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Design and Development of Automated Multipurpose Agriculture Machine

[#1]Vinayak Bhoite, [#2]Shubham Kaduskar, [#3]Shreyas Ugale, [#4]Rishikesh Kore, [#5]Prof. Ganesh Patil

[1]vinayakbhoite9@gmail.com
[2]sakaduskar01@gmail.com
[3]shreyash.ugale@gmail.com
[4]rishi.rk9168@gmail.com

[#1234]Dept of Mechanical Engineering
[#5]Assistant Professor, Dept of Mechanical Engineering

Savitribai Phule Pune University
DR. D Y Patil School Of Engineering and Technology lohegaon, Pune, Maharashtra

ABSTRACT

The project aims on the design, development and the fabrication of the robot which can dig the soil, put the seeds these whole systems of the robot works with the rack and pinion gear. 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 advantages of these robots are hands-free and at one time in two rows seed sowing operation is done. In the field of agricultural autonomous vehicle, a concept is been developed to investigate if multiple small autonomous machine could be more efficient than traditional large tractors and human forces. Keeping the above ideology in mind, a unit with the following feature is designed Plugging is one of the first steps in farming. During this process we till the land and make it ready for the seed sowing. By tilling we mean that a plough will be used which will have teeth's like structure at the end and will be able to turn the top layer of soil down and vice-versa. Seed sowing comes next where the seeds need to be put in ground at regular intervals and these needs to be controlled automatically. Limiting the flow of seeds from the seeds chamber.

Keywords- Seed sowing, agricultural, spacing, machineries, sowing methods.

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I. INTRODUCTION

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 plugging, seed sowing watching the farms day & night for an effective report, allowing farmers to reduce the environmental impact, increase precision and efficiency, and manage individual plants in novel ways. 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.

The concept of fully autonomous agricultural vehicles is far from new; examples of early driverless tractor prototypes using leader cable guidance systems date back to the 1950s and 1960s. In the 1980s, the potential for combining computers with image sensors provided opportunities for machine vision based guidance systems. During the mid-1980s, researchers at Michigan State University and Texas A&M University were exploring machine vision guidance. Also during that decade, a program for robotic harvesting of oranges was successfully performed at the University of Florida. In 1997, agricultural automation had become a major issue along with the advocacy of precision agriculture.

The potential benefits of automated agricultural vehicles include increased productivity, increased application accuracy, and enhanced operation safety. Additionally, the rapid advancements in electronics, computers, and computing technologies have inspired renewed interest in the development of vehicle guidance systems. Various guidance technologies, including mechanical guidance, optical guidance, radio navigation, and ultrasonic guidance, have been investigated. Agriculture involves the systematic production of food, feed, fiber, and other goods. In addition to producing food for humans and animals, agriculture also produces cut flowers, timber, fertilizers, animal hides, leather, and industrial chemicals.

II. OBJECTIVES

The objective of this project is to present the status of the current trends and implementation of Agricultural and autonomous systems and outline the potential for future applications. Different applications of autonomous vehicles in agriculture have been examined and compared with conventional systems, where three main groups of field operations have been identified to be the first potential practical applications: plugging, seed sowing. Our aim is to fabricate a Prototype Solar Operated Multi-Purpose Agricultural Robot which can perform the following functions:

- This project objective is to fabricate a robot vehicle which can make hole in the soil & sow the seed in soil, & this whole setup is run by using motors.
- To reduce human effort in the agricultural field with the use of small robot.
- To perform all operations at single time, hence increases production and saves time.
- To complete large amount of work in less time.
- Farmer can operate this robot easily.
- 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 issue.

III. SCOPE OF THE PROJECT

The Present project aims at designing an intelligent robotic vehicle which can be used in farming for different operations like plugging, seed sowing, Digging. In this machine we used three motors, two dc motors. This power is then transmitted to the rear wheel through gear drives. In this project an attempt is made to make the electric and mechanical systems share their powers in an efficient way. Thus taking into consideration the ever increasing pollution levels and to reduce the running cost of the digging machine, we are in an attempt to incorporate the above mentioned features in our Solar Operated Multi-Purpose Agricultural robot.

IV. METHODOLOGY

The basic aim of this project is to develop a multipurpose machine, which is used for digging the soil, seed sowing, with least changes in accessories with minimum cost. This whole system of the robot works with motors.

- 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, lead screw 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.
- Another dc motor is used to motion of the robot.

