



# Automotive Agricultural Electric Sprayer Pump

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## To Cite this Article

Dr. Kishor V. Bhadane, Sanket Phatangare, Shubham Deshmukh, Sharad Raut and Suraj Ranmale. Automotive Agricultural Electric Sprayer Pump. International Journal for Modern Trends in Science and Technology 2022, 8(06), pp. 207-212. <https://doi.org/10.46501/IJMTST0806034>

## Article Info

Received: 09 May 2022; Accepted: 05 Juen 2022; Published: 08 June 2022.

## ABSTRACT

*Agriculture is a profession of many tedious processes and practices, one of which is the spraying of insecticides in the vineyards. A typical vineyard requires extensive spraying every 4-5 days in the summer and every 3-4 days in the rainy season. The conventional methods are: a person carrying a sprayer and manually actuating a lever to generate pressure and pump the pesticide through a tube or a mobile vehicle carrying an inbuilt compressor and sprayer unit which has to be manually driven by a human operator. These methods are fuel consuming and susceptible to human errors. Another major drawback in human operated systems is that the operator is exposed to the harmful chemicals while spraying. Long term exposure, as in this case, can be extremely detrimental to the operator's health. This is a project which can be viewed as a viable alternate to these methods. The Automotive agricultural sprayer.*

**KEYWORDS:** Microcontroller, Solar panel, Battery, LCD, LDR, Motors, Relays, Bluetooth device

## 1. INTRODUCTION

The population of India is increasing rapidly in order to fulfill their diet & needs, the production of foods must be increased. But this must come at affordable to everyone. In India farming is done by traditional ways beside that there has been larger development of industry and service sector as compared to that of agriculture sector. To mechanization of agriculture in India some equipment has been developed. The pesticide sprayer is one among them and it is done by traditional farm workers by carrying backpack type sprayer, which requires human effort or by using electric pump. To improve the agriculture system and to reduce the human effort and problems associated with the backpack sprayer new equipment is fabricated which will be beneficial to farmers. The equipment utilize renewable energy source (Solar energy) which is

eco-friendly to function. The solar panel gives out electric supply to system. Also minimize the wastage of pesticide and time. Our contribution on our project is by using eco-friendly reliably available solar energy as a main source of energy making this multifunctional sprayer device by advancing the spraying methods which make friendly to use and operate which can be useable in different spraying stages of farming as per process requirement. It can be operated in small farming land with the standard spacing decreasing the labor cost and human effort. In this project we are trying to make a prototype model for farmers and cultivators for whom spraying of insecticides is harmful and hazardous.

## 2. OBJECTIVES AND MOTIVATION

### A. Objectives

- I. ECO friendly (Because we are using solar power and charged battery for operation)
- II. Easy to construction.
- III. More economical.
- IV. Easy to clean and maintain.
- V. Its works on renewable energy source called solar energy.
- VI. It does not create air pollution & noise.
- VII. Easy to handle.
- VIII. Does not required fuel for working hence cost reduce for operation.

### B. Motivation

Solar based pesticide sprayer is one of the improved model of pesticide sprayer pumps. Sun is the source of all energy on the earth. It is most abundant, inexhaustible and universal source of energy. All other sources of energy draw their strength from the sun. India is blessed with plenty of solar energy because most parts of the country receive bright sunshine throughout the year except a brief monsoon period. India has developed technology to use solar energy for cooking, water heating, water dissimilation, space heating, crop drying etc. 2 Most used pesticide sprayer available in market is petrol engine sprayer, which is bulky to carry, needs lot of maintenance (to engine and carborators) and cost incurred to maintenance, petrol to operate is noticeable. The another model which is inspired us to take this project is electrical pesticide sprayer in which battery is charged using conventional electricity but operates only for four hour once battery is fully charged. So improving operating time and solar energy harvesting is motivation of project.

## 3. LITERATURE REVIEW

Shailesh Malonde et al "Design and Development of Multipurpose Pesticides Spraying Machine" IJAEGT Volume 04: Pesticide spraying is the necessary procedure in cultivation of the crops. The present idea deals with the designing and fabricating a pesticide sprayer which will be useful and affordable to the farmers which will assist to increase the productivity of crops. This model carries multi nozzle pesticides sprayer pump which will perform spraying at

maximum rate in minimum time. Constant flow valves can be applied at nozzle to have uniform nozzle pressure.

Pandurang Lad et al "Solar Operated Pesticide Sprayer" IJARSE Volume 04A: Solar Operated Pesticide Sprayer is a pump running on electricity generated by photovoltaic panels or the thermal energy available from collected sunlight as opposed to grid electricity or diesel run water pumps. Besides reducing the cost of spraying, there is a saving on fuel/petrol. Also, the transportation cost for buying petrol is saved. The solar sprayer maintenance is simple. There is less vibration as compared to the petrol sprayer. The farmer can do the spraying operation by himself without engaging labor, thus increasing spraying efficiency.

