Real time reactive power compensation for battery/photovoltaic hybrid power source for internet of hybrid electric vehicle system

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Abstract

The E-vehicles which depend on the grid now-a-days are getting turned off in the travelling path because of the unexpected discharge of the battery. The gasoline-powered internal combustion engine is introduced in the above E-vehicles as Hybrid E-vehicle (HE-vehicle) so as to continue the travel even after the discharge of the battery, but due to pollution above HE-Vehicle has becomes inferior. The proposed power electronic and photo-voltaic source based Renewable & grid pluggable electric–vehicle provides a good solution to the above problems. The trickle charging delivered by the modified boost converter which is being used for charging the battery and makes it serve two main purposes: 1. for operating the electric motor 2. for transmitting the charge to grid. The Lead acid battery can be charged using a converter from Grid to Vehicle (G2V) for its functioning on rainy days. The stored energy can be transferred back to the grid through an inverter with Watt/VAr exporter. The methodology proposed through this paper performs battery charging by means of these main procedures: Solar panel, Grid and Regenerative braking system, which can significantly elongate the run time of electric vehicle and increase in the converter efficiency, the authors have demonstrated this achievement with a converter efficiency of 98.5%. The proposed system may act as an initiative in energy efficient driverless cars, a special application of Internet of Things.
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Keywords: Vehicle to grid; Grid to vehicle; Hybrid E-vehicle; Boost converter; VAr exporter; Reactive power compensation

1. Introduction

Day-by-Day, the usage of the vehicles rate is getting increased which in turn increases the pollution too. As petrol and diesel are widely used in cars, bikes and trains, the pollution is increasing throughout the year. This affects the ozone layer, which results in creating skin problems. Another serious problem caused by the pollution is the formation of smog which is harmful to human health and also responsible for road accidents. To overcome all these problems, the utilization of battery operated vehicles and their production is high in-demand. E-vehicle helps in smooth and safe drive at an affordable cost and it is a user-friendly vehicle which is comfortable to drive for differently abled-people, the youngsters and elders. The automatic gear system present in the E-vehicle helps the people to drive it on the basis of steering control. The E-vehicle controller has been designed by using a three-phase inverter system, and this design can tend to be an alternative power source for home-appliances. The positioning of the brushless DC Motor (BLDC) forward/reverse/brake is provided by the operating signal from the hall position sensor signal conditioning circuit. Wireless communication and embedded system are also used to make the inter-vehicle

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intelligent transportation system effectively. Pollution is the major environmental issue and it is happening often by vehicles. People are suffering from several ailments due to the pollution in the environment. To develop a pollution free environment, researchers introduced E-vehicle plug-in hybrid vehicle. Demerit of such vehicles is that it creates the demand of electric power on the way of travelling. To help the users in this situation, researchers used PV module to run the vehicle but it was impossible to utilize it during rainy days. To solve this problem, we use a boost converter for charging the E-vehicle which makes it more efficient. A survey indicates that until 2017, most of the people are badly affected due to the road accidents. They have been seriously injured; lost their body parts, suffered from heavy wounds and have lost their precious lives. People are not much worried about these effects, and they drive recklessly. Lack of concentration of drivers costs their lives and also leads to the killing of pedestrians. Persons travelling in cars find it difficult to identify the indication of traffic lights and they are unable to follow the signals. So, they neglect the choice of travelling in own vehicles. The amount spent for petrol/diesel on cars is increasing tremendously. The usage of E-vehicle proves to be an effective remedy for the all the above said problems. It will prevent the diseases caused by air pollution. The development cost is low for E-vehicle construction, and it can be extensively manufactured using Surface Mount Technology (SMT) electronic devices. As a result, the level of the damage is very low.

