

Solar Based Pesticide Sprayer

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Abstract

Compared to spraying pesticides manually outdoors, the environment is more closed, and has a high temperature, humidity and so on for operating the spray work in the green-house. In order to protect laborer and reduce labour intensity, we develop a prototype of pesticide spraying robot specially used in the greenhouse. This project work is an engineering solution to the current human health hazards in the confined space of agricultural field is achieved by an autonomous solar spraying robot for use in pest control. It can be observed that the solar based robot system will make precise spraying operation by being a solution to power failures in rural areas. This robot would be able to contribute the minimum input maximum output production system. Due to solar the maintenance and vibration as compared to the petrol sprayer is reduced. Here in this module we designed a robot, which can be controlled by mobile Bluetooth for operation. Its function is to mix the pesticide with water in pre-requisite amount and spray it in forward direction evenly, as per the set dosage.

Robot is controlled with an Arduino Uno by using an android App and in which we use Bluetooth communication to interface controller and android. Controller can be interfaced to the Bluetooth module though UART protocol. According to commands received from android the robot motion can be controlled. Although the productivity of the prototype is not quite efficient, the robot still meets the requirements of pesticide spraying in the greenhouse without human operators

Agricultural robotics is a logical proliferation of automation technology into biosystem such as agriculture, forestry, green house, horticulture etc. Presently a number of researches are been done to increase their applications. Some of the scientist contributions are mobile robot, flying robot, forester robot, Demeter which are exclusively used for agriculture.

Keywords: *Solar Panels, Solar Pump, Sprayer, Photovoltaic Cell (PV), Electricity, Bluetooth, ARDUINO.*

INTRODUCTION

The project aims on the design, development and fabrication of the demonstration unit of the project “SOLAR BASED PESTICIDE SPRAYER ROBOT” More than 42% of the total population in the world has chosen agriculture as their primary occupation. In recent years, the development of autonomous vehicles in agriculture has experienced increased interest. This development has led many researches to start developing more rational and adaptable vehicles. In the field of agriculture autonomous vehicle, a concept is being developed to investigate if multiple small autonomous vehicles, machines would be more efficient than traditional large tractors and human force. These vehicles should be capable of working 24 hours a day all year round, in most weather conditions. Moreover such a system may have less environmental impact if it can reduce over application of

chemicals and high usage of energy, such as diesel and fertilizer, by control that is better matched to stochastic requirements.

Per Capita Energy Consumption

The per capita energy consumption is too low for India as compared to developed Country .It is just 4% of USA and 20% of the world average. The per capita consumption is likely to grow in India with growth in economy thus increasing the energy demand.

Energy Intensity

Energy intensity is energy consumption per unit of GDP. Energy intensity indicates the development stage of the country. India's energy intensity is 3.7 times of Japan, 1.55 times of USA, 1.47 times of Asia and 1.5 times of World average.

How Much Energy Will We Consume In The Future?

According to the American Energy Information Administration (EIA) and to the International Energy Agency (IEA), the world-wide energy consumption will on average continue to increase by 2% per year. The graph below shows the actual values starting from 1980 until today in blue and the predictions of the energy consumption until the year 2030 in orange. A yearly increase by 2% leads to a doubling of the energy consumption every 35 years. This means the world-wide energy consumption is predicted to be twice as high in the year 2040 compared to today.

OBJECTIVES AND SCOPE OF THE STUDY

In agriculture farm, greenhouse, farmers have to suffer many problems while farming like hazards human health, insects eat their crops, breathing

problems. Insects are cause of many agriculture problems as they eat and damage the leaves and crops of farm.

Some of disease & their solution:

Fungicides: Robots can be used to combat plant diseases that cause a lot of damage to crops. Fungi are the most common causes of crop loss in the entire world. To kill a fungal disease you need a fungicide, a kind of pesticide. Fungal diseases interfere with the growth and development of a crop. They attack the leaves which are needed for photosynthesis and decrease the productivity of the crop and cause blemishes on the crops which make them worth less on the market. After the crops are harvested fungi can grow and spoil the fruits, vegetables, or seeds. Robots can treat plants that have been infected or destroy them if necessary. They could treat just the plants that need it, instead of covering the entire crop with fungicide.

