the machine and senses the obstacles in the path. It gives its output to the MCU which controls the machine. Solar panel A solar panel is a collection of solar cells which is designed to absorb the sun's rays as a source of energy for generating electricity. It supplies energy to the Dc Shunt Motor. The main concept solar panel is used to convert solar energy to electrical energy. The solar panel used is 12-volt solar panel. The solar panel is made of material of semiconductor and it consist of PV cell. Battery: The battery is used to save the electrical energy and in this project. Here, we use 12V Lead acid battery. 4.5. Charge Controller: The charge from the solar panel is stored in the charge controller where the solar power is converted into the electric power. This power during conversion process can be stored and used. Seed storage tank, soil plough, soil cover The Seed storage tank is used to store the seed and we can add the seed according to requirements. The soil plough is used to dig the soil in the field. The Soil cover is used to cover the soil after the sowing of the seeds. The Seed sowing disc which used to drop the seed to the field from the seed storage tank and it is controlled by the revolution of the wheels.

5. Comparison and Modifications of the System

In market seed sowing machine is manually operated is available or semiautomatic and IC engine operated seed sowing machine is only available. And in this project the seed sowing machine is operated through the solar power not through any fossil fuel. And another main thing is this machine is fully automatically operated through the IR sensor and MCU. The system is completely automatic helps to control the system automatically without any manual power applied to the system. The system automatically moves through the field without any help of the fuel powered engine system.

FIGURE 3. Semi-Automatic System

6. Gear Mechanism

The mechanism used in this seed sowing machine is normal power transmission Mechanism. Here the power from the rear wheels is utilized for the plantation of seeds. This is done by providing a bevel gear at the rear axle of the seed sowing machine. The power from the wheels is transferred to the disc containing the seeds in a perpendicular direction to the wheel axle. This is done by assembling a bevel gear normal to the bevel gear which is already present in the wheel axle. Since the wheel rotates, the bevel gears fixed to the axle also rotates. This in return, rotates the bevel gear which is assembled perpendicular to the bevel gear in the axle. As a result, the seed disc which contains the seeds also rotates.
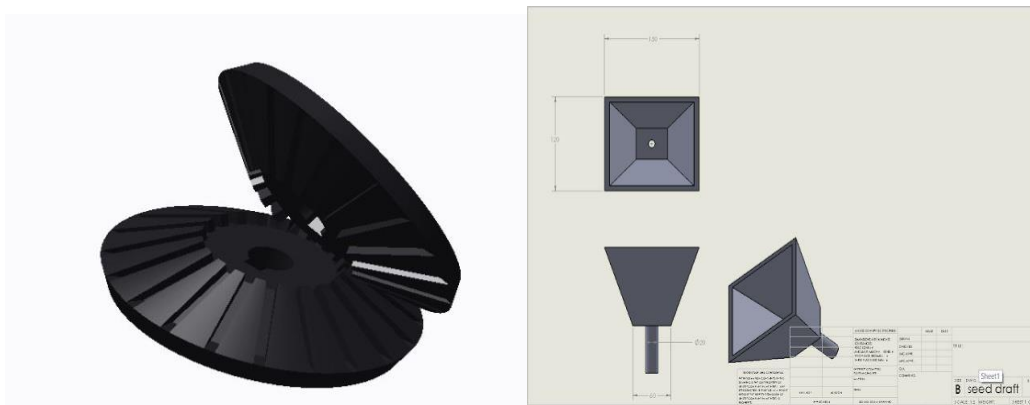

