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Review Article

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Hydrogen Solar Electric Vehicle: A Review

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Abstract

In this paper we will be discussing the development and advancement of hybrid electric vehicle (EV) that is implemented by due diligence of efficiently dealing with the solar hybrid car charging system byexecuting solar cells in the roofing system and body framework to charge the source which utilizes solar network. Solar photovoltaic panels are transcending to more effective and are currently effective enough to charge car batteries in a sensible quantity of time. And therefore, we have an effective network of sustainable and tidy power resources. We are also implementing a hydrogen energy channel within our vehicle so that we can traverse even in conditions where the solar energy is vague.

Keywords

Electric vehicles charging, Solar charging, Hydrogen vehicle, Solar hydrogen electricvehicle, Hybrid vehicle

Introduction

In the modern age,humans have hastened to clingthemselves overlooking renewable sources of energy for day-to-day life as it is clean, virtuous, and cheap [1, 2]. In this paper we will be inclining more on development of engineered solar vehicle with a backup power provided with hydrogen fuel cell. In this proposed design for a car,we would hover on being dependent on solar energy to rotate the motor for generating electricity as the main source [3, 4]. And backup power by hydrogen cell is provided in case there's a drastic change in climate which outputs as non-eligible for solar power generation. In this projectour main objective is to create an environmentally friendly clean vehicle with energy sources for both main and hybrid as renewable sources [5, 6]. As both sources of energy can be deemed as clean, we could say that our objective is satisfied [7, 8]. We have also added many add-up improvements toour vehicle design like overheat detection sensor, dim, and down interface, and covering the body with photovoltaic cells in such a way that maximum energy can be obtained from the sun. This engineering experimentation defined in this paper can be defined for "Cruise around with the Vehicle without Ever Charging and Go Green". By enhancing mechanical strength, lowering body weight, and improving battery efficiency, the use of nanotechnology improves the development of EVs [9, 10].

Hardware Implementation

Figure 1 solar panel converts light energy to electrical energy then charges the battery [8] and then with the help of power electronics controller controls the motor movement. In addition to that we have also implemented normal charging system which accepts normal DC current as power input and charges the battery

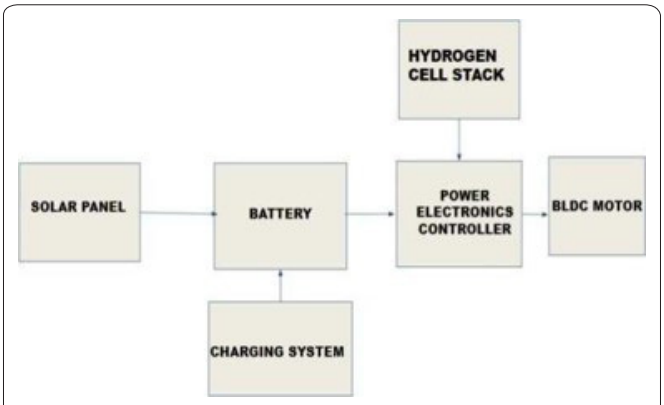

Figure 1: Block diagram of our hybrid vehicle.

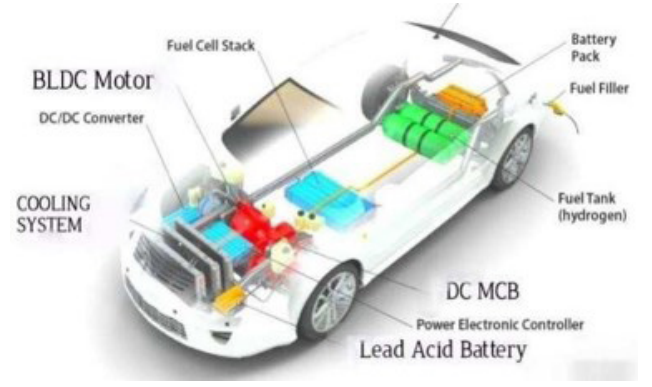

Figure 2: Design diagram of our hybrid vehicle.

[1], and hydrogen cell stack that takes hydrogen element from the cylinder and converts it into electrical energy and elude the current into the power electronic converter component and in there charges our battery [6]. After the battery charge is completed from our above-mentioned methodologies the battery will power Brushless DC (BLDC) motor and, in the end, rotate our motor. Our vehicle implements solar EV system, [3] normal charging EV system, and hydrogen EV system shown in figure 2. Our vehicle framework is designed within these very enhanced and advanced systems.

Solar EV charge technology block diagram and its implementation

Figure 3 the solar panel which is used to convert solar energy to electrical energy which in turn will be regulated to get a constant output as it varies continuously [1, 5]. And then we connected the output from the regulator circuit to the battery [3]. At one implementation we would charge a battery and with the next implementation we would pass the output to the charging system which holds a normal charging connectivity cable with 230 V AC 50 Hz output [6]. The battery we are using here is a lead acid battery of 12 V connected serially to reconstruct a 48 V framework for its output. We have also implemented a DC MCB (Miniature Circuit Breaker) which has a use case when any short circuit or any damage happens MCB would automatically turn off to protect its framework surrounding it. And finally, the BLDC motor controller is used so as to control the speed for the concurred motors following it [2].