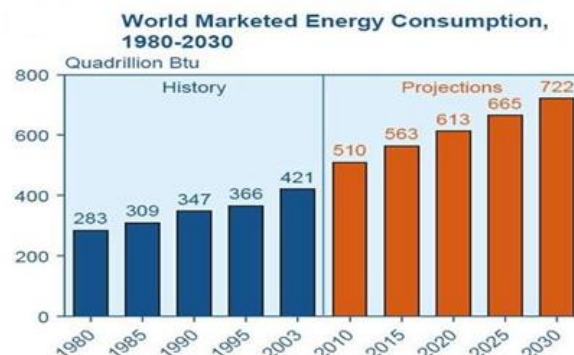


Figure:-1



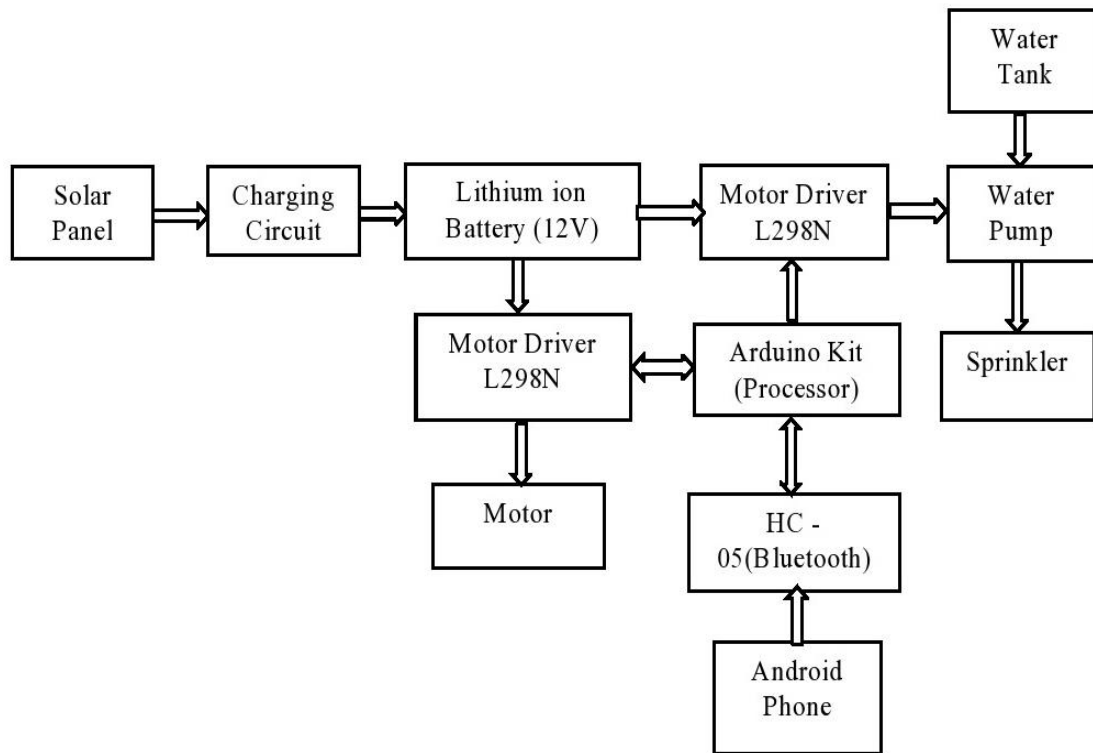
Figure:-2 Leaves damaged by insects

Herbicide: Another use for robots is in weeding. Robots can pull weeds from around the plants or just cut the tops off. All of the material can be collected by a robot and brought to a composting site limiting the need for herbicides, chemicals that destroy or inhibit the growth of plants. Herbicides are intended to kill weeds but many times also damage the crops.

