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DESIGN AND DEVLOPMENT OF MULTIPURPOSE SEMI AUTOMATED FORMING TOOL

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Abstract - This study aims to build "Multi-Purpose Agriculture Vehicle." India is famed for its agricultural goods and quality, and it's a vital economic engine. Most farmers are poor and have tiny farms, thus a portable, economical agricultural vehicle is needed. Current agricultural vehicles have just one purpose, either seed planting, water/fertilizer spraying, or ploughing. Solar panel, DC motor, body frame, toggle switch, solar powered pump, arduino uno are vehicle components. This agricultural vehicle relies on the quantity of solar energy the solar panel gets to operate its numerous sections. Crystal solar panels charge 12 volt batteries. DC motor is driven by battery-stored electrical energy. Switches regulate the motor to do water spraying, ploughing, and seed sowing. Power transmission uses spur gear, worm and spur gear, chain, and sprockets. This vehicle lowers human labour in agriculture and increases automation. This vehicle increases production on small farms. This car uses sustainable solar electricity. It can sow seeds, spray water, and plough using chain-sprocket and worm-and-spur gear mechanics.

***Key Words*: DC motor, solar, agriculture, multi-purpose.**

1. INTRODUCTION

Agriculture is main stay of many nations across the globe. There are multiple interventions by many scholars to utilize technology and mechanical intervention into agriculture. In the early 1920's itself there were attempts to implement robotics to help improve agriculture [2]. These were primitive models that required use of cable connection to operate the machine. Revolutionary attempts in the field of applying robots to agriculture continued to develop especially after 1980s as technological advancement in the mechanical engineering using the embedded systems. [1]

2 LITERATURE SURVEY

Seed planting, as mentioned by Saurabh Umarkar and Anil Karwankar [1,] is an essential part of the agricultural process. Pneumatic high-precision planting has been perfected for a broad variety of seed sizes, allowing for consistent seed distribution in seed spacing throughout the travel route, benefiting a wide range of crop types. A wireless network is employed for the receiver. The robot can only travel in one direction, which is the system's biggest drawback. When an obstruction is detected, the power is cut off immediately. In [2], agricultural researchers M.D. I. Sujon, R. Nasir, and Jayasree Baidya compared the results of using different planting methods and machineries, as well as applying oil seed rape at varying rates, on the emergence of plants from seeds and the resulting harvest. Using an approach similar to ultrasonic detection, the robot will shift its location and farm. A major drawback of this method is that it does not function optimally in all soil conditions. The authors of [3]—H. Pota R. Eaton, J. Katupitiya, and S. D. Pathirana—conclude that the decline in the availability of competent sowing personnel has made the use of bullock-drawn planting machinery more necessary. A crop's production is directly proportional to many parameters, including planting density and spacing. The Microcontroller 8051 in this system is responsible for mediating the exchange of data between the various sensors and actuators. The primary problem with this paradigm is that it relies on a single mechanism. The approach helps farmers with the fundamental task of planting seeds, as described in [4] by S. Kareemulla, K. Shaik, E. Prajwal, B. Mahesh, and V. Reddy. The method of operation for this equipment is elementary. Maximizing the overall yield is achievable. The labour shortage may be alleviated. Time and effort spent sowing with this robot equipment are reduced compared to manual and tractor-based methods. Likewise, there is less needless seed waste. Unfortunately, this model has one major flaw: it relies on only one underlying process. The aforementioned studies aided in comprehending the complexities of agricultural robot study. Many problems with mobility and grass-cutting efficiency plague the robots described in the aforementioned literature reviews. This study provides excellent solutions to these issues. In contrast to earlier built robots, this one makes use of three different systems. The potential of robots in the near and far future is also shown by this study.

3. Proposed methodology

This section provides the details about the implementation steps followed to construct the robot. The solid edge is

employed to design the dimensions of the tool and the Arduino ide is employed to dump the code and the hardware connections are employed as per the design.

