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DESIGN AND FABRICATION OF IOT BASED SOLAR POWERED BATTERY OPERATED SPRAY ROVER

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ABSTRACT
A farm's spraying operation is crucial. Pesticides are sprayed on plants to protect them from insect assault. Farmers still use the old-fashioned hand pump method to spray insecticides on their crops. Although it's crucial to produce high-quality plants that yield more and to turn a healthy profit, we also care about farmer safety. Health problems are caused by these insecticides. In comparison to drones, it is less effective for longer distances and costs more, making it unaffordable for small-scale farmers. They participated manually and carried their sprayer for fertiliser on their shoulders. Farmers get health problems as a result of fertiliser inhalation while they are spraying.
Farmers typically utilise a hand-operated spray pump or fuel for spraying. Due to the construction's excessive weight and practical impracticality in hell, the usual spraying results in injuries or weariness for the user. This inspires scientists to create and simulate a solar-powered spray machine. We provide our projects as a remedy for the aforementioned agricultural issues. Another goal of this design is to eliminate vibration while still employing a gasoline-operated spray pump, overcome handling-related casualties when performing spraying, and create an environmentally friendly spray machine by removing fuel. Farmers can spray pesticides at a fixed or adjustable height with the aid of an agricultural spray rover.
Keywords: *Farmers, Agriculture, Spray Pesticide, Fertiliser, Spray Rover*

INTRODUCTION
One of the key elements in the development of human civilisation has been agriculture. It is among the most fundamental and ancient human activities. Even though we are aware of the global increase in industry and urbanisation, almost 50% of the working people choose agriculture as their job. In the majority of emerging nations, agriculture is a key source of employment and a significant economic contributor.
Agriculture is unquestionably the foundation of the Indian economy, with 64 percent of the population depending on it for a living. Meeting the increased demand for supplies brought on by the growing population and a lack of knowledge of cutting-edge methods to boost production in accordance with demand are the key issues that Indian farmers face on a daily basis. In addition, farmers continue to use conventional techniques to spray pesticides on plants or crops. Farmers initially had to manually apply pesticides to the crops, but subsequently a hanging spraying equipment was invented, requiring farmers to hang it from their shoulders while applying pesticides to eradicate pests. Despite using a machine, farmers can still easily
The most recent studies indicate that a number of chronic disorders, including asthma, autism, birth deformities, learning difficulties, and reproductive dysfunction, are frequently linked to pesticide exposure. to lessen the farmers' exposure to these dangerous chemicals and to assist the farmers in producing more with less risk.
Low range, high efficiency, spontaneous micron particle sprayer, manually operated, solar-powered, battery-driven spray rover. It is created in the current work both in design and production. The framework was designed and built taking into account factors like the desired splashing limit, low

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weight, simplicity, ease of use, high working time, and for quicker integration of distance. In this way, the solar-powered sprayer was developed to serve as a financial incentive in the agricultural sector. For in order to understand the showering system, the traditional sprayer framework was concentrated when building the model. Farmers can easily adopt these methods, making it possible to fulfil the goal of inexpensive and safe farming. This would enable farmers to maintain the health of their soil and plants for sustained food production, resulting in a reliable supply of food and a strong community.

DESCRIPTION OF EQUPMENTS:

1. PUMP

An apparatus used to transport gases, liquids, or slurries is a pump. A pump overcomes the pressure differential by supplying energy to the system, such a water system, to transport liquids or gases from a lower pressure to a higher pressure. Except in applications with relatively modest pressure rise, such heating, ventilation, and air conditioning, where the operative equipment comprises of fans or blowers, a petrol pump is typically referred to as a compressor.

Pumps operate by pushing material with mechanical forces, such as compression or physical lifting. Positive displacement, reciprocating water pump that is operated by hand. A positive displacement pump moves a liquid or gas by forcing a fixed volume of fluid or gas into the discharge pipe while trapping the remaining volume. They are widely used to pump water out of bunds or small amounts of reactants from storage barrels sincez they are quite affordable. continual augmentation of energy.

Hand pumps give access to deeper, frequently unpolluted groundwater and also increase the safety of a well by shielding the water source from tainted buckets, making them the most sustainable and affordable choice for safe water provision in resource situations. This implies that communities frequently run out of spare parts, are unable to operate their hand pumps, and must return to conventional and occasionally far-flung, filthy resources. This is regrettable because water projects frequently invested significant resources to give that community a hand pump.