Pesticide: Pesticides are used to control insects that can be harmful to crops. They

are effective but have many side effects for the environment. Insects also adapt to the toxin in a pesticide and the survivors breed and pass the resistant trait on to the next generation making stronger insects that are harder to kill. Robots could solve this by removing pests from the crops without using chemicals. They might suck them up with a vacuum. A bellows based air system makes a vacuum that doesn't require the large amount of power of regular Vacuum systems.

BLOCK DIAGRAM:



COMPONENTS:

Solar Panel

A solar panel (also solar module, photovoltaic module or photovoltaic panel) is a packaged, connected assembly of photovoltaic cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. Each panel is rated by its DC output power under standard test conditions, and typically ranges from 100 to 320 watts.

twice the area of a 16% efficient 230 watt panel. Because a single solar panel can produce only a limited amount of power, most installations contain multiple panels. A photovoltaic system typically includes an array of solar panels, an inverter, and sometimes a battery and or solar tracker and interconnection wiring.

The efficiency of a panel determines the area of a panel given the same rated output - an 8% efficient 230 watt panel will have

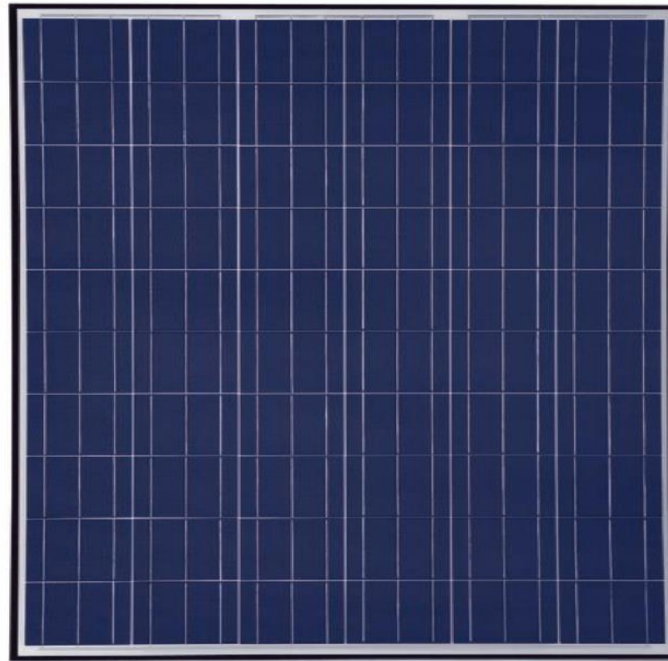


Figure:-3 Solar Panel

The Panel which we have used:

12V 200mA 2.4W Solar Panel

Mini Solar Cell has a Descent Efficiency of 2.7W, can easily be arranged for medium load applications including Medium voltage and current loads. Due to its compact size this can be used for Mini projects you desire with great efficiency of 15-16%.

SPECIFICATIONS

Quality custom-design solar energy panel

Polycrystalline solar cells

Max output power: 2.7W

Max working voltage: 13.2V

Max charging current: 220mA

Min output power: 2.4W

Min working voltage: 6V

Min charging current: 200mA

Size 140mm x 158mm x 3mm

Lithium Ion Battery:

A lithium-ion battery or Li-ion battery (abbreviated as LIB) is a type of rechargeable battery in which lithium ions move from the negative electrode to the positive electrode during discharge and back when charging. Li-ion batteries use an intercalated lithium compound as one electrode material, compared to the metallic lithium used in anon-rechargeable lithium battery. The electrolyte, which allows for ionic movement, and the two electrodes are the constituent



Figure:- 4 Samsung Lithium ion Battery



Figure:- 5 Battery holder

Lithium-ion batteries are common in home electronics. They are one of the most popular types of rechargeable batteries for portable electronics, with a high energy density, tiny memory effect and low self-discharge. LIBs are also growing in popularity for military, battery electric vehicle and aerospace applications.