Block diagram of hydrogen EV technology and its implementation

Figure 4 we use hydrogen cylinders to store hydrogen. The hydrogen stored in hydrogen cylinder will then be passed to hydrogen reformer from where the purification of hydrogen that entered and reformer and later is inserted into fuel cell stack. From this fuel cell stack the hydrogen we inserted will be converted to electrical energy with a compiled chemical process. The energy formulated from the previous method will then be revoked and thus generated into electrical energy. The part of power electronics and converter upholds the components automatic motor controller to control the speed of the motor, DC MCBA to protect the circuit illustrated inside [7], and regulator circuitry which will grant us a constant current output [4].

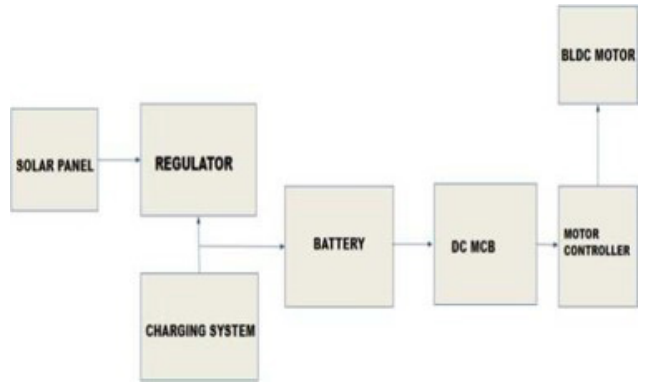

Figure 3: Block diagram of solar vehicle technology.

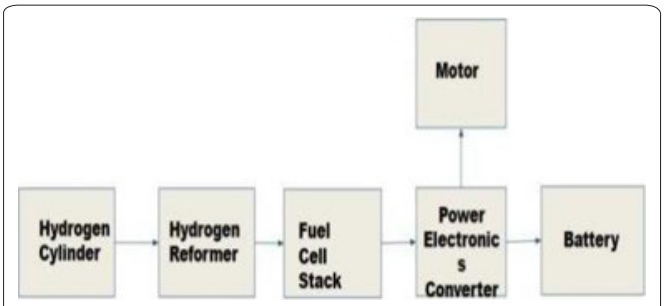

Figure 4: Block diagram of hydrogen vehicle technology.

The advanced control implementation in this project using Arduino

Figure 5 we use a temperature sensor in here to detect overheating in our circuitry framework. If the output from the temperature sensor exceeds certain coded input we gave to Arduino, the Arduino will switch control over to cooling fan to implement the cooling effect and also, we have defined a circuit consisting of Buzzer to act as an alarm if the previous premise returns positive. We have also implemented an LDR framework within Arduino to act as a dependent resistor which will automate the infringement of dim and down technology which hovers on automatically dimming and raising the light according to certain premises which we have defined for obliging bythe traffic rules.

Hardware Component Details

Solar panel

The solar panel we are using is manufactured with

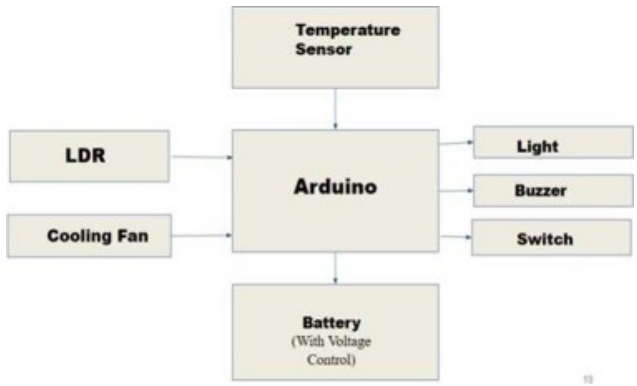

Figure 5: Block diagram of advanced control implementation.

amorphous silicon, mono silicon, and polysilicon. It hovers on a combination of 95 cells which traverses to 0.5 - 0.6 V from each cell, so the approx. output voltage will be from 58 V to 60 V [8].

DC MCB

We use DC MCB to protect our circuitry if there occurs any short circuit or damage within our circuit.

Lead acid battery

The battery we are using is a lead acid battery with 4 batteries serially connected to get 48 V of output which isthe output that our motor works on. When comparing, lithium-ion batteries are clearly superior in terms of traversing heat.

In particular, the capacity of electrode, specific power, and cycle life can be increased by adding nanomaterials such as carbon nanotubes, nano $LiFePO_4$ and nano Li_2MnSiO_4; this enhances the vehicle's performance [10].