2. SOLAR PANEL

A solar panel can be a photovoltaic module, a solar hot water panel, or a group of PV modules installed on a support structure and connected electrically. A bundled, connected arrangement of solar cells is referred to as a PV module. Electricity can be produced and supplied by solar panels as part of a larger photovoltaic system for use in both commercial and residential settings. Each module's rating, which normally runs from 100 to 320 watts, is based on its DC output power under standard test conditions (STC). The size of a module with the same rated output depends on its efficiency; for example, a 16% efficient 230-watt module has twice the area of an 8% efficient 230-watt module.

These include There are not many solar panels that are more efficient than 19%. There are limits to how much power one solar module can generate, so most setups use many modules. A panel or array of solar modules, an inverter, and occasionally a battery, solar tracker, and interconnecting cables make up a photovoltaic system.

Electrical connections are formed either in parallel or in series to produce the desired current capacity or output voltage. Silver, copper, or other non-magnetic conductive transition metals may be present in the conducting wires that remove the current from the modules. Electrical connections between the cells and the rest of the system are required. Popular terrestrial photovoltaic modules feature MC3 (older) or MC4 connectors on the outside to make it simple to connect them to the rest of the system and keep them weather proof

3. INVERTER

The inverter is often placed as close to the modules as is practicable while yet being easily accessible. The inverter is frequently attached to the exterior sidewall of the house next to the electrical main or sub panels in residential applications. When choosing the site, it should be kept in mind that inverters generate a light noise.

By connecting the inverter directly to a specialised circuit breaker in the electrical panel, the inverter converts the DC electricity produced by the solar panels into 120-volt AC, which may be used right away.

Your solar electric system's output will be used up first by the active electrical loads thanks to the connection of the inverter, energy production metre, and electricity net metre. The remainder of Your electrical panel receives power from your solar electric system before sending it to the grid. Your electric utility metre will advance if you are using your solar power system to generate more electricity than you are directly using.

4. WHEEL

A circular component called a wheel is designed to rotate on an axle. One of the key elements of the wheel and axle, one of the six fundamental machines, is the wheel. A ship's wheel, a steering wheel, and a flywheel are just a few examples of different uses for wheels.

Wheels and axles work together to make it simple to move heavy things, making it possible to transfer them while they are carrying a load or working on machinery. Applications related to transportation are typical examples. via enabling motion via rolling coupled with the use of axles, a wheel significantly minimises friction. Wheels need to have a moment imparted to them about their axis in order to rotate, either through gravity, or by using an additional outside force

5. DC MOTOR

The general design of DC motors and generators is the same.

PRINCIPLES OF MOTORS:

A device that transforms electrical energy into mechanical energy is an electric motor.

All DC machines have five main parts: the field system (i), the armature core (ii), the armature winding (iii), the commutator (iv), and the brushes (v).

(i) Field system: The field system creates a uniform field in which the rotating armature rotates. It consists of a number of prominent poles—always an even number—bolted to the interior of a circle-shaped frame, or "yoke. "The pole component is typically built of stacked laminations, while the yoke

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is typically made of solid cast steel. The d.c stimulating current is carried by field coils that are installed on the poles. The field coils are linked together so that adjacent poles are polarised in the opposite direction.

The coils' generated magnetic field (M.M.F.) creates a magnetic flux that travels through the pole pieces, air gap, armature, and frame. Air gaps on practical DC machines range from 0.5mm to 1.5mm.due to the composition of armature and field systems The majority of the m.m.f. of field coils are needed to create flux in the air gap in materials that have permeability. We can minimise the size of the field coils (number of turns) by shortening the air gap

Wheel-mounted DC MOTOR

Features,

• 125gm weight • 4mm shaft diameter with internal hole
• 10RPM 12V DC motors with gearbox
• Same-size motor available in a range of rpm
• 5kgcm torque
• Maximum no-load current is 60 mA; maximum load current is 300 mA.

BATTERY:

Batteries are used to store the energy generated by solar power. The lead-acid battery in use has a 12 v; 2.5 A capacity. Lead acid cells are the most affordable secondary cell and are frequently employed in industry. When a lead acid cell is prepared for usage, two plates are submerged in diluted sulphuric acid (H_2SO_4), which has a specific gravity of roughly 1.28.The negative plate (cathode) is made of lead (Pb), which is coloured grey, while the positive plate (anode) is made of lead -peroxide (PbO_2), which has a chocolate brown tint.

Lead sulphate ($PbSO_4$) is created on both plates of the cell when it discharges current to a load, and water is created in the electrolyte as a result of the chemical reaction that takes place. After a certain, The cell has lost a certain amount of energy, both plates have changed to the same material, and the specific gravity of the electrolyte (H2so4) has decreased. After that, the cell is considered to have discharged. There are various ways to determine whether or not the cell has been discharged

CALCULATIONS

Building a motor is only the beginning of a good science project. It is crucial to measure various electrical and mechanical properties of your motor and to use the following practical methods to calculate any unknown values.

