"Solar-Powered Pesticide Sprayer Vehicle"

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Abstract : The proposed project aims to reduce the labour-intensive tasks associated with manual pesticide spraying in agriculture. It involves the development of a remotely controlled, semi-automated vehicle powered by solar energy. The vehicle is designed to spray pesticides and insecticides directly onto individual lesions with high precision, thereby minimizing chemical waste and ensuring efficient application. Its sustainable solar-powered design and 12-volt battery make it cost-effective and environmentally friendly. The vehicle is powered by an Arduino Uno and controlled remotely. Its movement is achieved using a 12-volt DC gear motor, which is driven by the IBT_2 motor driver. Overall, this innovative solution addresses the challenges of manual labour while promoting efficient, precise, and sustainable agricultural practices.

Index Terms : **Arduino, Solar-powered, IBT_2 motor driver, 20-Watt solar panel, Solar charge controller, 12-volt DC gear motor, Relay module, 12-volt Lead-acid battery.**

I. INTRODUCTION

India has an agrarian economy, and a larger part of the country's populace depends on agribusiness to make a living. As of now, the cultivating strategies are either physically or semi-automated, with a high level of labour. In the past few years, the accessibility of specialists has consistently diminished along with the increase in compensation. Hence, there is a requirement for higher efficiency. In this manner, the gadget will be planned to offer assistance to the ranchers to overcome the above-mentioned issue. Mechanised vehicles can offer us an arrangement. The essential reason for vehicles in the commerce world has been to supplant human labour with robots or mechanised frameworks to make work more proficient, accurate, uniform, and cost-effective.

II. SIGNIFICANCE OF SOLAR ENERGY

The sun transmits an enormous sum of vitality called sun-oriented vitality. It transmits more vitality in a single day than the whole world's employment in a year! This vitality comes straightforwardly from the sun. Like most stars, the Sun may be an enormous ball of gas containing the basic components of hydrogen, helium, and more. The Sun produces vitality within the internal centre of its body through a preparation known as atomic combination. It takes somewhat more than eight minutes for the sun's vitality to form its way to Soil. It voyages 93 million miles (145 million kilometres) to reach the surface of the Soil. Sun-based vitality voyages at around 186,000 miles (160 million kilometres) per moment. As it were a little division of the light that the Sun emanates into space comes to the Earth's surface.
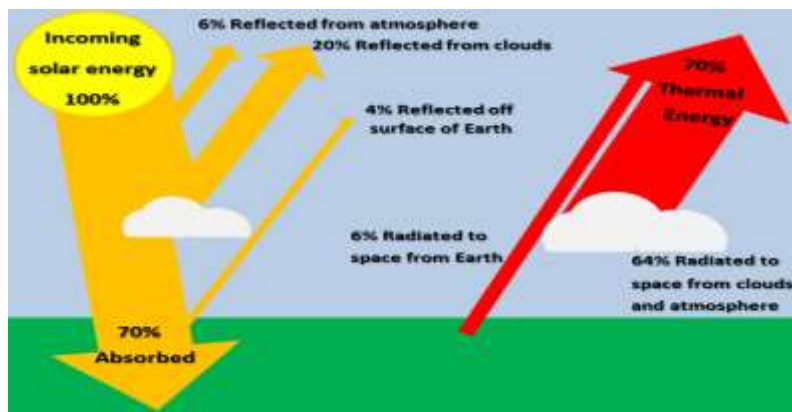
Fig 1: Solar energy incident on earth