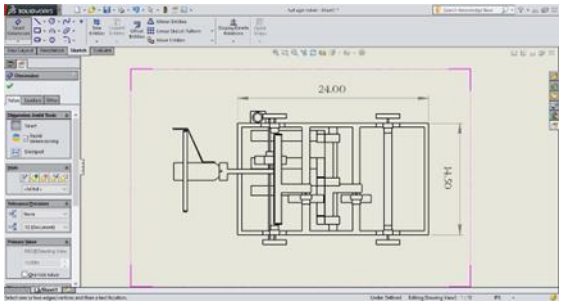


Fig-2: Plan of the Building

Before the implementation the design of the frame is the software is essential to avoid the wrong calculations and the above figure shows the designed model in the solid edge.

The design of the body frame is as shown in the below figure,

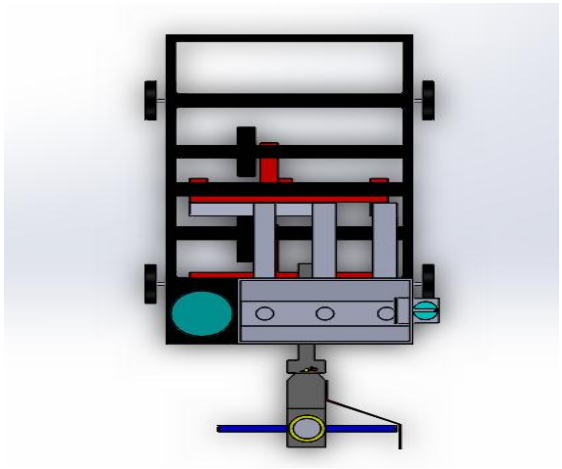


Figure 1: Body of the frame

To remove the weeds, the motor with different blades were added and the software design is as shown below,

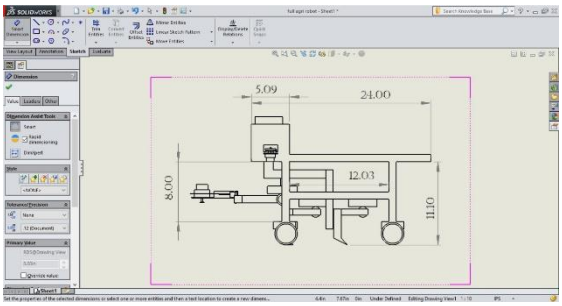


Figure 2: Weed remover design.

To dig the land, the implementation in the proposed model is as shown in the below figure

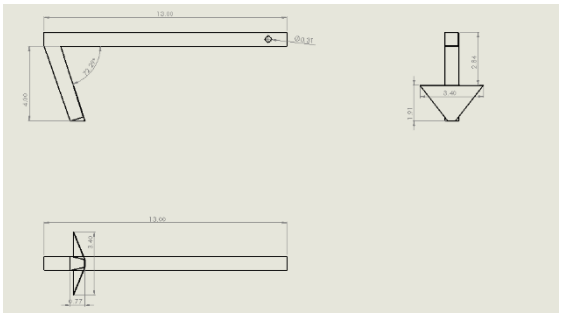


Figure 3: Plying of the land

Placing of the components on the frame is as shown in the below figure

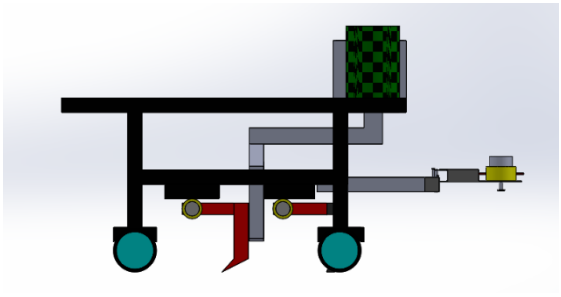
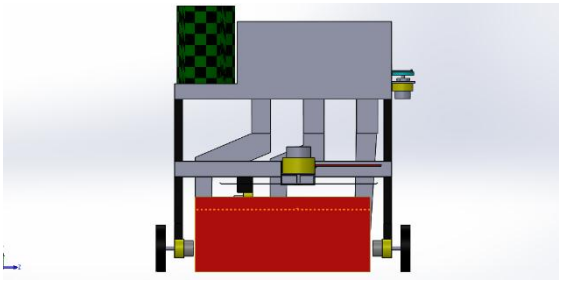


Figure 4: Skelton view of the proposed model.

