IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

SOLAR OPERATED MULTI FUNCTIONAL AGRICULTURAL VEHICLE.

Sudesh Kulkarni, Avinash Rade, Hanumant Raykar, Rohan Shelake , Prof. H.S.Kulkarni*

UG Student of Mechanical Engineering, Faculty Of Mechanical Engineering

Department of Mechanical Engineering , SKN Sinhgad College Of Engineering Pandharpur ,Solapur, Maharashtra

Abstract: The Solar Operated Multi-functional Agricultural Vehicle (SMAV), which combines electric propulsion, renewable energy, and advanced agricultural capabilities, represents a state-of-the-art approach to sustainable farming techniques. SMAVs provide a full answer to contemporary agricultural difficulties because they are outfitted with electric motors for propulsion, solar panels for power generation, and adaptable attachments for a range of agricultural jobs. With the use of precision agriculture technology, such as GPS, sensors, and automated control systems, farmers can optimize crop management techniques for increased yields and less environmental impact. These technologies also help to increase productivity and resource efficiency.

Key Words **-** Solar Multi-functional Agricultural Vehicle (SMAV), Renewable Energy, Electric Propulsion, Solar Panels, Versatile Attachments, Precision Agriculture, GPS, Automated Control Systems, Resource Efficiency.

I. Introduction

Solar Power Generation: The vehicle is equipped with solar panels mounted on its surface to capture sunlight and convert it into electricity. These panels may be integrated into the vehicle's structure or deployed as removable modules for flexibility.

Electric Drive System: SMAVs typically utilize electric motors for propulsion, powered by the electricity generated from the onboard solar panels. This eliminates the need for fossil fuels and reduces greenhouse gas emissions associated with traditional combustion engines.

Versatile Attachments: The vehicle can be equipped with various attachments and implements to perform a wide range of agricultural tasks, including ploughing, seeding, planting, fertilizing, spraying, harvesting, and transporting crops.

Precision Agriculture: SMAVs may incorporate advanced technologies such as GPS, sensors, and automated control systems to enable precision agriculture practices. This allows for precise application of inputs (such as seeds, fertilizers, and pesticides) and optimized crop management, resulting in higher yields and resource efficiency.

We can remove many challenges in the agriculture sector by implementing this project. The system is powered by solar energy which is the most clean energy worldwide. Crop cultivating machinery has become very popular nowadays. The most common type of machine is used for soft grass furnishings. It is installed in the appropriate machine structure. The engine has 1000 RPM and is connected to the electrical supply by roll of wire. Motor rpm is increased by gears. Motor is controlled by electric switch for ease of operation..

The machine will be controlled by smart phone. The system is like a moving robot having four wheels and the cultivator is attached to back side of the robot.

The seed sowing system is mounted on the on the robot. The water pump and the water tank is mounted on the system and can be control wirelessly.

These features makes the system is perfect for the farming

II. Problem Statement

Energy Dependence: Conventional agricultural vehicles rely heavily on fossil fuels, leading to high operating costs and environmental pollution.

Limited Access to Electricity: Many agricultural areas lack access to reliable electricity, hindering the adoption of electric vehicles or machinery.

Labour Intensive Operations: Traditional farming methods often require significant manual labor, leading to inefficiencies and labor shortages.

Environmental Impact: Agricultural practices can contribute to soil degradation, water pollution, and greenhouse gas emissions, necessitating sustainable solutions.

Equipment Versatility: Farmers require versatile machinery capable of performing various tasks such as plowing, planting, harvesting, and transportation.

Farming is a very tough work to do.

Cultivation is very expensive.

No portable means of watering is available.

Seed sowing is done manually.

Soil flattering and crop cutting is also manual time consuming and a very hard work to do.

