

# Solar Electric Powered Hybrid Vehicle

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**Abstract:-** This paper gives you a basic overview about designing and implementing the process of solar electric vehicle. The power obtained from the Photovoltaic (PV) system keeps on changing with solar radiation and ambient temperature because of the nonlinear voltage current characteristic, exhibited by the PV system. However, with the advancement in technology, it is now possible to obtain maximum power from the PV cell and thus overall efficiency can be improved. This hybrid power generation system is a simple and cost-effective control, and maximum power point tracking (MPPT) control has to extract more power. Also, this hybrid system is developed through an experimental model.

This paper the study on charging using constant voltage (CV) method. This method has a function of determining output voltage of the PV system on maximal condition, so PV system will always produce a maximal energy. A model represented a PV system with and without MPPT. PV system showed a different outcome energy.

**Keywords:-** Solar Panel, Batteries, Electric System, MPPT.

## I. INTRODUCTION

Solar cars depend on PV cells to convert sunlight into electricity to drive electric motors. Unlike solar thermal energy which converts solar energy to heat, PV cells directly convert sunlight into electricity. The design of a solar car is severely limited by the amount of energy input into the car. Photovoltaic (PV) system is one of renewable energy

application. The electrical energy production of PV system depends on the weather, because the output energy of PV system depends on variation of solar radiation when the weather change. The large amount of solar radiation increases the output power of PV system, and vice versa. Because of that condition, the amount of consumption power may be larger than the amount of output power. PV system will not always produce maximum power even the solar radiation is on the maximum condition. Therefore, PV system needs another system to improve the efficiency by maximize the output power using a maximum power point tracking (MPPT) method.

## II. THEORY

### A. Mppt System

MPPT or Maximum Power Point Tracking is algorithm that included in charge controllers used for extracting maximum available power from PV module under certain conditions. The voltage at which PV module can produce maximum power is called maximum power point (or peak power voltage). Maximum power varies with solar radiation, ambient temperature and solar cell temperature.

A MPPT solar charge controller is the charge controller embedded with MPPT algorithm to maximize the amount of current going into the battery from PV module.

MPPT is DC to DC converter which operates by taking DC input from PV module, changing it to AC and converting it back to a different DC voltage and current to exactly match the PV module to the battery.

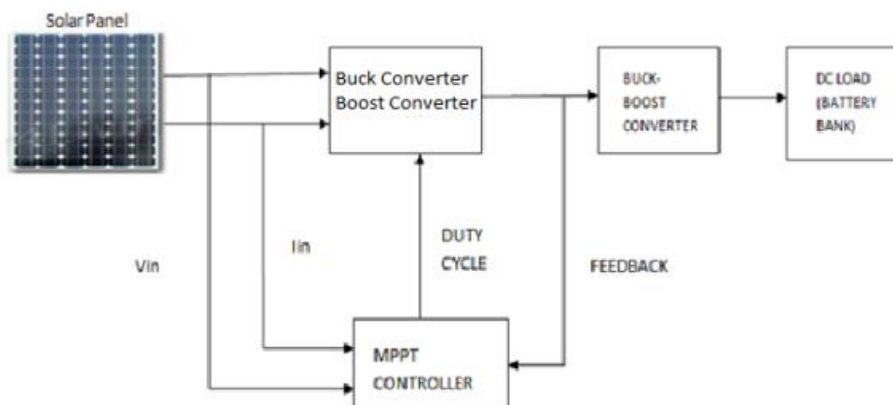


Fig 1:- MPPT System Diagram

Constant voltage method was applied on the MPPT algorithm to produce maximum power of PV system. CV method was used to determine the output voltage of PV system on the maximum condition. Thus, it was expected that system produced the maximum output power.

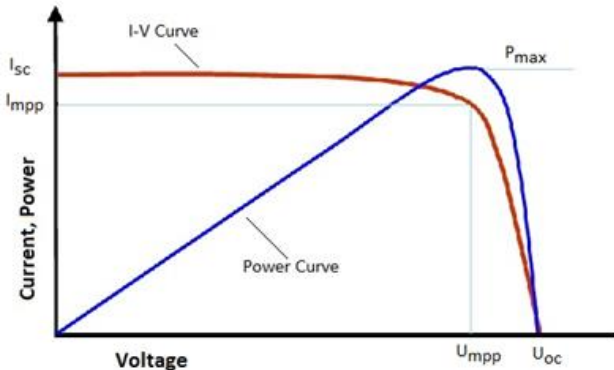


Fig 2:- I-V Diagram

**B. Proposed of System**

Solar energy is one of renewable energy resource where needs a photovoltaic module to convert it into electrical energy. One of the problems on solar energy conversion is the process of battery charging. To improve efficiency of energy conversion, PV system needs another control method on battery charging called maximum power point tracking (MPPT). The power obtained from the

Photovoltaic (PV) system keeps on changing with solar radiation and ambient temperature because of the nonlinear voltage current characteristic, exhibited by the PV system. However, with the advancement in technology, it is now possible to obtain maximum power from the PV cell and thus overall efficiency can be improved. This hybrid power generation system is a simple and cost-effective control, and maximum power point tracking (MPPT) control has to extract more power.