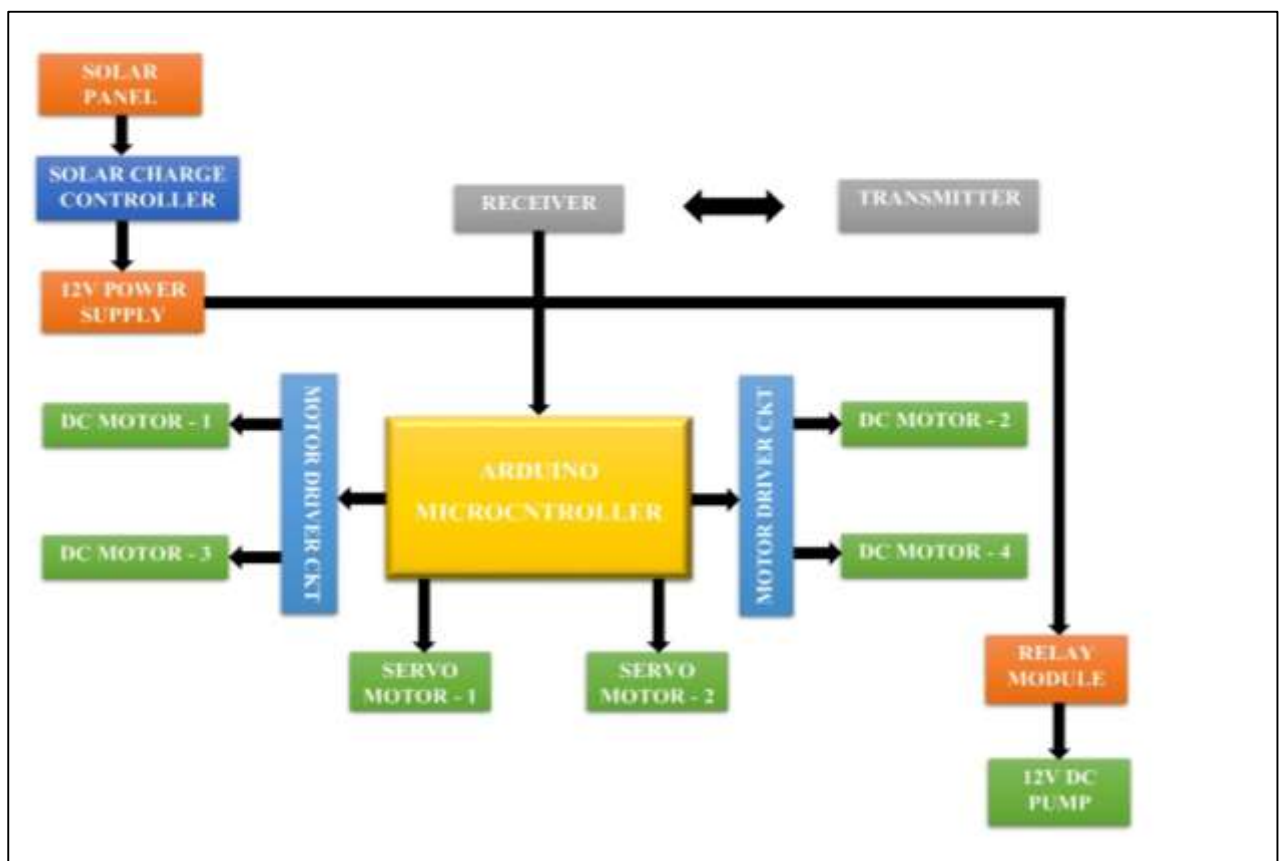## III. PROPOSED METHODOLOGY

1.   Block diagram

Fig 2: Block Diagram

This framework is a vehicle designed for agricultural field support purposes. The farming vehicle is created with Arduino, an IBT-2 engine control shield, an HC-05 Bluetooth module, a 4-wheel drive with 4 DC gear motors, a water pump, spouts, a cutter setup, a battery, and a solar-powered board. This vehicle with a manual sun-following-sun-powered board performs a few concurrent operations. Their proficiency and working speed enormously influence efficiency. The distinctive electrical components are associated with the combination of the Arduino board and motor shield.

2. The Chassis

To create the chassis, first create a rectangular block of dimensions (22.9*14.2*9.5 in3). Then sketch two offset rectangles on the two adjacent faces of the block at an offset of 1 inch and use the command "extrude cut" to generate the chassis as shown in the figure below.
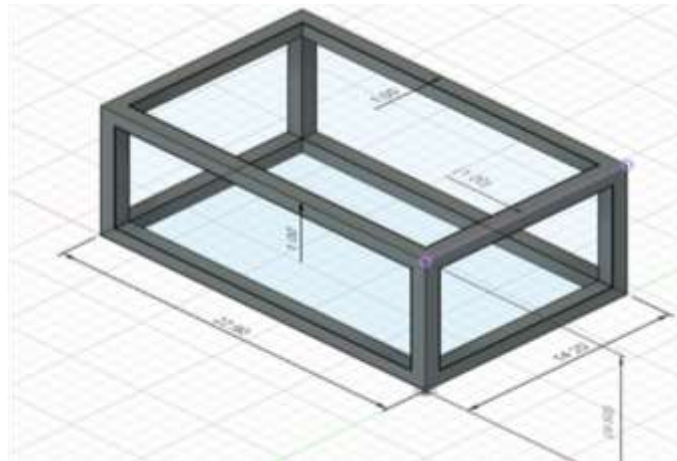

Fig 3: Chassis with dimensions

IV. HARDWARE DETAILS

Fig 4: Hardware

1. Arduino:

Within the Solar-Powered Pesticide Sprayer Vehicle project, the Arduino serves as the control middle for engine operations, sensor integration, information handling, and communication. It facilitates the development of DC motors using motor driver modules and integrates with the Bluetooth module for accepting the flag-transmitted form of the remote. Generally, the Arduino Uno's simplicity, adaptability, and strong community have made it a go-to stage for prototyping and tinkering within the domain of implanted systems and physical computing.