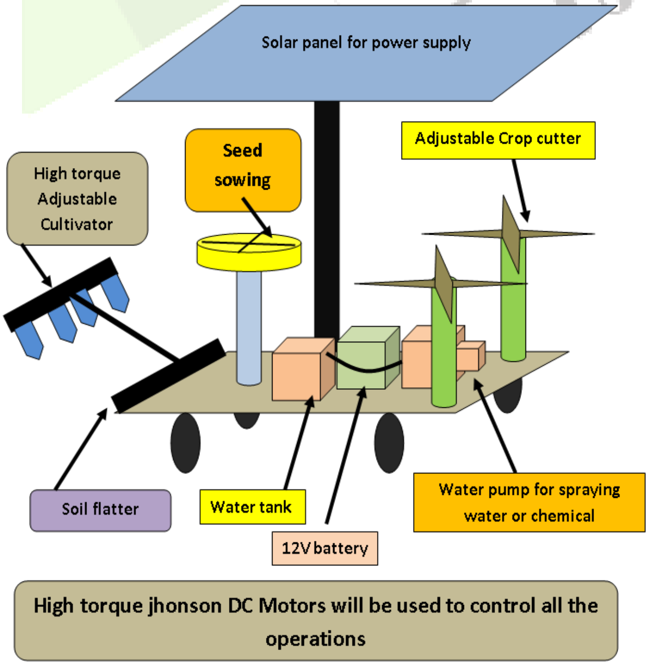
III. Objective

The objective of the Solar Operated Multi-functional Agricultural Vehicle (SMAV) concept is to revolutionize farming practices by promoting sustainability, efficiency, and productivity.

- Enhance Agricultural Productivity: The SMAV aims to improve agricultural productivity by offering a range of functions to assist farmers in various tasks such as plowing, planting, spraying, harvesting, and transportation of crops.
- Reduce Environmental Impact: By utilizing solar power as a primary energy source, the SMAV aims to reduce dependence on fossil fuels and minimize greenhouse gas emissions associated with traditional agricultural machinery.
- Cost Savings: The use of solar energy can lead to significant cost savings for farmers by reducing fuel expenses and maintenance costs associated with conventional diesel-powered machinery.

Versatility and Adaptability: The SMAV is designed to be versatile and adaptable to different agricultural tasks and environments

IV. Model Set Up & Material



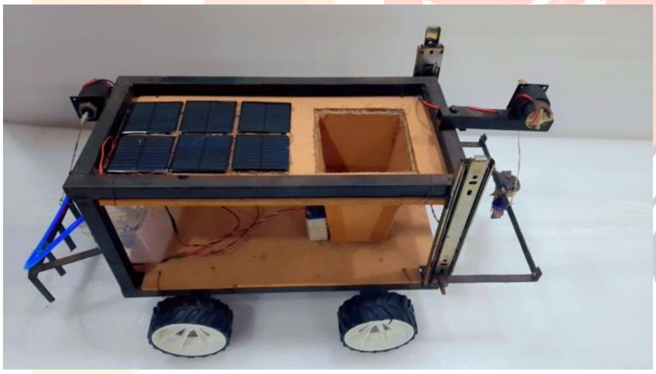
The Fig5(a) Structure representation of Solar Operated Multi-functional Agricultural Vehicle (SMAV)

Material:-

SOLAR PANEL
IRON FRAME
WHEEL
BATTERY
PLASTIC CONTAINER
MDF BOARD
9V WATER PUMP
TUBE
RACK CHANNEL
SHARP BLADE
IRON STRIP
ELASTIC
DC MOTOR
DC MOTOR CLAMP

V. Model working

The machine will be a moving robot having four wheels and everything is attached to the machine.
The system will use cultivator to cultivate the field which is attached to the back side of the robot.
Cultivator can be move up and down with the help of rack and pinion and motors.
Soil flatter will used to flat the soil.
Two high RPM 12V drill machine will be modified and used with cutting blades to cut the crop.
We used seed sowing system that is mounted on the robot.
We can use solar panel and battery for power supply. And whole system will work on solar energy. We can also use 12V adaptor.
Water pump and water tank is also mounted on the system for proper watering can be done.



