Modeling of Smart Hybrid Electric Vehicle

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Abstract- The aim of this paper is production of electrical power from the solar photovoltaic panel which is used to run the electric motor in electric vehicle. The generation of electrical power by using the concept of solar energy due to sunlight. This system normally called as Hybrid electric vehicle. The generated electric power can be utilized in electric vehicles or it can be stored in batteries and also it can fed back to the grid during peak hours (Vehicle to Grid system). The advanced technology 'Adaptive Headlight Technology' to reduce road accidents is also implemented in Hybrid Electric Vehicle hence the vehicle named as 'Smart Hybrid Electric Vehicle'. This system is energy efficient due to installation of LDR on the vehicle. By using this concept, this will help to reduce the usage of non-renewable sources, and there is a great achievement in reducing carbon emission in the environment. This system also improves the living standards of human.

Index Terms- Hybrid Electric Vehicle, Battery, Photovoltaic Panel, Vehicle to Grid, Grid to Vehicle, Indicators, Headlamp, Controller, LDR, etc.

I. INTRODUCTION

This paper refers to the generation of electricity by the use of solar photovoltaic panel and this energy is used for running electric motors in electric vehicle. In conventional electric vehicles Electric battery is the main power source to run the electric motors in the vehicle. This scheme having some limitations in acceleration due to only one energy source. These limitations can be overcome by using one more energy source parallel with Chargeable batteries. This scheme improves the acceleration characteristics of electric hybrid vehicle. In today's consent many lives are destroyed in road accidents due to foggy weather in the winter season and also due to disoperation of the driver. Road accidents cause the financial detriment. For this, inventions like 'Adaptive Headlight technology' are very helpful. This technology reduces the risks of accidents due to disoperation of driver. Also The Smart Hybrid electric vehicle consist of a laser light which can automatically turn ON when fog is detect by fog sensor. This Scheme is mainly used for reduction in road accidents due to foggy weather. This features of hybrid electric vehicle makes the vehicle fully Automated due to which even if driver forget to give the indicator while turn the steering the indicators will turn ON.

Now there are great concerns on the Green House Gases emissions (GHG) due to burning of fossil fuel in the vehicles. Due to continuous use of fossil fuels in the conventional vehicles dependency on foreign countries increase which reduces the economic growth of country. Increase in greenhouse gases tends to increase in temperature of earth called as Global Warming. Effects of global warming consist of acid rain, skin disease and it effect on living things. Smart hybrid electric vehicle system overcomes this problem as installation of solar photovoltaic panel on the rooftop of the vehicle. As solar energy is the type of non renewable energy it does not pollute the environment and available in abundant quantity without any cost. Also the Smart Hybrid Electric Vehicle is the energy efficient vehicle as it consist of LDR which can be turn ON the headlights according the presence of headlight. This system is more helpful for reducing dependency on the fossil fuels and also reducing the road accidents. The aim of our paper is to make a 'Smart hybrid electric vehicle' with adaptive headlight technology and other advanced feature will help to achieve safety, comfort and reliability and to reduce dependency on fossil fuels and hazardous emissions.

This system is based on the 'Vehicle to Grid System'. During peak hours in grid the vehicle can supply the energy fed back to the grid, this allows the gaining of financial benefits.

II. LITERATURE SURVEY

The commonly used configurations of the driving chains, the comparisons among these configurations, and then finally the possible developments of hybrid electric vehicles in the near further. Plug-in hybrid electric vehicles are also included in the discussion [1]. Effect of a solar panel area and orientation within this tropical region like Bangladesh. Also, the vehicle dimensions and electrical system components on vehicle performance, weight, and fuel savings have analyzed. It is seen that significant fuel-savings could be achieved by using solar & electric power in comparison to the traditional vehicle [2]. The greater community on alternative energy and its applications, as well as to build a practical solar and electrical powered car that could have real world applications upon further technological advances [3]. The demand for non renewable fuel in the world, especially by light-duty vehicles, continues to increase with economic growth and development. Fossil fuel driven vehicles are not only creating financial strain due to fluctuating fuel prices but are also polluting the environment and causing hazardous effect on health risks to the community[4].