Specification and Features:

Nominal discharge capacity 2,500mAh

Charge: 1.25A, 4.20V, CCCV 125mA cut-off,

Discharge: 0.2C, 2.5V discharge cut-off

Nominal voltage 3.6V

Motor Driver L298N:

Dual Motor Controller Module 2A with Arduino, this allows you to control the speed and direction of two DC motors, or control one bipolar stepper motor with ease. The L298N H bridge module can be used with motors that have a voltage of between 5 and 35V DC.

There is also an onboard 5V regulator, so if your supply voltage is up to 12V you can also source 5V from the board.

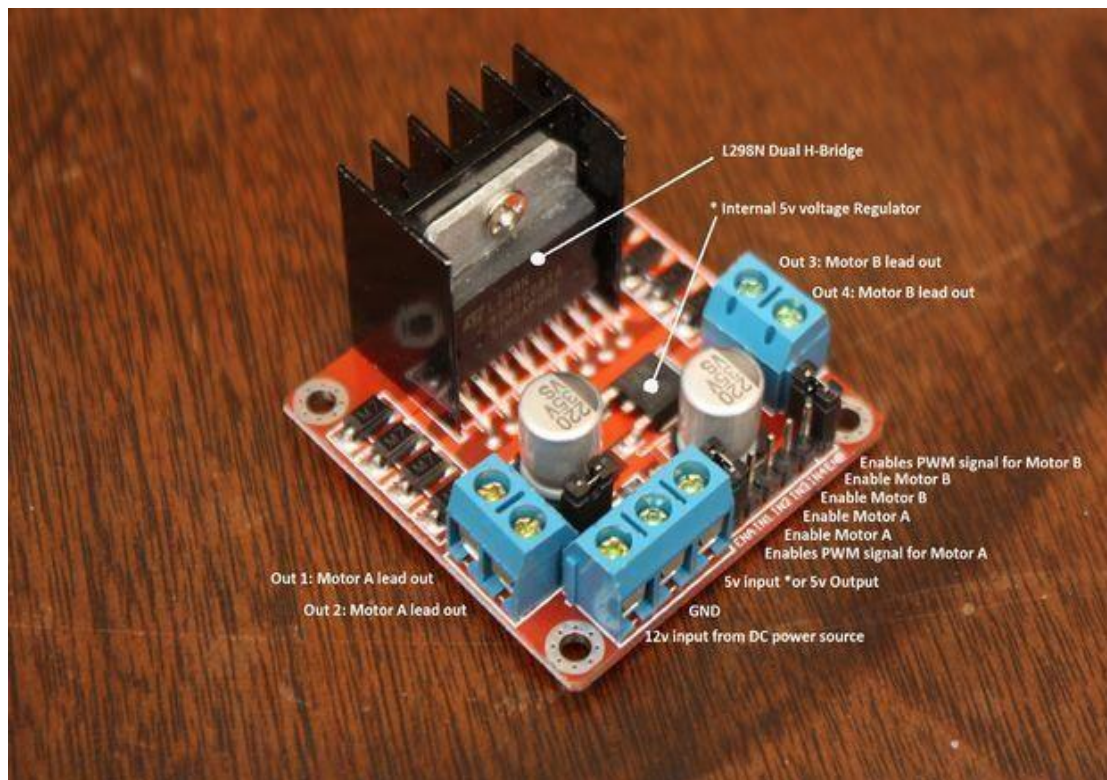


Fig 6 Motor Driver L298N

Arduino UNO:

The Arduino Uno is the most common version of Arduino family. The Arduino Uno is a micro controller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. The Arduino Uno is great choice for beginners.

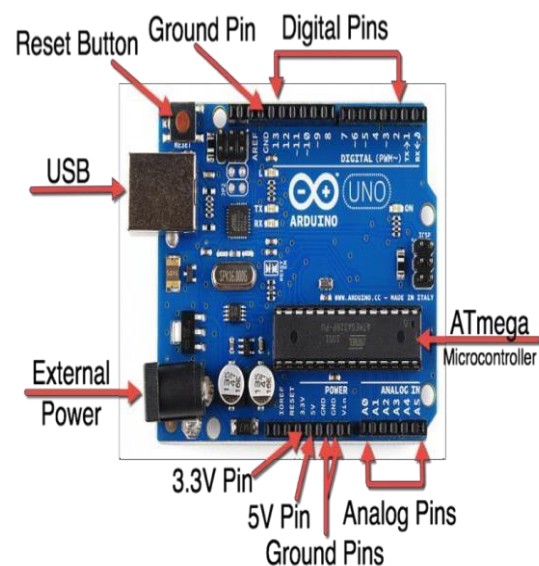


Fig 7 Arduino UNO

It contains everything needed to support the micro controller; power it with an AC-to-DC adapter or battery to get started.