FIGURE 4. Gear Mechanism

7. Working Methodology

The main working functions in this project is to dig the soil, sow the seed and put the soil after sowing and keep going in the correct path and repeat the seed sowing process. All of these takes place with the help of the solar energy from the sun. So, first we absorb the solar energy from the sun, on solar panels by PV cells where the solar energy gets converted to electrical energy. Next, it gets transferred to the charge controller, wherein the power supply is limited and given to the batteries for saving the electrical energy. The electrical energy, which are stored in batteries and is supplied to the DC motors, when the solar energy is not separately is not sufficient to run the machine. The DC motor converts the electrical energy into mechanical energy. This mechanical energy is transmitted to the rear wheel using the transmission system. The most important component in the machine is the Micro Controlling Unit (MCU). It controls the DC motor by switching it on, switching it off and also has the control over its motion. The MCU controls the DC motors based on the results of the IR sensors. The IR sensors are used to find the correct path in which the machine has to go. It also identifies if there are any obstacles across the way. The seed sowing process will take place by first digging the soil with the help of plougher. Then a seed from the seed storage tank drops down to a disc, and then into the soil. The seed sowing time is based on the revolution of the wheel. (i.e, one seed per revolution). Then the soil is put back and adjusted. Fertilizers can also be sprayed along the way while the sowing process takes place. The vehicle traverses the field according to the above pathway (pic.1). The vehicle moves between the two black stripes and digs the soil between the stripes. When it reaches one end the sensor in the vehicle senses the pathway of the stripes and turns the vehicle accordingly. The seed draft(pic.2) is a container like structure which is used to store the seeds. It contains a small hole at the bottom through which the seeds pass through. The tube contains a slit which is used to plant one seed at a time in such a way that only one seed passes through it.
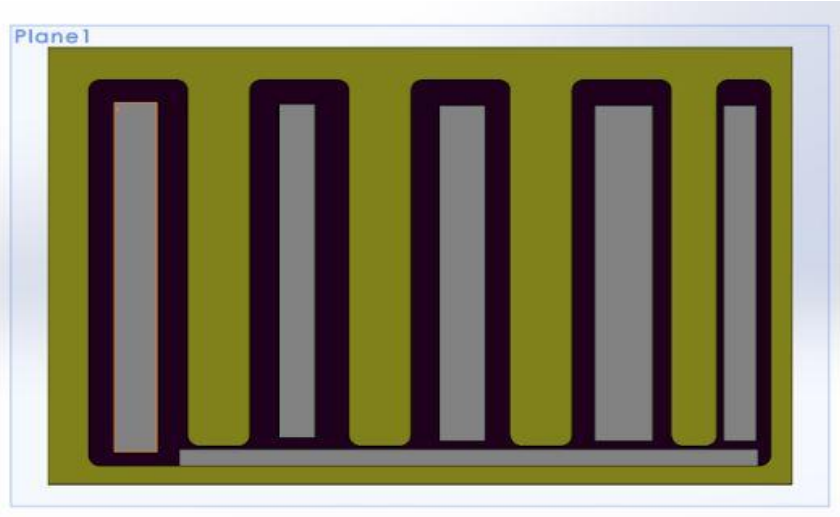
FIGURE 5. Working Methodology

8. Design and analysis

The theoretical design of the vehicle body was done using PTC Creo. In this design we use stainless steel in the frame work because to carry a load of 20N so we gone with the stainless steel is good corrosion resistance, it is light weight so machine can use less power and it is having high strength. Seed tank are made of mild steel (sheet metal) used in our design. To check the strength of the vehicle body deformation analysis was done in Ansys and the result obtained are shown below. The total deformation of the frame work is 0.2m for 1000N.
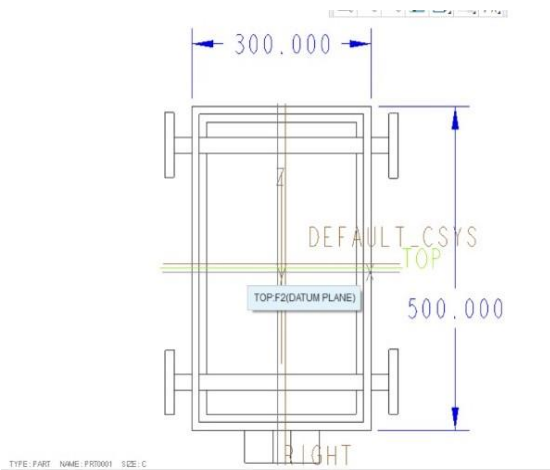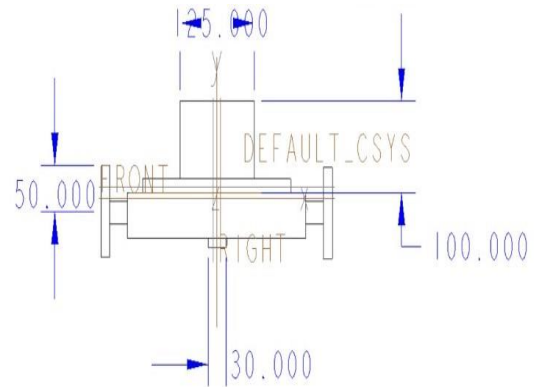

