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PORTABLE BATTERY POWERED SOLAR CHARGED PESTICIDE AND WATER SPRAYING REMOTE OPERATED BOT

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Abstract - Water and pesticides are an indispensable part of the agricultural sector. Water and frequent spraying of pesticides is important for agriculture to give any kind of output. While it is an essential exercise, it is also time-consuming and expensive as most water sprayers, especially pesticide sprayers are operated based on fuel engine. Fuel operated engines are expensive, inefficient, labour-intensive, prone to excessive use and environmentally unsustainable. In order to overcome this, we found the new concept known as "Portable Battery Powered Solar Charged Pesticide and Water Spraying Remote Operated Bot". This pesticide and water sprayer is operated on solar energy. It has many advantages such as low cost of spraying, less vibration, automation as it detects plants with built-in sensors, environmentally sustainable as compared to the petrol sprayer. Hence, the system can be easily operated and there is no need of labour which increases the efficiency of farmers.

***Key Words*:** Pesticide sprayer, solar-charged, Agriculture robot, Portable battery operated, Water sprayer, tanker mechanism

1. INTRODUCTION

1.1 Purpose

Humans have been using pesticides since the Mesopotamian era, but even today not much advancement is seen in spraying methods. Agriculture in India had developed in remote antiquity, and down to the eighteenth-century India was ranked among a few developed countries of the globe. India being an agrarian nation, a large population directly or indirectly is employed by the agricultural sector. As a result, there is a lot of scope and opportunity to bring advancements in is section. Blending technology with farming methods will definitely increase the efficiency.

But even today, almost 60% don't use modern technology for enhancing agricultural produce and returns. The main reason for this is the lack of electricity in remote villages. This inspired us to an ingenious solution by using solar energy and other modern technologies.

1.2 Product Scope

To manufacture a Remote Operated Bot that is powered by solar charged battery, which detects plants, sprays the required adequate quantity of pesticides and water and it works using an android application. To adapt to the variety of crop lengths, it would be also possible to alter the height of the bot up to 2.5 feet.

2. LITERATURE SURVEY

With the help of the following papers, we came to a conclusion of making a Portable Battery Powered Solar Charged Pesticide and Water Spraying Remote Operated Bot that is powered by solar charged battery which would detect plants, spray the required amount of water and pesticides and it works using an android application. It would be also possible to alter the height of the bot according to the requirements.

1] Agricultural Robots—System Analysis and Economic Feasibility (2006), from this we understood the monetary feasibility of inculcating autonomous robotic vehicles in comparison to conventional systems, three scenarios were considered; robotic weeding in high value crops, crop probing in cereals and cutting of grass on a golf course etc. The evaluation was based on a systems analysis and a distinct economic feasibility study. The results showed that in all three situations, the robotic applications in the long term are more economically viable than the conventional systems.

In 2] Agricultural Fertilizers and Pesticides Sprayers – A Review (2015), automation in pesticides spraying devices made distribution equal on the farm and decreased the quantity of waste, which results in inhibition of losses and wastage of input applied to farm. It will reduce the cost of production. Modernization of agricultural methods generates a greater productivity in minimum input. Even though this is true, still in India there is a large development in industrial sectors compared to agricultural sectors. Traditionally, backpack sprayers are used for pesticide spraying, they have to carry these sprayers for longer durations. This task is very cumbersome, and also cost of labor is substantial.

In 3] "Solar Sprayer - An Agriculture Implement", "International Journal of Sustainable Agriculture", (2010), this paper explains how a traditional 'Power Sprayer' which works on fossil fuel can be modified into solar sprayers. As the cost of non-renewable energy sources keeps on increasing including the soaring prices of fuel, it would be ingenious to curtail the fuel use by inculcating the improved model which functions on the principle of solar energy. The functioning price of power sprayer for 1 hour operation is considered and its cost is compared with the overhead of solar sprayer. It apparent that there is no requirement of working cost for the solar sprayer but, the initial funding towards the solar unit is a onetime investment with a functioning duration of twenty years.

3. COMPONENTS AND COST ESTIMATION

Table -1:

Sr no	Component	Specifications/ Material	Qty.	Cost (Rs.)
1	Frame & Legs	M.S. (20*20*3mm) & 25*25*3mm	As required	50/kg
2	Solar panel	STD 9 Watt	1	500
3	DC motor	STD 12V	4	120*4
4	Small DC Pump	STD 12V	1	500
5	Nut bolts	STD M.S.	12	15*12
6	IR Sensor	STD	1	50
7	Arduino Nano	STD	1	250
8	Battery	12V, 7Amp	1	540
9	Wheels	ϕ 4 inch	4	25*4
10	Motor Holder	STD	4	75*4
11	Nozzle	Plastic	3	30*3
12	Paint	STD Black	1	150
13	Motor Driver	STD	2	100*2
14	Wooden Ply	6mm Thick	As required	14/ft^2

