Hybrid Sources Powered Electric Vehicle Configuration

DR. R. SANKARGANESH[1], R. KUMAR[2], C. KAVITHA[3]

[1] *Associate Professor, Department of Electrical and Electronics Engineering, K.S.R College of Engineering, Namakkal, Tamilnadu, India*

[2] *PG Student, Department of Electrical and Electronics Engineering, K.S.R College of Engineering, Namakkal, Tamilnadu, India*

[3] *Lecturer, Department of Electrical and Electronics Engineering, K. S. Rangasamy Institute of technology, Namakkal, Tamilnadu, India*

Abstract- This work presents the concept and integration of solar power generation such as solar panels, DC-DC converters, batteries, charge controller, 230V AC power, power converters, smart controllers, generators, connectors and electronic components such as motor. Solar panels capture the sun's energy and DC-DC converters optimize power transfer by controlling voltage levels. The battery is taken by the controller to ensure energy storage and output. The power converter seamlessly converts the DC output into stable 230V AC power for grid connection. The intelligent controller automatically adjusts the variation to optimize energy capture in different situations. Additionally, the generator and genset combination provides strong backup power, increasing reliability in situations where solar energy is insufficient. This partnership aims to provide flexible and adaptable, versatile and efficient solar energy solutions to meet different energy needs in different offices.

Index Terms- BLDC, PV array, Generator, Inverter, Converter,Mongoose Optimizer.

I. INTRODUCTION

The modern search for a sustainable energy solution has led to the integration of various devices into an integrated solar energy system. At the center of the system is a solar panel designed to use sunlight and convert it into direct current through the photovoltaic effect. In order to improve power efficiency, a DC-DC converter has been introduced to control the power level of solar panels to ensure efficient power distribution. In addition, batteries work mainly in energy storage, storing excess electricity during periods of strong solar radiation. The charge controller monitors the charge and discharge of the battery, increasing its operating life and reliability. The solar generator is also equipped with a converter that converts the DC output into a constant 230V AC power supply to facilitate integration with the power grid. Electricity is always there. Intelligent controllers manage the coordination and dynamic changes of these components to optimize performance in different environments. Solar energy has the ability to restore reliability as well as renewable energy. The generator is combined with the generator to provide additional power during periods when sunlight is insufficient. The connection mechanism provides a seamless transition between regeneration and backup power, adding a layer of regeneration to the system. With its adaptability, sustainability and ability to solve various energy management problems, this solar solution represents a significant step towards meeting the growing global demand for clean and reliable energy.

II. ANALYSIS OF ELECTRIC VEHICLE

The integration of solar panels, DC-DC converters, batteries, controllers, 230V AC power, power converters, smart controllers, generators, connected products and electric vehicles (EVs) marks the beginning of efficient transportation. Solar panels are placed on the surface of the vehicle, harnessing solar energy and using a DC-DC converter to conveniently charge the battery while the vehicle is stationary or in motion. The battery, controlled by the controller, becomes the main power of the electric car and provides power to the electric motor. Integration of the power adapter ensures compatibility with conventional 230V AC power, allowing for easy charging when a dedicated charging station is available. The intelligent controller optimizes energy management by adjusting the energy conversion of solar panels, batteries and plans according to current driving and energy needs. Also, connecting the system to and from the generator is not sufficient to provide a backup power solution during long journeys or while the sun is charging. This dual-energy system increases the range and flexibility of electric vehicles and reduces dependence on external charging. The coupling mechanism helps improve the overall efficiency and reliability of electric vehicles by seamlessly switching between renewable and backup power sources. The analysis of the integration of solar energy shows the potential for sustainable and diverse energy mobility in accordance with the world's changing environment around the friendly solution.

III. SYSTEM DESCRIPTION

The solar generator has many important features to use solar energy efficiently and effectively. Its main element is the solar panel, which captures sunlight and converts it into direct current (DC) through the photovoltaic effect. A DC-DC converter is used to improve power output and ensure compatibility with the battery and load. This converter controls the voltage level of the solar panel to make power conversion efficient.

The battery acts as energy storage by storing excess electricity from the solar panel during high solar radiation. Integrated controller to control battery power and discharge, preventing overcharge or deep discharge and thus extending battery life. Batteries play an important role in providing stable power during periods when solar energy is low, providing uninterrupted power to connected devices.