2. Related works

Razman Ayop, and Chee Wel Tan have proposed a boost converter design of MPPT control algorithm using non-linear characteristics of PV module (Ayop and Tan, 2018). This paper has been designed with nine parameters. It uses both hill climbing and MPPT control algorithm for its functioning. The proposed method accurately designs the input capacitance, input inductance and output capacitance, and it is used to implement the real-time output through hardware in an efficient way so as to charge the battery. Hifsa Shahida, Muhammad Kamran and Zeeshan Mehmooda proposed a novel optical temperature controller to have an identification of the standard temperature of solar panel using MPPT algorithm (Shahida and Kamran, 2018), which is used to run the DC load. The output power of solar panel is identified and it undergoes smoothing of output power and DC load. This methodology is efficient in charging the battery, and it is provided as an input by using buck converter. Pothirasan (Pothirasan and Rajasekaran, 2016) has proposed the usage of three phase inverter that has DC source as input, and delivers AC source as output. The power from AC source is used in controlling the brushless DC motor that has Hall Effect sensor as H1, H2 and H3, which are set in a position of 120 degrees mode that will result in good power conduction to run the BLDC motor. Further, it is observed that the power generated through the solar panel is conveyed/transmitted to the grid, and it happens when the
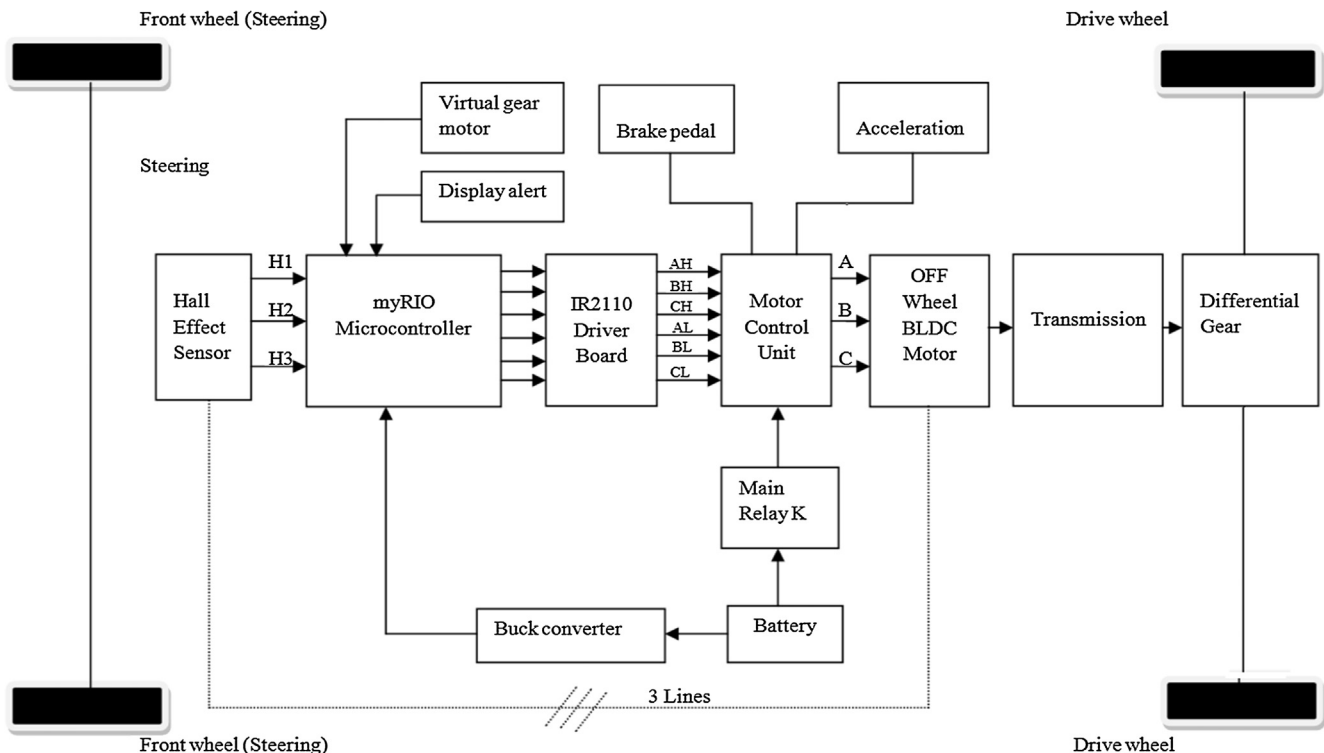

Fig. 1. Working principle of E-vehicle controller.