The compartments designed for the model to store the water/pesticides and seeds is as shown in the below figure



A. Components employed in the model design

Arduino microcontroller

Arduino Atmega328 microcontroller as shown in figure is used to command the various components. The Arduino atmega328 microcontroller and its architecture is shown in figure

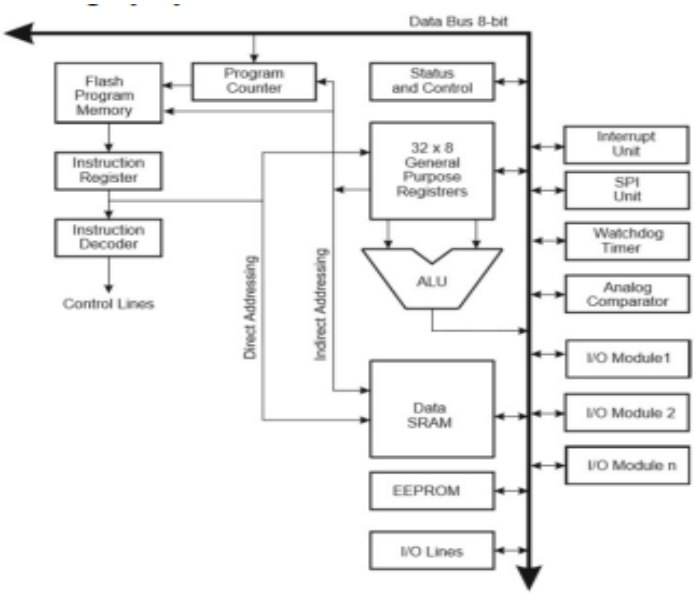


Figure 5: Architecture of the Arduino

B. Solar panel

The solar cells that are seen on satellites and calculators are also called photo voltaic(PV) cells as shown in Fig.3, which as the name implies (photo meaning \light" and voltaic meaning \electricity"), convert solar energy directly into electrical energy. A module is a group of cells which is electrically connected and packed into a frame (most commonly referred as solar panel). Solar panels are a great way to cut your electricity that everyone wants to live on their own or at least reduce our home's carbon footprint, and solar panels make this dream possible. Solar panels are made of photovoltaic a (PV) cell, which converts sunlight into electricity.

Figure 6: Solar panel

C. Motor Driver IC L293D

The motor driver is a module for motors that allows to control the working speed and direction of two motors simultaneously. The motor driver is designed and developed on the basis of L293D IC. L293D is a 16 pin motor driver

IC as shown in Fig.5. It provides bidirectional drive currents at voltages ranging from 5 V to 36 V. The L293D is an IC with eight pins on each side to control two DC motors simultaneously. It consists of 4 input pins, 4 output pins and 2 enable pins for each motor [9-10].

Figure 7: Motor IC

Implementation of the Model

The flow chart of the proposed system is as shown in the below figure,

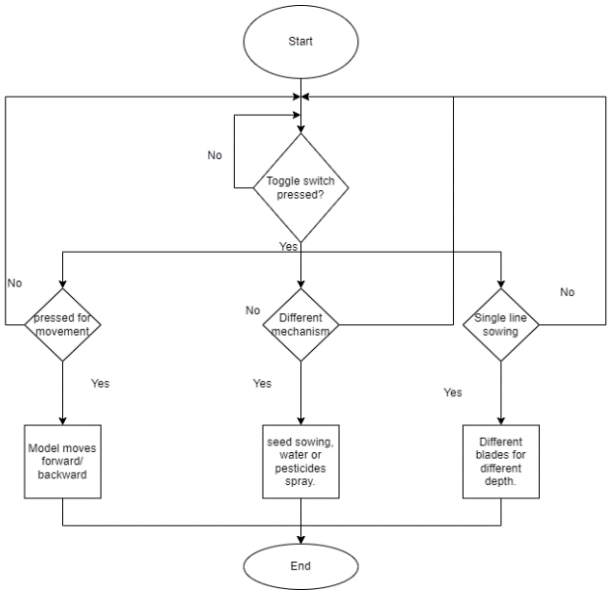


Figure 8: flowchart of proposed model.