Solar Operated Multi-functional Agricultural Vehicle (SMAV)

VI. Formulas

A good science project doesn't end with building your motor. Different electrical and mechanical parameters need to be measured and unknown values need to be calculated. The following useful formulas will help you in measuring your motor. We are going to use the International system of units (SI). SI is a modern metric system officially recognized in the field of electrical engineering in the United States. One of the fundamental laws of physics is. It states that current through the conductor is directly proportional to applied voltage and is expressed as:

I = V / R
where I – current, measured in amperes (A);
V – applied voltage, measured in volts (V);
R – resistance, measured in ohms (Ω).
This formula could be used in many cases. You may calculate the resistance of your motor by measuring the consumed current and applied voltage. This formula explains that for any given resistance in the motors (in this case, the resistance of the coils), the current can be regulated by applied voltage. The consumed electrical power of a motor is defined by: PIN = I * V Where Pin = input power, expressed in watts (W), I = current, expressed in A; V = applied voltage, expressed in V. The output mechanical power of a motor can be calculated as follows: Pout = τ * pi * pi Where Pout = output power, expressed in W; τ = torque, expressed in N•m; pi = angular speed, expressed in R per second (R/s). It is easy to calculate the angular speed of a motor if you know the rotational speed of a motor in RPM: RPM = rotational speed * 2π/ 60 ORR = rotational speed in RPM

π – mathematical constant pi (3.14).
60 – number of seconds in a minute.
If the motor has 100% efficiency all electrical power is converted to mechanical energy. However such motors do not exist. Even small precision-machined industrial motors like the one that we use as our generator in our generator kit have a maximum efficiency between 50% and 60%. Most of the motors made from our kits have a maximum efficiency of around 15% (See Experiments section for how we estimate this). Don't be fooled by the 15% maximum efficency. All of our kits are for education purposes only and not for real application. This efficiency isn't bad at all. In fact, it's much higher than most of the self-made designs on the Internet can offer. The motors are powerful enough to perform all kinds of tests and calculations. Measurement of the torque is a difficult task
It requires expensive equipment, so we recommend calculating it. The motor efficiency is calculated as the mechanical output power of the motor divided by the electrical input power. For example, E = pout / pin Pout = pin * E After substitution, we get the following formula: I * V / E I * P * R * 2 * P / S = I * P * E The formula for calculating the torque is as follows: Put the motor on the load Why do you need the motor to be on the load? If there's no load, there's no torque. Measure the current, voltage, and rpm. Now, at this speed, you can compute the torque for the load assuming you know the motor efficiency.
Our estimated 15% efficiency represents maximum efficiency of the motor which occurs only at a certain speed. Efficiency can range from zero to the maximum; for example, in our example, below 1000 rpm is not the optimal speed, so 10% efficiency is used for calculations. For example: speed = 1000 rpm; voltage = 6 Volts; current = 220 mA. Σ = (Σ * 6 * 60 * 1000 * 3 * 3 * 0.14) / (Σ * 2 * 2 * 0.4 * 0.3 * 0.4) = 0,00126 N'm Since the result is very small, it is usually expressed in mN's. There are 1000 mN' in 1 N'm, and the resulting torque is 1,26 mN'm. It can also be converted to still common g-cm by multiplying 10.2; the resulting torque is 12,86 g In our example, the input electrical power is 1.32W (0.22A x 6V) and the output mechanical power (1000 rpm x 2x3.14x0.00126N•m/60) is 0.132W. The motor torque changes as the speed increases. When there is no load, the motor has maximum speed and no torque. Load increases the mechanical resistance and the motor starts consuming more current in order to overcome the resistance. The speed decreases as the load increases. When the load increases, the motor stops at some point (stall). When the torque reaches maximum, the motor has stall torque. Stall torque is difficult to measure without special tools, but can be found by plotting the speed and torque graph. Stall torque can be found by taking at least two measurement with different loads. How accurate is torque calculation? Voltage, current, and speed can be measured accurately. Efficiency of the motor can also be measured accurately. The accuracy of the measurement depends on the assembly, sensor location, friction, motor and generator axle alignment, etc.
If you want to get meaningful numbers you might use a second generator kit as explained in Torque and Efficiency Calculation section.
Speed, torque, power and efficiency of the motors are not constant values. Usually the manufacturer provides the following data in a table like this one (sample data from one of the motors used in generator kit):
I = V / R
where I – current, measured in amperes (A);
V – applied voltage, measured in volts (V);
R – resistance, measured in ohms (Ω).
Pin = I * V