4. METHODOLOGY

We used Mild Steel bars for constructing a frame to keep the weight of the frame low. On this frame, retractable link is used on the top end on which a solar photovoltaic panel is fixed which converts solar power into electricity. This electricity is then provided to battery via solar panel and used for charging the battery. We mounted an object detecting IR sensor on the frame for detecting plants coupled by spray nozzles which are downward facing connected to up to 10-litre tank mounted on the frame. For spraying operation through nozzles, this tank is attached to a pump which driven by another DC motor that receives power from the same battery. Pump is regulated by connecting it to the Arduino board. Finally, we control the whole system by a remote operator/ Android app. We are using a Solar panel connected to 12V dry cell battery for storing electrical energy by using a unidirectional diode. A 12v DC motor is connected to this dry cell battery to convert the electrical energy into mechanical energy. As the bot will work in the open, battery can be recharged uninterruptedly during discharge itself, by placing the panel on the sprayers itself. The bot takes around 2-2.5 hours for complete discharge, but by regularly changing the battery, discharge can be continued for further more hours. Our vehicle bot will be working on the tank mechanism for movement in which the 2 front and 2 back wheels will be moving together. Energy received from the solar cell is also provided to an IR sensor for detecting plants. As the battery will be charged by the solar energy and this is consumed by the pump, the wheel motor and the IR sensor setup. As a result, this mechanical operation requires no conventional fuel like petrol. The pump motor connected to the bottom part of tank sucks the spraying liquid from tank and delivers it to the nozzle. As the IR sensor detects a plant, this motor is activated and pesticide/water is sprayed through the 3 provided nozzles. As the bot moves forward and can be controlled with an android app, you can cover a greater area, with a working period of around 2 hours.

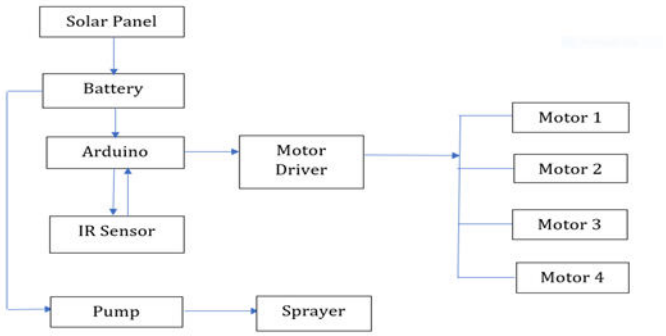

Fig -1

Fig -2

Fig -3

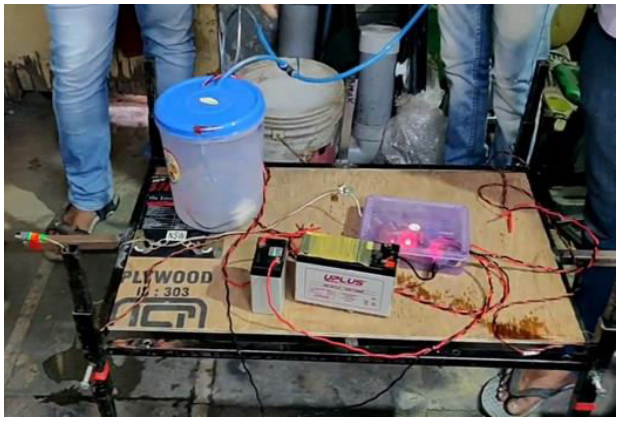

Fig -4

5. RESULTS

Table -2:

Parameters	Values
Android Controller Range	10 m
Nozzle Spray Area	39.25 sq. cm
Working Time on Full Charge	2-2.5 hours
Battery Charging Time on Solar Energy	6-8 hours
Spraying Width	Around 3ft
Water discharge per nozzle	160 ml/min
Complete Tank Discharge Time	30 mins
Permissible Weight	20kg
Average Speed	10 km/hr
Best Charging Time	Morning: 8 AM to 10 AM Evening: 4 PM to 6 PM
Variable Height of Frame	1 to 2.5 feet

6. CONCLUSION

Through our planning, we have concluded that our design of the project saves cost, reduces physical strain on farmers, is solar powered so subsidy will be granted by the Government also GST for solar powered machines is reduced to 5%. This pesticide sprayer is solar operated as a result it requires minimum maintenance and zero cost for operating.

It has many advantages such as relatively low cost of spraying, being environment friendly and also saving on fuel. When compared to traditional methods, the vibration is also greatly reduced. Hence, the system can be easily operated and there is no need of laborers which increases the efficiency of farmers

6. FUTURE SCOPE

1. We can use monocrystalline solar panels in future, instead of polycrystalline solar panels to increase the efficiency.
2. We can use Lithium-Ion batteries, smaller in size and deliver more power but cost is high around 7k to 8k rupees
3. Image processing applications for further enhancement to make the project fully automated to do away with the requirement of human inspection or intervention.
4. The current technology uses IR sensor which is not as sophisticated as image processing
5. As the structure develops, it can be used for multiple operations such as seeding, ploughing, soil inspection etc.

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