V. COMPONENTS

5.1Arduino:

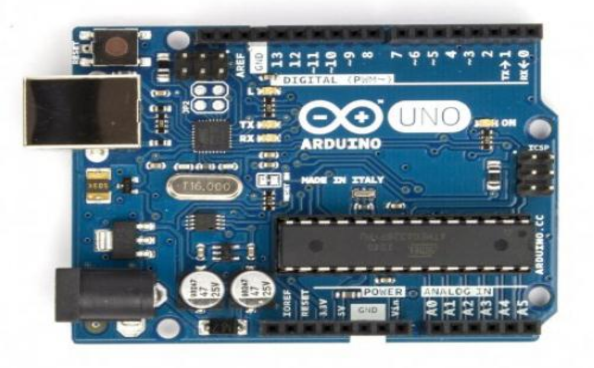
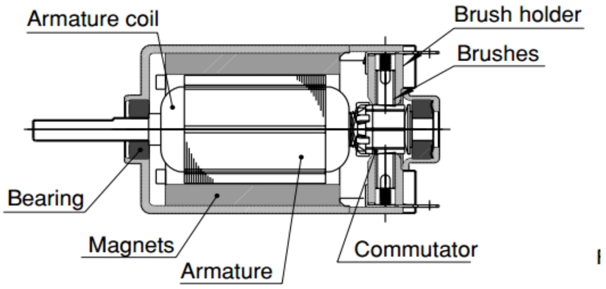


Fig1.Aurdino board

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter

Summary: Microcontroller ATmega328
Operating Voltage 5V Input Voltage (recommended) 7-12V. Input Voltage (limits) 6-20V Digital I/O Pins 14 (of which 6 provide PWM output) Analog Input Pins 6 DC Current per I/O Pin 40 mA DC Current for 3.3V Pin 50 mA Flash Memory 32 KB (ATmega328) of which 0.5 KB used by bootloader SRAM 2 KB (ATmega328) EEPROM 1 KB (ATmega328) Clock Speed 16 MHz.

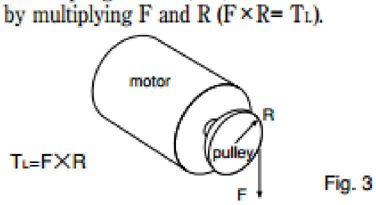
5.2 DC Motar :



Fir2:Dc motar

Japan Servo's DC Miniature Motors are widely used in a variety of application fields, from copiers and other office equipment, to remote-controlled equipment, medical equipment, vending machines, and game machines. These motors may be combined with Japan Servo's full line of gearheads to meet a wide range of torque and output speed specifications. Japan Servo provides a practical and economic choice as drive actuators. Strict quality control ensure reliable performance as well as prompt delivery at reasonable price. Japan Servo provides a full variation line-up of stock model and customized design motors to best meet your specific application needs.

Features • Long-life: Intermittent operation over 1 million cycles with optimized brush design*1 • Continuous operating life of 3000 hours*1 • High output: High heat dissipation and heat resistance achieves higher output • High strength: High radial load capacity due to robust construction, large diameter output shaft and ball bearings • Low noise and increased insulation due to new resin brush holders • Large selection of gear heads and reduction ratios are available to meet all needs • Also available with magnetic revolution sensor and noise filter*2.

Term/Symbol	Content
No-load rotating speed No	Rotating speed with no load
No-load current Io	Input current with no load
Stalling torque Ts	Max. value for motor-generated torque. In general, a DC motor's stalling torque is equal to its starting torque.
Load torque T_L	As shown in Figure 3, when a pulley with radius R is attached to the motor and force of F is applied to the pulley's circumference, the torque generated, T_L, can be derived by multiplying F and R ($F \times R = T_L$).  Note : Using the lock with voltage applied could cause burnout.

5.3Solar panel:

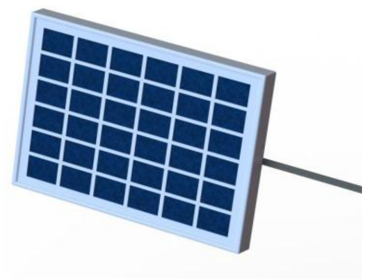


Fig3:Solar Panal

- Model:- SVL-0010P
- Panel size : 40*40 cm
- Maximum power (Pmax) : 10Wp
- Voltage at Maximum Power (Vmp) : 17.40 volt
- Current at maximum power (Imp) : 0.58 Amp
- Open circuit voltage(Voc) : 21.20 volt
- Short circuit current (Isc) : 0.66 Amp
- Tolerence : +5% , -5%
- Normal operating cell temperature: 45 degree Celsius
- Temperature coefficient: -0.41% /C