Dr. H. Erdal Ozkan et al. [1]: The main goal of this study was to design and develop software and hardware for an intelligent sprayer that can control variable-rate spray outputs through the nozzles based on availability of a target in sight and density level of the canopy sprayed.

C. Umayaal et al. [2]: This paper deals with the exposition of how robotics can be applied to various phase of agriculture.

A.S. Wankhede et al. [4]: The Equipment is especially made to work in row crops such as cotton pulses etc. of an agricultural field.

## 4. BLOCK DIAGRAM

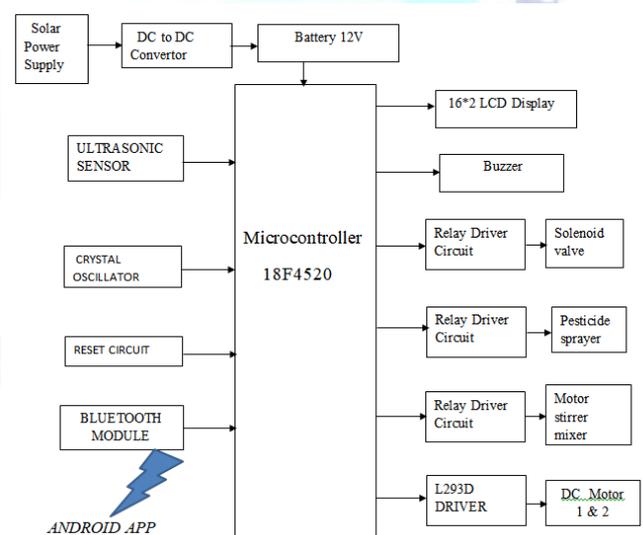


Fig1. Block diagram.

## 5. SYSTEM DEVELOPMENT

PIC 18f4520 Microcontroller:

It is an 8-bit enhanced flash PIC microcontroller that comes with nano Watt technology and is based on RISC architecture. Many electronic applications house this controller and cover wide areas ranging from home appliances, industrial automation, and security system and end-user products.



Fig2. PIC 18f4520Microcontroller

Ultrasonic Sensor:

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit.



Fig3. Ultrasonic sensor

L293D Motor Driver IC:

A motor driver is an integrated circuit chip which is usually used to control motors in autonomous robots.

Fig4. L293D motor drier IC

Bluetooth Module (HC05):

HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration.

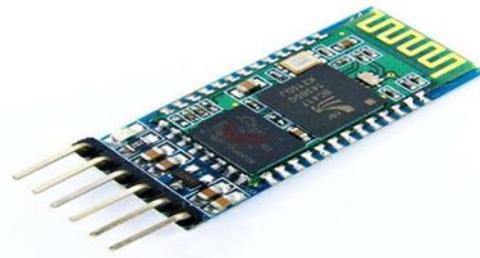


Fig5. Bluetooth HC-05.

LCD Display:

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs.

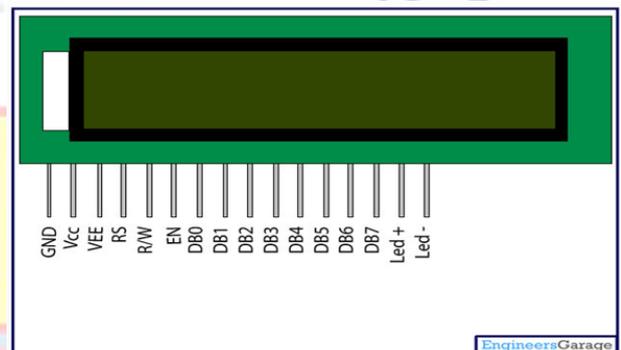


Fig6. LCD Display

DC Motor:

DC motor is an electrical machine that utilizes electric power resulting in mechanical power output. Normally the motor output is a rotational motion of the shaft. The input may be direct current supply or alternating supply. But in case of DC motor direct current is used. The mechanism of dc motor is like a bar wound with wire is placed in between 2 magnets having North and South Pole. When it is provided with electric supply the wire becomes energized resulting in rotational motion which leads to rotational output.



Fig7. DC Motor

Solar panel:

A solar cell panel, solar electric panel, photo-voltaic (PV) module or just solar panel is an assembly of photo-voltaic cells mounted in a framework for installation. Solar panels use sunlight as a source of energy to generate direct current electricity. A collection of PV modules is called a PV panel, and a system of PV panels is called an array.



Fig8. Solar panel

Battery:

12V 2Ah Rechargeable Lead Acid Battery is normally use for robots in competition. Wired or Wireless Robots runs for a long time with high speed with this type of battery.



Fig9. Battery

Relay Driver:

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal.

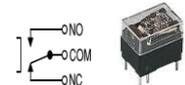


Fig10. Relay Driver

Piezoelectric buzzer:

A buzzer or beeper is an audio signal device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke.