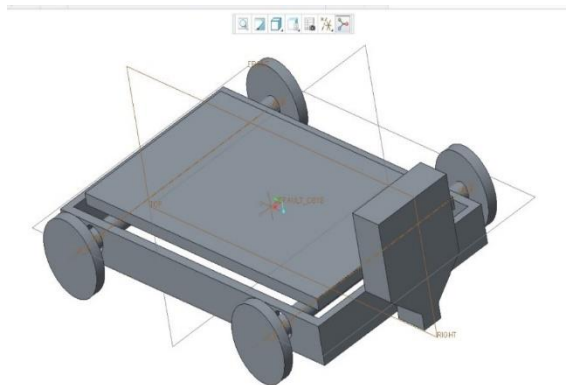**FIGURE 6.** Top View drafting

FIGURE 7. Rear view drafting

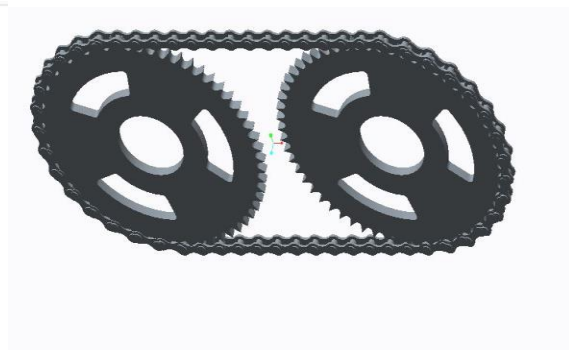**FIGURE 8.** Isometric View

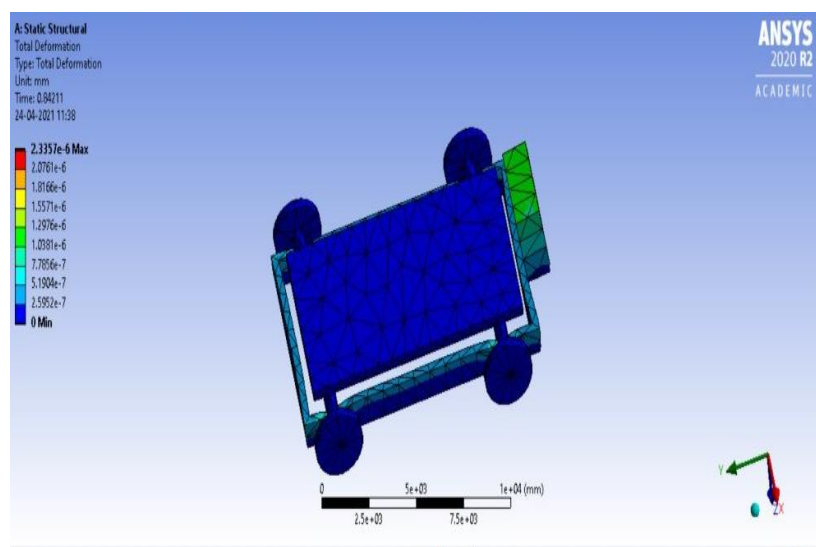**FIGURE 9.** chain and drive mechanism

FIGURE 10. Total Deformation

8. Conclusion

We know that 70% of the population is depends on the agricultural activities in India. Hence my prominent aim of this project is to fully automate the seed sowing process and fertilizer spray. This is project is fully worked on the conventional energy so we can reduce the demand for the fossil fuel and we can reduce the pollution caused by unconventional energy and thus we can save the revenue for the government spend in unconventional energy resources. Thus the solar energy can be used in all the areas over the country at some place (remote area) the fossil fuel available is less. This project saves money and time for the farmer

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