Microcontroller- ATmega328

Operating Voltage- 5V

Input Voltage (recommended) - 7to12V

Input Voltage (limit) - 6to20V

Digital I/O Pins-14 (of which 6 provide PWM output)

Analog Input Pins-6

DC Current per I/O Pin-40 mA

DC Current for 3.3V Pin-50 mA

Flash Memory-32 KB (ATmega328) of which 0.5 KB used by boot loader

SRAM-2 KB (ATmega328)

EEPROM-1 KB (ATmega328)

Clock Speed-16 MHz

DC MOTOR:

DC Motor – 100RPM – 12Volts geared motors are generally a simple DC motor with a gearbox attached to it. This can be used in all-terrain robots and variety of robotic applications. These motors have a 3 mm threaded drill hole in the middle of the shaft thus making it simple to connect it to the wheels or any other mechanical assembly.

100 RPM 12V DC geared motors widely use for robotics applications. Also, you don't have to spend a lot of money to control motors with an Arduino or compatible board. The most popular L298N H-bridge module with onboard voltage regulator motor driver can be used with this motor that has a voltage of between 5 and 35V DC or you can choose the most precise motor driver module from

the wide range available in our Motor driver's category as per your specific requirements.

Nut and threads on the shaft easily connects and internally threaded shaft for easily connecting it to the wheel. DC Geared motors with robust metal/plastic gearbox for heavy-duty applications, available in the wide RPM range and ideally suited for robotics and industrial applications. Very easy to use and available in standard size

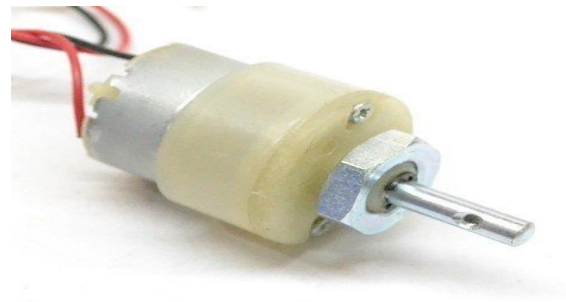


Fig 8 DC Motor

SPECIFICATIONS:

Operating Voltage: 12V DC

Gearbox: Attached Plastic (spur) Gearbox

Shaft diameter: 6mm

Shaft Length: 21 mm

Torque: 1.2 Kg-cm.

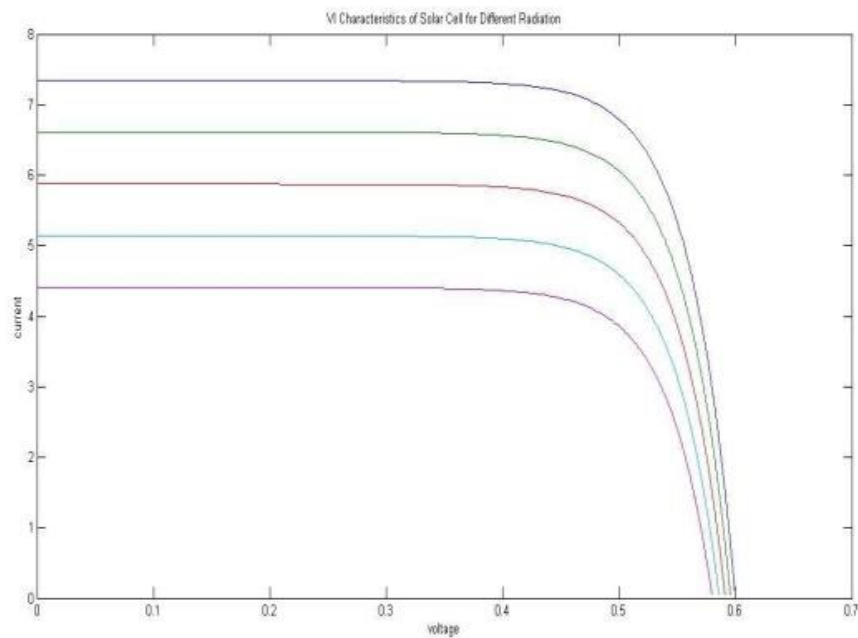
No-load current = 60 mA (Max)