Fig11. Buzzer

## 6. METHODOLOGY

Instead of traditional spraying we are giving model with automatic spraying for that we have given program to IC for doing multiple working operation. For developing different directional and operation of motors we used relay sensors. For minimizing fuel cost and efficient working instead of fuel we use renewable energy obtained from solar and for storage of energy we used battery set in our model. Bluetooth sensing is developed in model for giving commands. Ultrasonic sensors are used to detect obstacle for way detection. For working of stirrer and wheels are driven using DC

motors. Multinozzle functioning we are given some adjustable nozzle in model to spray properly. Displaying chemical quantities and voltage of battery and all specification showing done using LCD display.

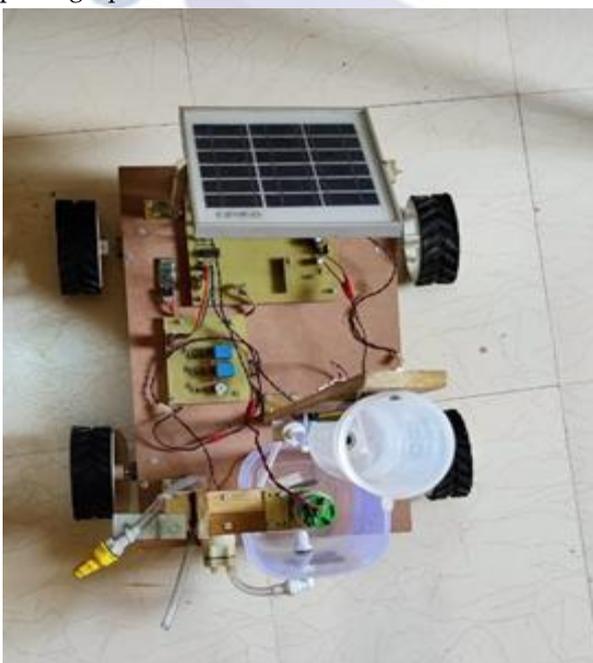
#### PERFORMANCE ANALYSIS

Sr.no	Task Name	Months
1.	Planning	Jul, Aug, Sep 2021
2.	Research	Sep, Oct, Nov 2021
3.	Design	Oct, Nov, Dec 2021
4.	Purchasing	Dec 2021
5.	Manufacturing	Dec 2021, Jan, Feb 2022
6.	Testing	Jan, Feb 2022
7.	Final testing	Mar 2022
8.	Result	Apr, May 2022

Table: Monthly development.

#### 7. RESULT

Actual prototype model is shown in following photograph.



#### 8.FUTURE EXTENSION

The solar sprayer is mainly used for spraying liquefied pesticides. It can also be used as automatic spray painting robot. The developed system can be used for spraying the fertilizer, fungicides. The pesticide sprayer operates with minimal pollution. The same technique and technology can also be extended for all types of power sprayers in future we have a greater advantage with this advanced technology.

The future scope of this project includes –

1. Take up build a full-scale prototype which can be utilized in the fields in real time.
2. Facilitate charging of the battery using a solar charger thus bringing the costs even further down.
3. Battery energy can be saved by using PWM scheme for driving pump.

#### 9.CONCLUSION

The proposed system of the prototype results that it was successfully able to fulfill the human need for spraying the pesticide in vineyards. While comparing with the previous pesticide sprayers this is more efficient and we can overcome health hazards.

This project demonstrates the implementation of robotics and mechatronics in the field of agriculture. This being a test model the robustness of the vehicle is not very high. The performance is satisfactory under laboratory condition. The model gave a fairly good rate of area coverage and the cost of operation as calculated was also reasonably low. In addition the safety and long term health of the farmers is ensured by eliminating human labour completely from this process. It does not compromise the performance of a petrol based pesticide sprayer.

It does not compromise the performance of a petrol based pesticide sprayer. In addition, the model is designed to be eco-friendly and lower cost, and thus will prove to be more efficient when compared to petrol based pesticide sprayer. A minor modification to the form factor, the module can be brought out as a commercial product.

#### ACKNOWLEDGMENT

We would like to express our special thanks of gratitude to our guide Dr.K. V. Bhadane (Department of Electrical Engineering) and our H.O.D. (Dr. Sunil Kadlag) as well

as our principal (Dr. M.A Venkatesh) who gave us the golden opportunity to do this wonderful project on the topic of (AUTOMOTIVE AGRICULTURAL ELECTRIC SPRAYER PUMP), which also helped us in doing a lot of Research and we came to know about so many new things we are really thankful to them. Also thankful to our project coordinator Prof. R. A. Patil sir helps us to complete this project and Dr. K. V. Bhadane Sir who suggested this project to us.

#### **Conflict of interest statement**

Authors declare that they do not have any conflict of interest.

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