III. SYSTEM DESCRIPTION

The Smart Hybrid Electric Vehicle is consisting of two energy sources – solar energy and electric battery. During sunlight the battery charged through energy from solar photovoltaic panel

as the energy generated due to radiation of the sunlight. During rainy season or light sunshine hours the battery will be charged through external electricity supply, thus the vehicle does not pollute the environment.

In fossil fuel vehicles the burning of fossil fuels pollutes the environment. This system consists of 'Adaptive Headlight Technology' which will help to reduce the road accidents caused by lack of attention of the driver of vehicle. While turning the steering of the vehicle the headlights also rotates automatically in that direction hence chances of accidents are reduced as this technology indicates rotation of the vehicle to the driver of another vehicle. Also this system consists of laser light for indication of the presence of the vehicle during foggy weather conditions. When fog is detected by the fog sensor it will turn on the laser light automatically so that the chances of accidents caused by foggy weather are reduced. While the detection of any obstacle in front of the vehicle it will sensed by IR sensor and it gives signal to turn ON upper and dipper of headlights.

The Smart Hybrid Electric Vehicle is the energy efficient vehicle which allows the use of LDR so that it controls the intensity of the headlight so great amount of energy has been conserved. During Turning the vehicle the side indicators will automatically turned ON so that if the driver is forget to give the indicator , indicator will automatically turned ON by the use of limit switches. This system is based on the 'Vehicle to Grid System'. During peak hours in grid the vehicle can supply the energy fed back to the grid, this allows the gaining of financial benefits.

III. COMPONENTS OF SMART HYBRID ELECTRIC VEHICLE

1. Solar panel--

A photovoltaic (PV) module is a packaged; connect assembly of typically 6x10 photovoltaic solar cells. Photovoltaic

Modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. We are using polycrystalline type of solar photovoltaic panel which having efficiency in the range of 16-18%.

We are using here a solar panel of 10 watts having dimensions 300*350*22.

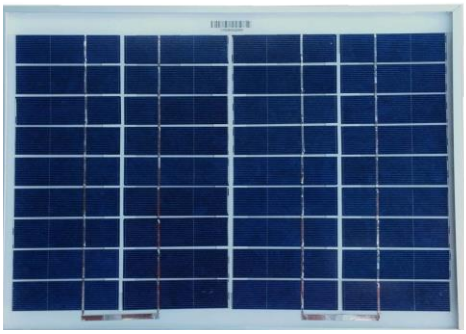

Fig.1. Solar panel

2. DC Servo motor--

The DC servo motor is a rotary electrical machine that converts direct current electrical energy in the form of mechanical energy. Normally all the DC motor having same internal mechanism, either electromechanical or electronic. A speed of DC motor can be controlled over a wide range.

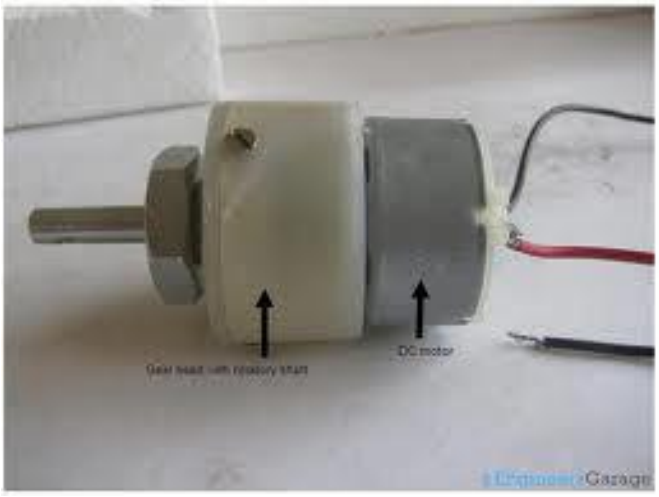

Fig 2. DC Servo motor

3. Battery—

An automotive battery is a type of rechargeable battery that supplies electric energy to an .An automotive SLI battery (starting, lighting, and ignition) powers the starter motor, the lights, and the ignition system of a vehicle's engine.