• BD

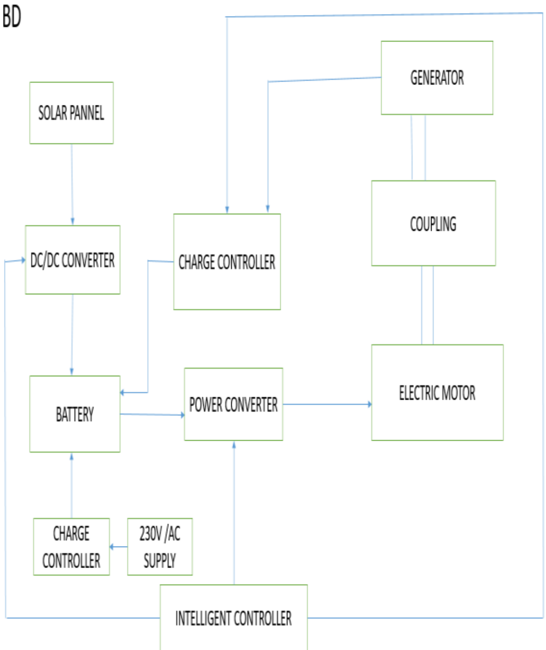

Fig. 1 Proposed block diagram

Where a direct connection to the grid is required, a power converter is added to convert the DC output to 230V alternating current (AC) power. The smart controller manages the coordination of solar panel, battery and power converter to optimize the performance of the system. Additionally, a generator can be integrated into the system in cases where solar energy alone is not sufficient. The generator, together with the generator, can be a backup power to supplement solar energy for insufficient sunlight for a long time. These products are carefully combined under the guidance of intelligent controllers to provide a reliable and stable solar power system that can meet the needs of different energy sources.

IV. EXPERIMENTAL SETUP

In the experimental setup, the solar panel serves as the main power source that converts sunlight into direct current. The DC output is then taken to a DC-DC converter that optimizes the voltage level for efficient power conversion. As an energy storage unit, the battery stores excess electricity from the solar panel through charging regulation. A power converter is included in the system, converting the battery's DC output into 230V alternating current (AC) power, making it compatible with modern devices and the grid.

The intelligent controller controls the entire system and dynamically adjusts according to current conditions to improve energy efficiency. In addition, a back solution was provided by installing the test, generator and generator together. The coupling mechanism provides a seamless transition between continuous power supply and reverse power supply. The experimental setup allows for a comprehensive evaluation of the composite material, allowing researchers to evaluate the effectiveness of the process in a variety of situations. Metrics can be collected on energy production, storage quality, and the impact of changes made by smart controllers. In addition, a backup power source consisting of generators and engines can be tested to test the reliability of the system in cases where the sun is not sufficient. This experimental setup provides a useful platform to examine the feasibility and effectiveness of integrated solar energy systems in practical applications, providing insight into potential advances in renewable energy and recovery solutions in nature.

V.COMPARISON OF ELECTRIC VEHICLE WITH HYBRID

Below is a table comparing the configuration parameters of hybrid electric vehicle: This table gives a brief overview of how hybrid electric cars compare with conventional internal combustion engine cars in terms of non-essentials. It demonstrates the advantages of the hybrid configuration in terms of fuel efficiency, emissions, driving range and overall environmental impact.

Table. 1 Comparison of existing and proposed system

Parameter	Hybrid Sources-Powered EV	Traditional IC Engine Vehicle
Fuel Efficiency	Optimized through power source integration	Dependent on internal combustion engine efficiency and fuel type
Emissions	Reduced due to electric propulsion and regenerative braking	Higher emissions from continuous internal combustion engine operation
Driving Range	Extended through electric propulsion and energy recovery	Limited by fuel tank capacity and conventional engine efficiency
Energy Consumption	Generally lower due to efficient power management	Higher energy consumption in traditional internal combustion engine vehicles
Cost of Operation	May be lower due to improved fuel efficiency and regenerative braking	Higher fuel and maintenance costs for traditional IC engine vehicles
Complexity	Higher due to integration of multiple power sources and electronic control systems	Simpler mechanical setup in traditional IC engine vehicles
Environmental Impact	Reduced overall impact with lower emissions and efficient energy use	Higher environmental impact with conventional IC engine emissions and resource consumption

VI. SIMULATION RESULT

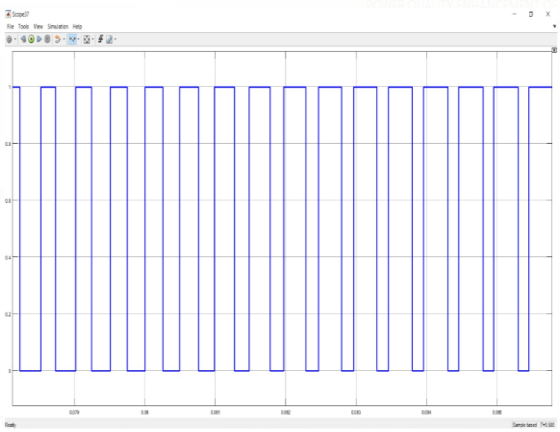
Fig. 2 Time vs boost converter pulse voltage