where Pin – input power, measured in watts (W);
I – current, measured in amperes (A);
V – applied voltage, measured in volts (V).
Pout = τ * ω
where Pout – output power, measured in watts (W);
τ – torque, measured in Newton meters (N•m);
ω – angular speed, measured in radians per second (rad/s).
angular speed can be calculated easily if you know the rotational speed (RPM) of the motor: RPM = RPM * 2π/60 RPM = rotational speed (radians per second /s) RPM / 60 = rpm / rotational speed (seconds per minute) PI = mathematical constant pi / 3.14 E = POUT / PIN Pout = Pin / E After substitution, we get: I * V / (RPM / 60) / (RPM * 2π) / I * V / (PIN / E) The formula for calculation of torque is:

VII. Scope

Advanced Energy Storage: Integration of more efficient and higher capacity energy storage solutions, such as advanced batteries or super capacitors, can enhance the energy storage capabilities of solar agricultural vehicles.
Autonomous Operation: Future solar agricultural vehicles could incorporate autonomous or semi-autonomous capabilities, leveraging technologies such as GPS, sensors, and artificial intelligence to navigate fields, perform tasks, and optimize operations with minimal human intervention.
Precision Farming: Solar agricultural vehicles can play a significant role in precision farming by integrating sensors, imaging systems, and data analytics.
Modular Design: Modular design concepts could allow solar agricultural vehicles to be easily customized and adapted for various tasks and farm sizes.
Energy-Efficient Technologies: Continued advancements in energy-efficient technologies, such as lightweight materials, aerodynamics, and electric drivetrains, could further improve the energy efficiency and performance of solar agricultural vehicles.

VIII. Conclusion

The Solar Multi-functional Agricultural Vehicle (SMAV) concept represents a significant advancement in sustainable farming practices, integrating renewable energy, electric propulsion, and advanced agricultural technologies. By harnessing solar power for electricity generation and employing electric motors for propulsion, SMAVs offer a cleaner and more efficient alternative to traditional fossil fuel-powered vehicles. The versatility of SMAVs, combined with precision agriculture technologies, enables farmers to optimize crop management practices, increase productivity, and reduce environmental impact. As the demand for sustainable food production continues to grow, SMAVs stand as a promising solution to meet the challenges of modern agriculture while promoting environmental stewardship and resource efficiency.

IX. Referance

"What is Wi-Fi (IEEE 802.11x)? A Webopedia Definition". Webopedia.com.
"Authorization of Spread Spectrum Systems Under Parts 15 and 90 of the FCC Rules and Regulations". Federal Communications Commission of the USA. June 18, 1985. Archived from the original(txt) on September 28, 2007. Retrieved 2007-08-31.
Ross Greenwood (November 3, 2014). "So just what’s the big idea anyway?". News.com.au.
Phil Mercer (August 11, 2012). "Wi-fi, dual-flush loos and eight more Australian inventions". BBC News.
"WATCH: 5G WiFi Will Help Integrate Wireless Networking Into Everyday Lives". huffingtonpost.com. Retrieved 11 June 2017.
"European Inventor Award: High-speed wireless networking". www.epo.org. Retrieved 11 June 2017.
EP 0599632
Sygall, David (December 7, 2009). "How Australia's top scientist earned millions from Wi-Fi". The Sydney Morning Herald.
"Wi-Fi Alliance: Organization". Official industry association Web site. Retrieved August 23, 2011.
IEEE-SA – IEEE 802.11 and Amendments Patent Letters of Assurance
Moses, Asher (June 1, 2010). "CSIRO to reap 'lazy billion' from world's biggest tech companies". The Age. Melbourne. Retrieved 8 June 2010.
"World changing Aussie inventions – Australian Geographic". Australian Geographic.
"How the Aussie government "invented WiFi" and sued its way to $430 million". ArsTechnica.

"Australia's Biggest Patent Troll Goes After AT&T, Verizon and T-Mobile". CBS News.
"Australian scientists cash in on Wi-Fi invention". The Sydney Morning Herald.
"CSIRO wins legal battle over wi-fi patent". ABC News.