The primary goal of this project is to create a versatile machine that can be used to dig dirt, plant seeds, level the muck, and spray fertilizer with the least amount of accessory changes and for the least amount of money. The versatile tool's whole power supply is battery and solar powered.

•Designed for the four-wheeled multi-purpose tool A DC motor powers this machine, which is primarily designed to excavate the ground.

•Sheet metal is used to construct a funnel for storing seeds, and the seeds pass through the funnel and into the ploughed soil through a hole bored in the shaft.

•After the seeds have been sown, a leveller and a sprayer are used to level the soil and provide fertiliser to the plants.

•The battery is recharged using a solar panel mounted on top of the multifunctional tool.

•As a result, the solar panel and battery are able to extract the greatest amount of energy possible from the sun.

•The 12-volt battery is needed to power the whole multifunctional gadget.

•In order to operate the vehicle, toggle switches are used.

The proposed models have the following features

•A new L-shaped leg has been introduced, and it is positioned at the rear of the frame, as seen in the image below. toggled switch controls motor and L-shaped leg is attached to it. The blades of the motor are activated when the toggle switch is pressed, as indicated in the image below.

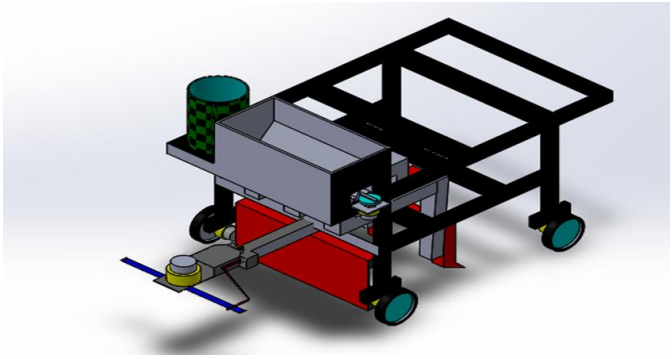


Figure 9: L-shaped structure at the backside

- If the weeds are growing between two plants, a particular function is provided in the model to handle this situation. Plants are plucked and held in place with dirt by the blades, which are inserted at the sides of the plant with greater breadth. The blades then remove weeds and put the plant back in place with soil that does not injure the plant.
- Perform seeding: For placing the seeds instead of plowing the three lines, only the water pump, leveller will work and other actions are not performed. To place the seeds only one blade is used to dig land with more depth of soil. By using toggle switch the large blade is used to dig the land.

For weed removal only L shaped structure is moved and rest three blades won't work (seeding, leveller and water pump is not used).

For seeding, leveller and water pump is used only three lines are sown all over the field.

The different blades are providing for obtaining the different depth and width of soil which is shown in the below figure,

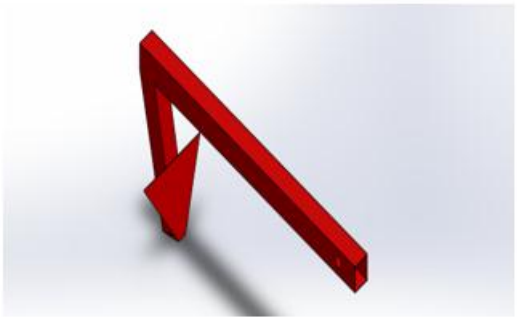


Figure 10: Single line sowing.

Prototype design

The designed robot will perform the seed sowing, pesticide spraying and grass cutting operations simultaneously. When the solar panel gets heated it converts sunlight into electricity. This electrical energy is fed into the charging circuit. The pulsed voltage is given to battery in order to charge it. The charging of battery is controlled with the help of voltage sensors. Since battery is bidirectional it will charge and supply voltage to ardunio at a time. The voltage supply with sustained oscillation is fed into ardunio with the aid of high pass filter. The channel relay provides voltage supply to all different mechanisms. The motor driver is used to drive the DC motors which run the robot.