The International System of Units (SI) will be applied. In the USA, electrical engineering is officially taught using this contemporary metric system.

The fundamental Ohm's Law is one of the most significant physical rules.

$I = V / R$,

where I is the current in amperes (A),

V is the applied voltage in volts (V), and

R is the resistance in ohms (Ω),

indicates that current through the conductor is directly proportional to applied voltage.

In various situations, this formula could be applied. You can determine your resistivity by simply monitoring the applied voltage and consumed current for your motor.

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. This formula demonstrates that the current may be regulated by applied voltage for any given resistance (in motors, it is essentially the resistance of the coil).
The following formula describes how much electrical power the motor uses:
Pin is equal to I * V,
where Pin is the input power in watts (W),
I is the current in amperes (A), and
V is the applied voltage in volts (V).
Motors are intended to perform some task, and two crucial factors determine their power. It consists of motor torque, or the motor's turning force, and speed. The motor's output mechanical power could be computed using the formula below:
Pout = τ * ω
where Pout is the output power in watts (W), is the torque in Newton metres (N•m),
ω –angular speed in radians per second (rad/s).
If you know the motor's rotational speed in rpm, it is simple to determine the angular speed:
ω = rpm * 2π / 60
where is the angular speed expressed in radians per second (rad/s);
rpm is the rotational speed expressed in revolutions per minute;
π – mathematical constant pi (3.14).
There are sixty seconds in a minute.
The mechanical output power divided by the electrical input power is used to calculate the motor's efficiency.
E = Pin/Pout
Pout then equals **Pout = Pin * E**

Following replacement, we obtain.
T * ω = I * V * E
T * rpm * 2π / 60 = I * V * E

Additionally, the torque calculation formula is **τ = (I * V * E *60) / (rpm * 2π)**
Connect the load and the motor. The best way to do it is to use the motor from the generator kit. Why is it necessary to link the load to the motor? Well, there won't be any torque if there is no load.
For instance, if the speed is 1000 rpm, the voltage is 6, and the current is 220 mA (0.22 A):
τ = (0.22 * 6 * 0.1 * 60) / (1000 * 2 * 3.14) = 0.00126 N•m
Since the result is typically modest, milli Newton metres (mN•m) are used to express it.
The computed torque is 1.26 mN•m since 1 N•m is equal to 1000 mN•m.
The torque can alternatively be expressed in terms of the more widely used gram force centimetres (g-cm) by multiplying the result by 10.2, making the torque equal to 12.86 g-cm.
In our example, the motor's electrical input power is 0.22 A x 6 V, or 1.32 W
The mechanical output power is calculated as follows:
0.132 W = 1000 rpm x 2 x 3.14 x 0.00126 N•m / 60.
Motor torque varies as a function of speed. You have your maximum speed and zero torque when there is no load. Mechanical resistance is increased by load. In order to overcome this resistance, the motor begins to draw more current, which causes the speed to drop. The motor stalls if the load is increased past a certain threshold. Stall torque is the term used to describe the maximum torque at which it occurs. While stall torque measurement without specialised equipment is challenging, you can get this number by charting a speed-torque graph. To determine the stall torque, you must make at least two measurements under various loads

WORKING PRINCIPLE

The system consists of solar panel, charging unit, Battery, Pump and sprayer. The solar panel delivers an output in order of 12 volts and 5 watts power to the charging unit. The charging unit is used to strengthen the signal from the solar panel. The charging unit delivers the signal which charges the