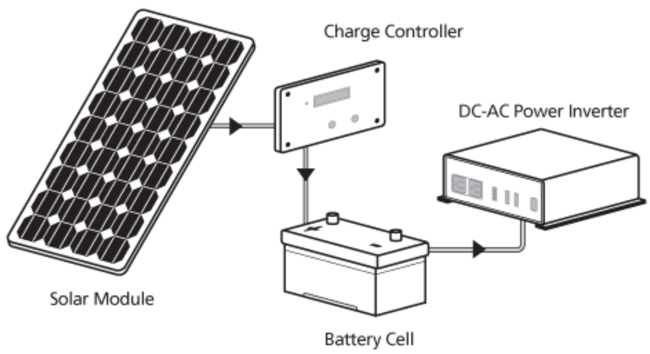
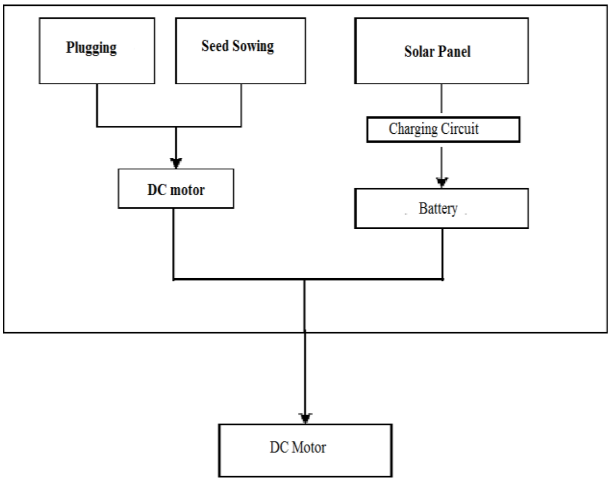


Fig4:Solar circuit

VI. MATERIAL USED FOR COMPONENT

- Drill bit = M12 Stud Bit= Mild Steel
- Frame = Mild Steel
- Motor = 30 rpm for drill and seed sowing operation
- Motor = 60 rpm for Run rear wheel
- Pulley = Mild steel material
- Rack and pinion= Mild steel martial
- Drill bit Frame= Mild Steel material
- Wheel material rim = Mild steel

VII. BLOCK DIAGRAM OF AGRICULTURAL MACHINE



VIII. DESIGNED MODEL

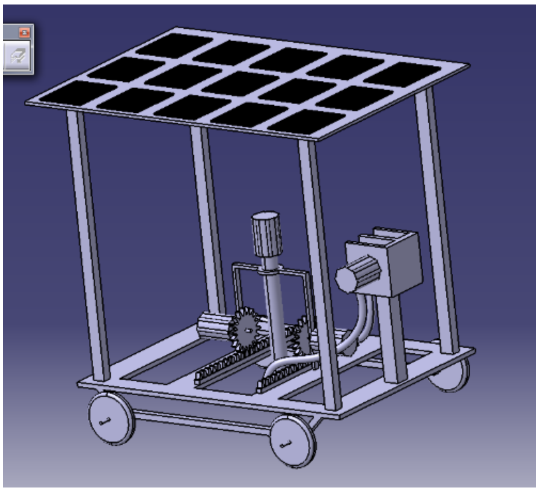


Fig5:Model of machine

IX. FABRICATION OF THE WORKING MODEL

Once design is over we are planning to prepare working model of the equipment.

- **Cutting**: cut a material with suitable dimension
- **Welding:** Different components were joined by metal arc welding process.
- **Assembly:** Once all the above components were ready with the help of welding technology and using fasteners components were assembled to final model.
- **Programing:** Making a program for Arduino which is used for performing sequencing operation.

X. FUTURE SCOPE

- We can interface sensors to this Machine so that it can monitor some parameters.
- We can add Wireless Technology to Control Machine.
- We Can add More Drill for different crops.
- We can add water tank + fertilizer tank in Machine to reduce more efforts.
- There are to be proper provisions are needed to couple the machine with the tractor.
- We can add solar panel for spraying System.

XI. CONCLUSION

Agricultural machine is designed and made automated operative with the use of solar energy and DC motar to assist human to perform various agricultural operations like cultivating , ploughing , seeding and also other operations by attaching and detaching different tools for different agricultural operations.

The proposed system is open architecture so any one can make this type of system using any way or path. The system uses image processing to observe the leaf color which increases further accuracy of the system as it identifies color very accurately than human. The system also observes different environmental conditions such as humidity, soil moisture and temperature which human cannot measure accurately by open eyes to decide the plant health so the accuracy of the system is high. It also involves watering mechanism and cutting process which reduces human labor and we can reduce labor further by modifying the system further for other agricultural work such as picking, harvesting, weeding.

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