2. 12V DC gear motor:

The 12V DC gear motor could be an essential component in the Solar-Powered Pesticide Sprayer vehicle, giving controlled and slow-speed revolution with expanded torque. Their gearboxes decrease motor speed while upgrading torque, which is fundamental for cultivating arrival. This engine sort is instrumental in accomplishing the vehicle's responsiveness, permitting it to explore deterrents, execute exact developments, and contribute to the general proficiency and adequacy of the Solar-Powered Pesticide Sprayer vehicle amid pesticide spraying operations.

3. IBT-2 motor driver:

IBT 2 is a type of motor driver or motor controller that is commonly utilized in mechanical technology and other applications to control the development of engines. It stands for "Coordinates Bridge Type 2." IBT 2 motor drivers are outlined to control the speed and direction of DC (direct current) motors, typically brushed DC motors. They are regularly utilized in ventures like robot cars, rambles, and other devices that require motor control.

4. MG996R servo motor:

The MG996R (in some cases referred to as MG996K) could be a well-known show of servo motors utilized in a wide run of applications, especially in mechanical technology and remote-controlled vehicles. It's a advanced metal-geared servo motor. It is controlled through PWM signals, where the beat width of the flag decides the position of the motor shaft. The MG996R servo motor is broadly utilized in radio-controlled vehicles, mechanical arms, camera gimbals, and other applications where exact and controlled development is required.

5. DC to DC buck converter:

A DC-to-DC buck converter is a type of switched-mode power supply that decreases voltage while increasing current from its input to its output. The output voltage of a buck converter is always less than the input voltage.

6. HC-05 Bluetooth module:

Inside the Solar-Powered Pesticide Sprayer Vehicle project, Bluetooth is the important component of all the communication between the vehicle, and inaccessible is done with the Bluetooth module. HC-05 could be a Bluetooth module that's planned for remote communication. This module can be utilized in a master or slave setup. Serial modules are used by Bluetooth to allow all serial-enabled devices to communicate with each other.

7. 12V DC pump:

A 12V DC pump is a type of electric pump that operates on a 12-volt direct current (DC) power supply. These pumps are designed to be powered by a 12V DC source, such as a battery or a power supply. They are commonly used in various applications, particularly in situations where a low-voltage power source is available or where mobility is required.

8. 5V relay module:

A 5V relay module is an electronic device that uses a 5-volt power supply to control high-voltage, high-current electrical circuits. In the Solar-powered pesticide Sprayer Vehicle project the relay module is for the ON and OFF operation of the 12V DC Water pump.

9. 12V, 7ah battery:

A 12V, 7Ah battery is a rechargeable lead-acid battery that provides a consistent 12-volt power source and has a capcity of 7 amperes. These batteries are widely used in various applications where a stable 12V power source is required. it'll recharge through solar energy.

V. SOLAR CHARGING UNIT

Fig 5: Charging Unit

VI. PROTOTYPE MODEL

Fig 6: Model

Fig 7: Application Interface

VII. RESULT

As a result, we have concluded that the solar-powered pesticide sprayer utilizing IOT is the most suitable automotive system technology for the farm. As a result, it takes up time, and human resources, and requires less than one person to manage the system.

VII. CONCLUSION

The prototype has good area coverage at low costs. It eliminates harmful chemicals and farm labour and can be remotely monitored. Suitable for small and medium-sized farmers, it can be scaled up and used for fertilizers, pesticides, fungicides, and watering lawns. Large-scale production will reduce costs and boost Indian farming practices. The project combines pesticide spraying, reducing farmers' workload and health problems. Vehicles that can be driven on uneven surfaces and are heavy enough to carry equipment have been built, along with a strong structure to withstand the field's challenges.

VIII. REFERENCES

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[8]   https://youtu.be/DgCk0s08jpc?si=3Yxp3iwQhMtBLwJu

[9]   https://youtu.be/dHirOow4dh8?si=fpuPnIwXdA_LlpAK