Load current = 300 mA (Max).

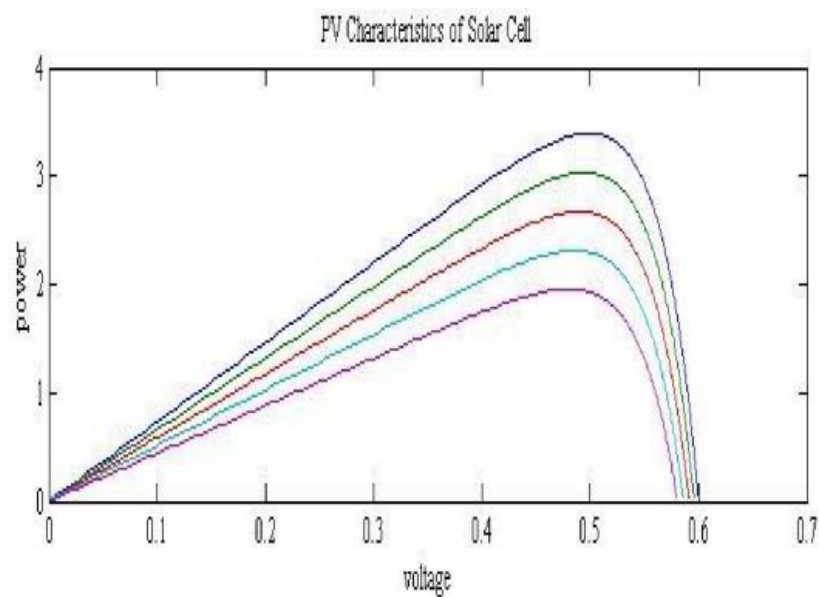
Dimensions: Body Diameter: 38mm;

Motor Length with shaft: 77 mm;

Same size motor available in various
RPMs



VI Characteristics



PV Characteristics

Actual Model:

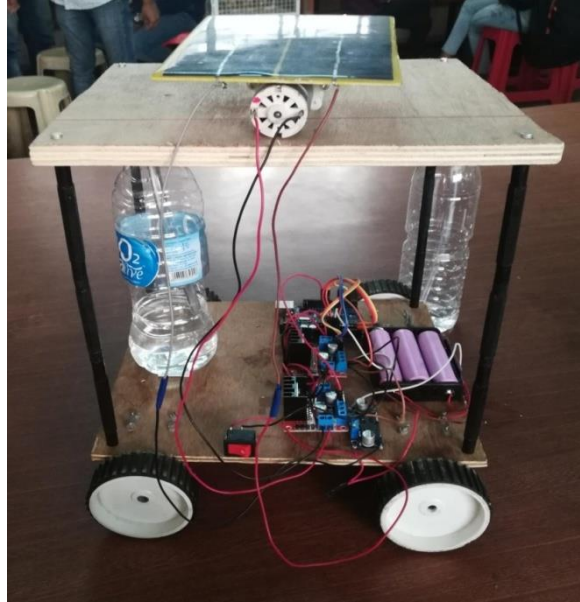


Figure: 9

CONCLUSIONS

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.

FUTURE SCOPE

We are planning to combine all the electricity work done in farm in one complete solar scheme.

From the automation point of view we can make flying type robot so we can spray the pesticide from long distance and see the operation.

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