BLDC motor

BLDC motor capacitates on the input voltage from 45 - 48 V the power generated by it will be 280 W and the loading capacity extends to 400 - 550 Kg. If we were to compare it with other motors available, we must say that it's highly efficient and more powerful [7].

Arduino UNO

Arduino Uno is a micro controller with 8-bit memory and 28 pins. Here we use an Arduino board based on ATmega328. And the coding environment for Arduino would be Arduino IDE.

Light dependent resistor (LDR)

LDR concurs directly proportional relation when lamination of light to resistance within the circuitry. We use this to activate automatic dim and down technology for our project.

LM35 temperature sensor

We use LM35 temperature sensor as it is small, cheaper, has input voltage from 4 - 5 V and recurs rate of temperature range from -55 °C to 150 °C.

Cooling fan

Cooling fans are implemented to protect our circuitry from overheating. It's cost effective, easily installable, and has an input voltage of 12 V. The speed for the cooling fan is in direct proportion to heat sensor output that is served, if the temperature is high the speed will be in high mode and vice versa if the output is low temperature.

Motor speed controller

Motor speed controller or just motor controller is implemented to control the speed of the motor and to initiate battery power supply to the motor. It's a circuitry framework and the input that is to be provided will depend on the motor basis, and with the speed controlling port we recur on the speed adjustments.

Software Details

ArduinoIDE

Figure 6 is an Arduino IDE software, it is an IDE framed for writing, compiling, and uploading the code in our Arduino board to perform input functionalities that we discussed earlier.

CAD software

Figure 7 is CAD software it is used by us to design the external framework for our project. This software has many tools and functionality that allows us to develop or rather implement anything we can design.

Tinker CAD

Figure 8 is Thinker CAD software. It is using Tinker CAD here, as it is a circuitry software design software and to link as an interface between them by program code.

Conclusion

The conclusion we can formulate from this project is that of the vast expanding opportunity for harvesting renewable sources of energy for everyday use case implementation just like this project of solar car. We must realize the potential change we could make throughout the world in the present by small implementations of clean, cost effective, pollution free solar car like this one. A one step towards a greater future may lie in solar cars throughout the world as they have proven to be an effective, competitive alternative to traditional fuel car methodologies.

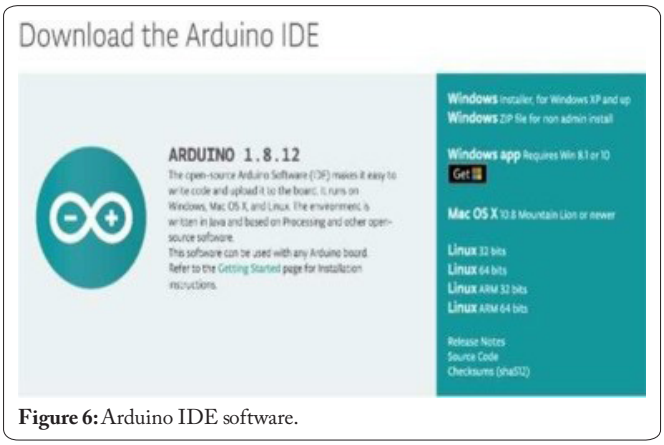

Figure 6: Arduino IDE software.

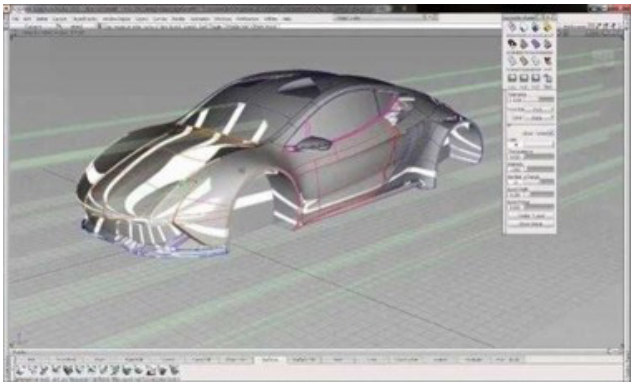

Figure 7: CAD software.

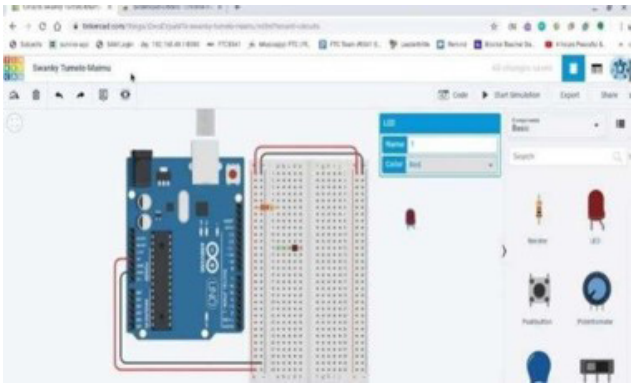

Figure 8: Tinker CAD software.

Acknowledgements

None.

Conflict of Interest

None.

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