The proposed body model is as shown in the below figure,

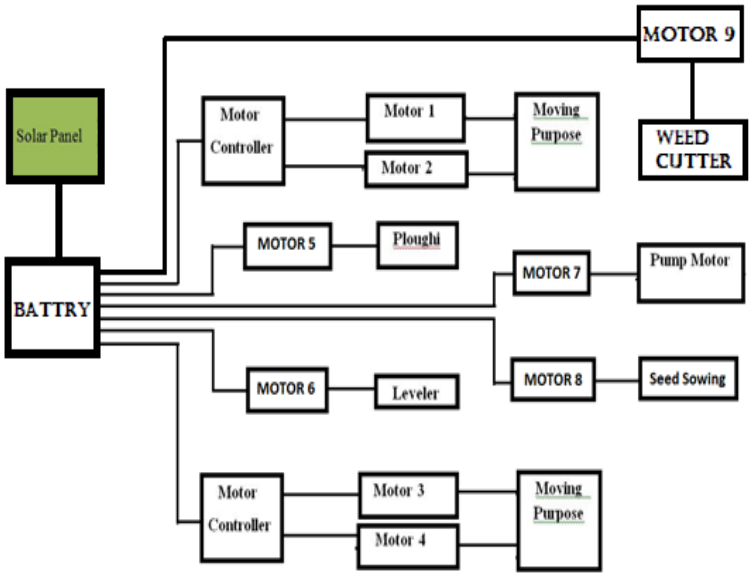


Figure 11:Proposed flow for multi-purpose Robot.

The dimensions of the tool designed is explained in this subsection.

DC motor

With other tools, it moves the frame. DC motors are geared. DC motors are a kind of DC motor whose inner workings have been revealed. Geared DC motors have gears, unlike normal DC motors. RPM is a motor's speed measured in shaft rotations per minute. Gears enhance torque and slow the car. Selecting the right gear combination reduces a gear motor's speed. Gear reduction reduces a vehicle's peak speed while increasing torque. This Insight covers every detail of the gear head and geared DC motor's functioning. Internal and external DC motor construction is explained.

The gear structure for the DC motor is as shown in the below figure,

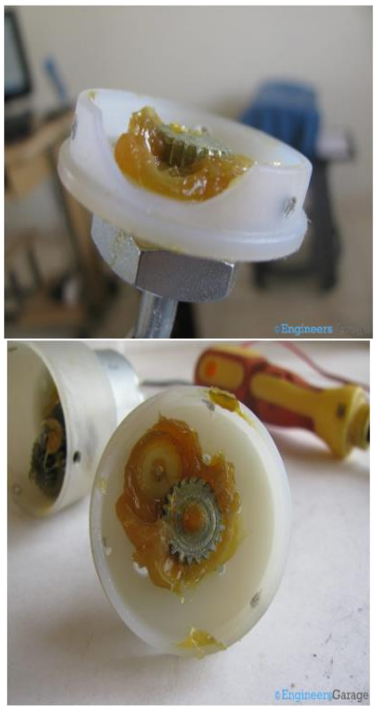


Figure 12: Gear Structure of DC motor

A 12 V battery is employed for the implementation with the characteristics such as, it has a weight of 750 g, having a capacity of 1.3 Ah and it is as shown in the below figure,

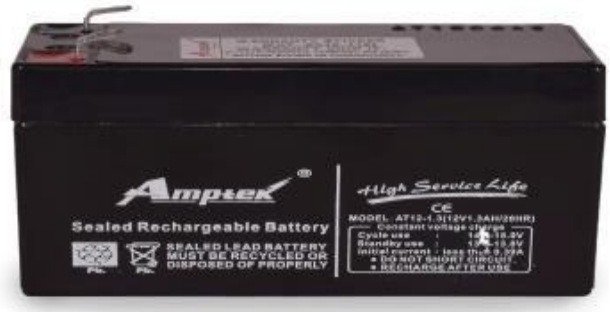


Figure 13: Employed battery.

To charge the battery the solar panels are employed and it as shown in the below figure,

Figure 14: Solar panels

The water pump is employed to sprinkle the pesticides or water and this pump is solar enabled water pump with the dimension of 12*8*5 cms, operates with 6-12V, current ratings of maximum of 1.2A. The water pressure is 5 meters.

The seed plough is as shown in the below figure which can be employed based on the requirement and it is as shown in the below figure.