**III. WORKING PRINCIPLE**

When the sunlight falls on the PV panels, these panel convert the solar energy from sunlight to electric dc current. This dc current is used to charge the batteries of the system. In this system used two microcontroller ATMEGA328 (8-bit microcontroller) and ESP12E (32 nit microcontroller with embedded Wi-Fi). this two-microcontroller run on 5v and 3.3.v power supply resp.9v battery issued for both micro controllers ,16x2 LCD display DTH11(temperature and humidity sensor) LDR, dust sensor, current sensor, voltage sensor. All this peripheral along with microcontroller used power supply form 9v battery .12v battery is used for charging form solar panel via MPPT buck and boost converter which are connected by ATMEGA328 microcontroller. Main controller which is ATMEGA328 is handling all peripherals and MPPT system, ESP82 Wi-Fi microcontroller is used to communicate with google firebase (cloud).

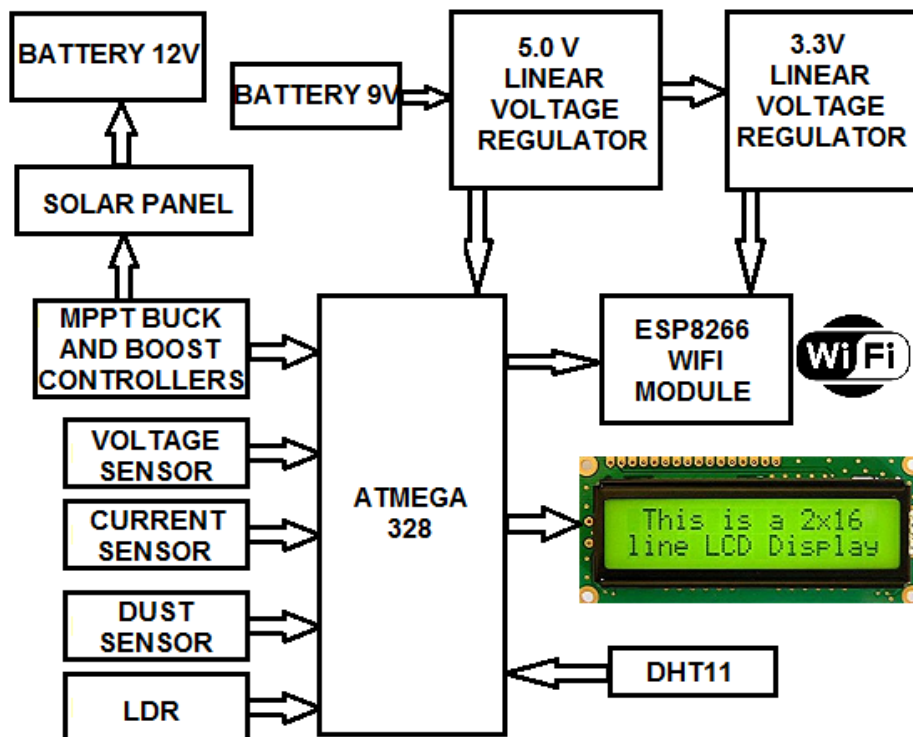


Fig 3:- Block Diagram

In circuit diagram, at extreme bottom there is power supply circuit which has 9v battery LM7805 (5v) liner regulator AMS1117 and filtering capacitor along with power LED. This section gives regulated 5v and 3.3v power supply

to the system. The main controller ATMEGA328 is used 5v power supply to the IC pin 7 And 20. DTH11 temperature and humidity sensor is interface with microcontroller through I/O pin 4. IC pin 9 and 10 is connected to crystal oscillator 16Mhz

along with 22pf decoupling capacitor 16x2 LCD display is interface with 6 I/O pin (6,7,8,5,12,11) pin 1 is reset pin and is pulled with 10kohm resistor and the same pin connected to ground via momentary push button switch(reset switch) Dust sensor is attached to pin 13 one analog pin for measuring voltage 10kohm and 2.2kohm voltage driver circuit is used and input to ADC to analog pin for measuring current ACS712 (5A) current sensor is used to attached to ADC 1 (analog pin) Serial communication in both micro controller is required to send data form main control (ATMEGA328) to

Wi-Fi controller (ESP12E) the serial communication UART is uses microcontroller own UART pins ESP12E microcontroller supplied by 3.3v reset pin is pulled up with 10kohm resistor and same pin is attached to reset switch pin 9 of main controller is used to controlled buck-boost convertor along with PC817 optocoupler ULN2003 relay driver ,relay for switching buck boost converter diode 1n4007 are attached at the output of buck-boost converter for isolating both this output is used to charge 12v battery.