Here we are using Lithium-ion battery which having long life cycle as compare to Ni-Cd batteries. We are using 12V, 2.5 Ah batteries for vehicle operation.

Fig 3. Battery

4. LM393 IC

The LM393 series are dual independent precision voltage comparators capable of single or split supply operation. These devices are designed to permit a common mode range−to−ground level with single supply operation. Input offset voltage specifications as low as 2.0 mV make this

device an excellent selection for many applications in consumer, automotive, and industrial electronics.

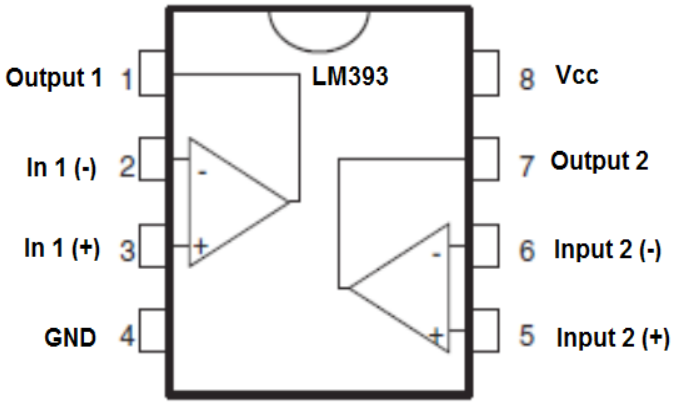

Fig 4. Battery

5. LM78XX

The LM78XX series of three-terminal positive regulators is available in the TO-220 package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut-down, and safe operating area protection.

6. Headlamps

Headlamps are used to illuminate in dark. We used hero splendor headlamps with LED lamps**.**

7. Limit Switches

Limit switches are used in a variety of applications and environments because of their ruggedness, ease of installation, and reliability of operation. They can determine the presence or absence, passing, positioning, and end of travel of an object.

8. Indicators

Indicators are used to indicate where the vehicle will turn. In our project four indicators are used of Hero splendor.

9. LED

Nichia LEDs are the most popular, high quality and reliable light emitting diodes to buy on the market since many years. Skilled eyes quickly recognize the solid lead frame, clear edges and unique Dome. These high performances LED for highest demands are convincing by features like long lifetime, true colors and processing quality.