Figure 15: Seed sowing plough

To level the soil after ploughing is also provided to the robot and it is as shown in the below figure,

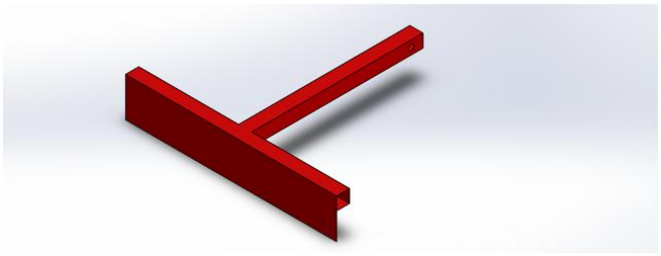


Figure 16: Leveller blade

To remove the weeds from the field the various blads are provided and it is as shown in the below figure,

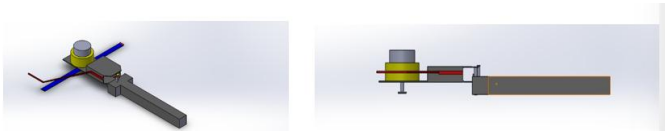


Figure 17: Adjustable blades for weed removal

The prototype of the proposed model is as shown in the below figure

Figure 18: Prototype model of the proposed system

The controlling of the model is performed by using the DPDT switch and the operations are of it is as shown in the below figure

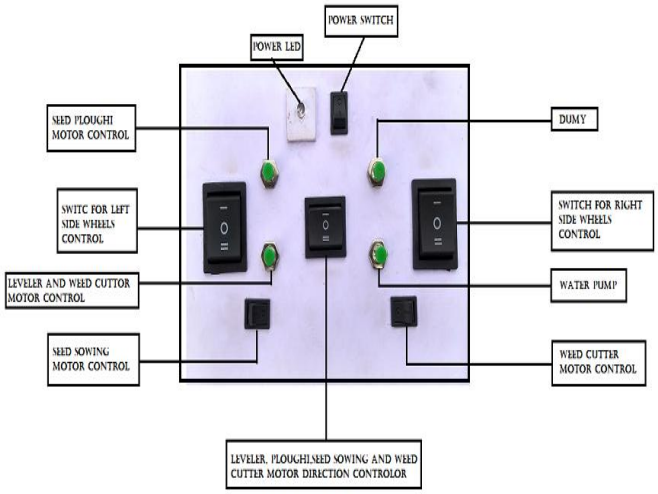
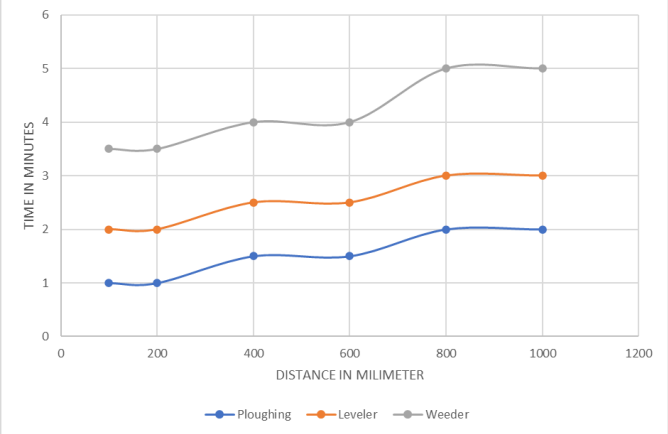


Figure 19: Various operations performed by Robot.

The performance from the model which includes ploughing, leveller and removal of weeds and the below graph shows it,



Conclusion

Multipurpose farming robot has effectively actualized and tried for operations like ploughing, seeding, grass cutting and water sprinkling. An underlying result of this examination shows that the greater part of these frameworks that work with self-governing, are more adaptable than customary frameworks. The upsides of multipurpose horticultural robots are lessening human intercession, guaranteeing appropriate water system and proficient use of assets. In future, it can be reached out by utilizing ultrasonic sensors and cameras for playing out similar activities without human administrator for estimating the different parameters like soil condition, region secured by the robot and leveling.

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