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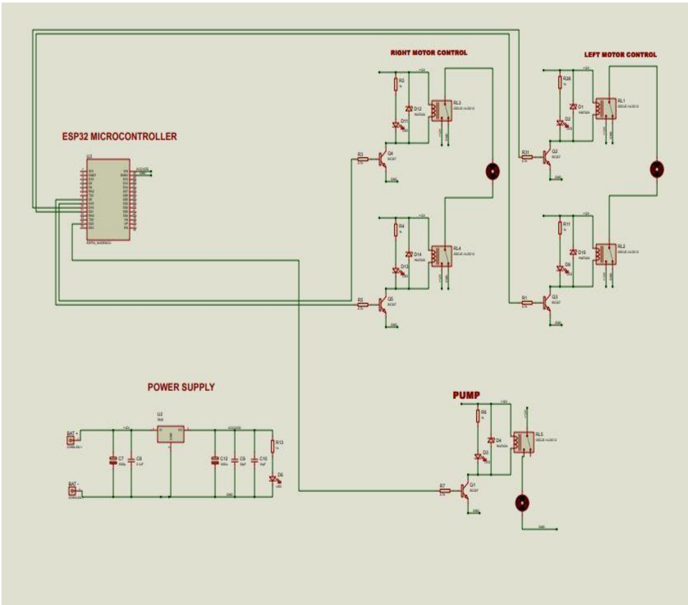
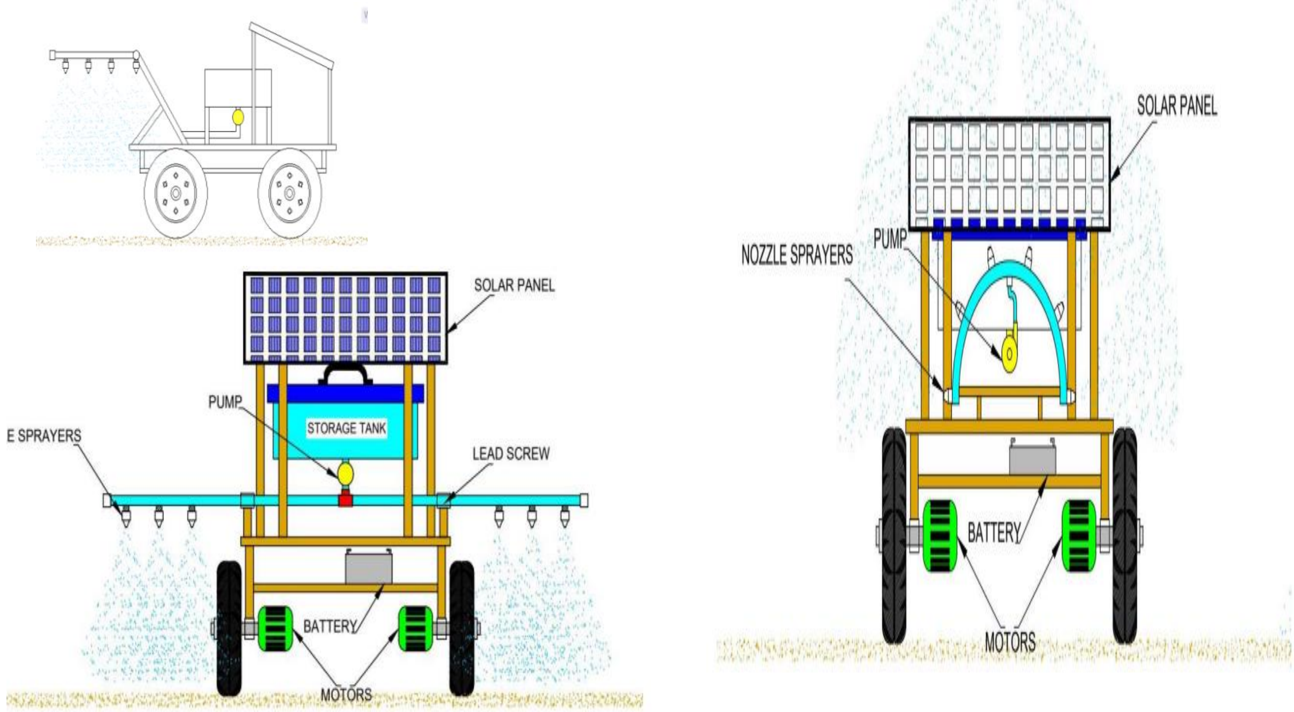
battery. According to the charged unit, the pump operates, such that the sprayer works. The concept of this model is to spray the fertilizers, water or pesticides without manual effort. The robot is built up with sensors to detect the starting and ending point of the field, the sensors were also placed in the agricultural field which would send the signals and the sensors in the robot will receive the signals. The robot will start spraying the filled substance in both sides, when the robot reached the end of the agricultural land, the sensors in agricultural land will send the signals which is received by the sensors in robot when the robot detects the end point the sprayer nozzle which is controlled by the pump will be turned off, to avoid the wastage. The robot will be automatically moved to the next column and starts spraying the filled liquid to the crops which was planted

CIRCUIT DIAGRAM



DRAWING



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CONCLUSION

It is observed that, this model of solar powered pesticide sprayer is more cost effective and gives the effective results in spraying operation. As it runs on the non-conventional energysource i.e. solar energy, it is widely available at free of cost. In now days where world is moving towards the finding the new ways for the energy requirement, it can be a better option for the convention sprayer. As India is a developing country, this product can be become more popular in rural areas

FUTURE SCOPE

1. Future scope of this type of sprayer are very bright because it is very useful in agriculture and reduce the workload.
2. It reduces the time consumed in spraying the pesticide liquid and work very effectively.
3. It will help the farmers to do work in any terrain, season and conditions.
4. It will reduce the danger for the farmers from different breathing and physical problems

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