V. BLOCK DIAGRAM AND WORKING

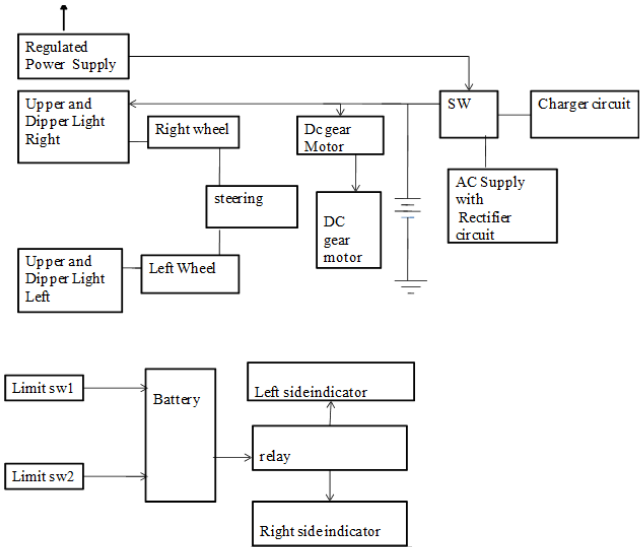

Fig 5. Block diagram of smart hybrid electric vehicle

- Electric battery charged through energy from solar photovoltaic panel or directly from electricity.
- Battery supplies the power to DC servo motor for its operation.
- LDR senses the intensity of light and automatically turns ON or OFF the headlights.
- During turning of vehicle, when steering rotates in particular direction the indicator will turn automatically in that direction.
- Presence of any obstacle will sense by IR sensor and give signal to headlights to turn ON upper and dipper.
- If fog is present in the atmosphere, presence of fog is detect by fog sensor and give signal to laser light to turn ON.
- Smart hybrid electric vehicle run automatically with minimum operation performed by driver.

VI. PROTOTYPE MODEL

Fig 6. Prototype model front view

Fig 7. Prototype model top view

- Vehicle dimensions - 1.5 m*1 m.
- Solar photovoltaic panel dimensions- 300mm*350mm*22mm. 10W, 12 V, 0.4 A.
- Battery specifications – 12 V, 2.5 A.
- Transformer rating – 12 V, 2 A.
- DC Servo motor – 12 V, 200 mA.
- Vehicle speed (average) is 10 km/hr.
- Output power from solar panel – 10watt
- Time required to charge the battery fully using solar panel – 3Hrs
- Time required to charge the battery fully using direct electricity – 2Hrs

VII. APPLICATION

- This system can be implemented in car
- This system can be implemented in trucks and heavy duty vehicles to reduce the chances of road accidents.

VIII. CONCLUSION

This solar based smart hybrid electric vehicle integrating battery powered motor and backup with photovoltaic panels, can gives a valuable solution for energy saving as well as accidental problems. Through technology review and comparative analysis it is prove that SHEVs can significantly reduce harmful emissions of gases.

Solar energy technology and its uses are very important for developing countries. As solar energy is renewable type of energy it freely available in abundant quantity, maximum use of solar energy can be done by the smart hybrid electric vehicle. Also the road accidents are reduced by using smart hybrid electric technology.

IX. REFERENCES

[1]. Ismet Ugursal, V. "Energy consumption, associated questions and some answers."Applied Energy (2013).
[2]. Chan CC. The state of the art of electric, hybrid, and fuel cell vehicles. Proceedings of the IEEE 2007; 95(4):704 – 18.
[3]. Momoh, OD and Omoigui,MO. An overview of hybrid electric vehicle technology, In: Vehicle Power and Propulsion Conference, 2009. VPPC '09. IEEE; 2009
[4]. Graham, R. (2001). Comparing the benefits and impacts of hybrid electric vehicle options. Electric Power Research Institute (EPRI), Palo Alto, CA, Report, 1000349
[5]. Kempton, W. and S.E. Letendre, Electric vehicles as a new power source for electric utilities. Transportation Research Part D transport and Environment, 1997. 2(3): p. 157175.
[6]. Kempton, W. and J. Tomic, Vehicletogrid power fundamentals: Calculating capacity and net revenue. Journal of Power Sources, 2005. 144(1): p. 268279
[7]. H. Shimizu, J. Harada, C. Bland, K. Kawakami, and C. Lam, "Advanced concepts in electric vehicle design," IEEE Trans. Ind. Electron., vol. 44, pp. 14 – 18, Oct. 1997.
[8]. J. A. Cook and B. K. Powell. "Discrete Simplified External Linearization and Analytical Comparison of IC Engine Families," Proc. 1987Amer. Conrr. Con$, vol.1, pp. 326 - 330, June 1987.
[9]. Lowi, T.J., Review: American Business, Public Policy, Case Studies, and Political Theory. World Politics, 1964. 16(4): p. 677715.
[10]. M. Ehsani, K. M. Rahman, and H. A. Toliyat, "Propulsion system design of electric and hybrid vehicles," IEEE Trans. Ind. Electron., vol. 44, pp. 19 – 27, Feb. 1997.