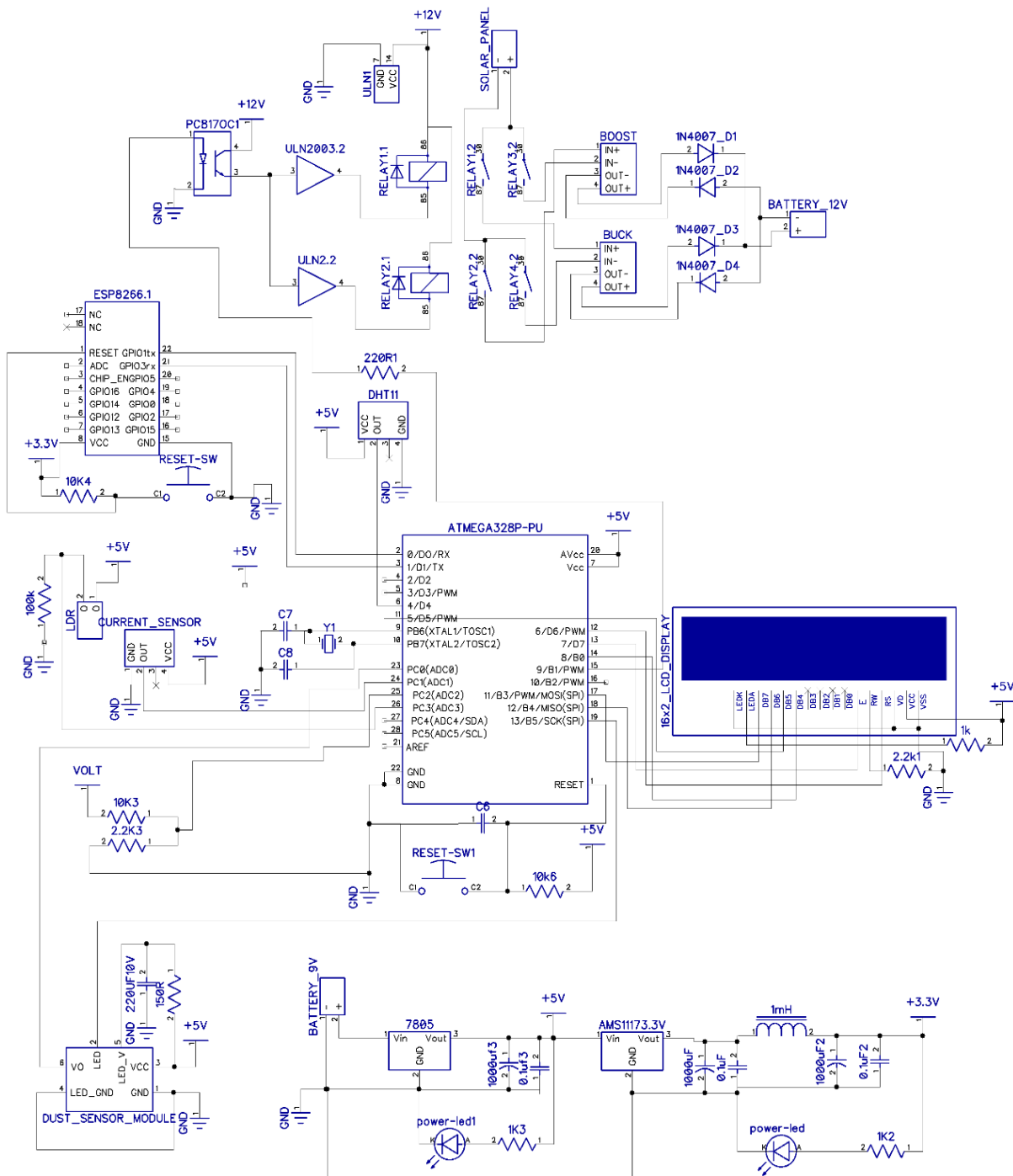


Fig 4:- Circuit Diagram

#### IV. CONCLUSION

It is essential that the design of solar cars are efficient, safe and takes into account the specific requirements and limitations. For example, in order for the solar car to run on solar power it needs a lot of power and an optimum angle needs to be decided to maximize this power output. It is best to use a MPPT to maximize the current going into the battery and to choose an efficient solar array or panel. This being said, the solar car can have a significant impact on the reduction of unhealthy greenhouse gas emissions and help prevent global warming. We need to make use of solar powered cars so that we can reduce our dependence on fossil fuels. Maximum Power Point Tracking is one of the effective ways of obtaining maximum power from the DC source with high efficiency. In this paper, P&O algorithm is used because of its fast switching and high reliability property. We can obtain the constant voltage during changing irradiance and environmental conditions from the PV system. If we use this technique for low voltage DC transmission, then we can reduce the losses obtained in AC transmission, due to corona effect, high voltage surges, etc. Because of the less insulation in DC, we can save cost and it is one of the environmentally friendly ways of power generation and transmission

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