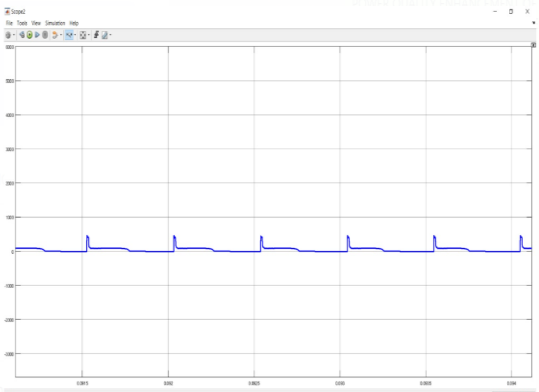
Fig. 3 Time vs PV voltage

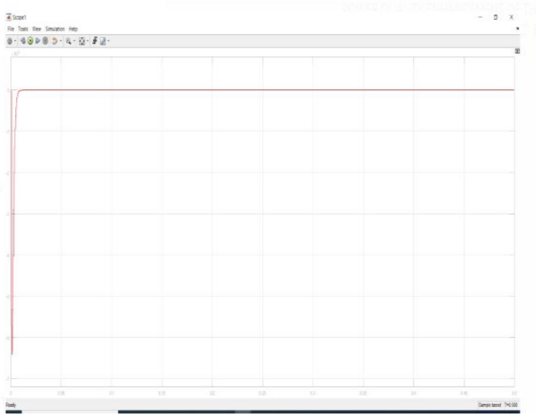
Fig. 4 Time vs boost converter output power

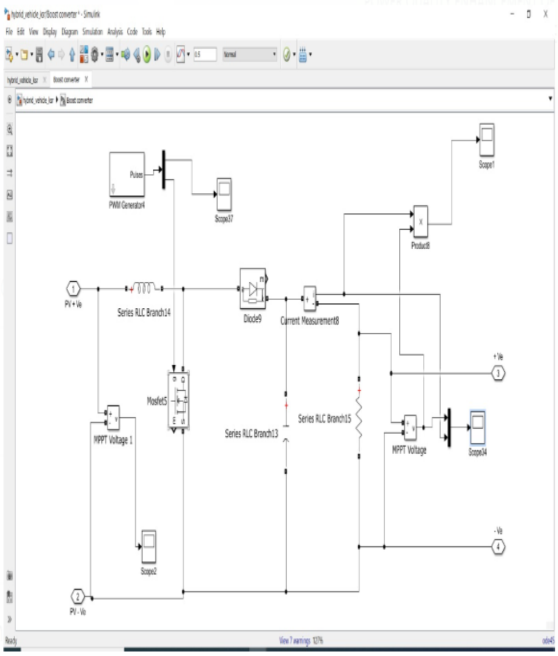
Fig. 5 Boost converter circuit diagram

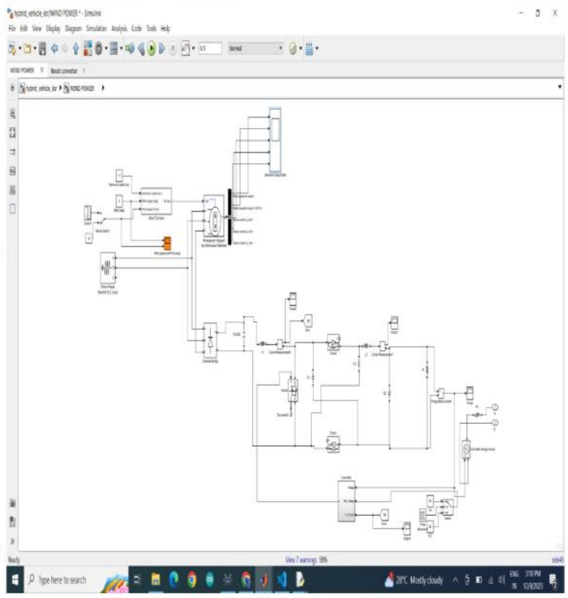
Fig. 6 Simulation of wind system

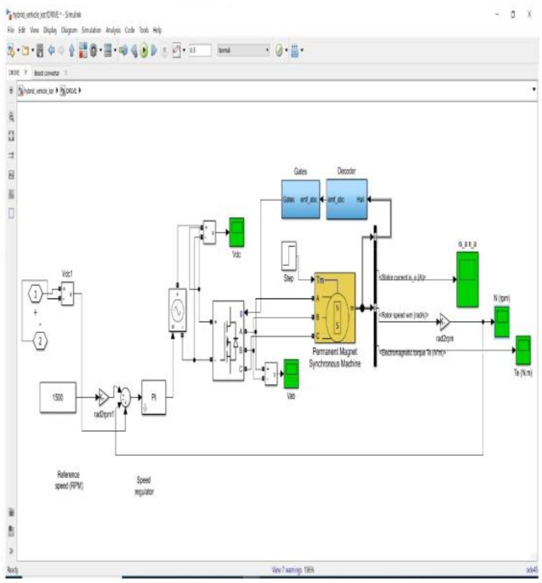

Fig. 7 Motor drive circuit diagram

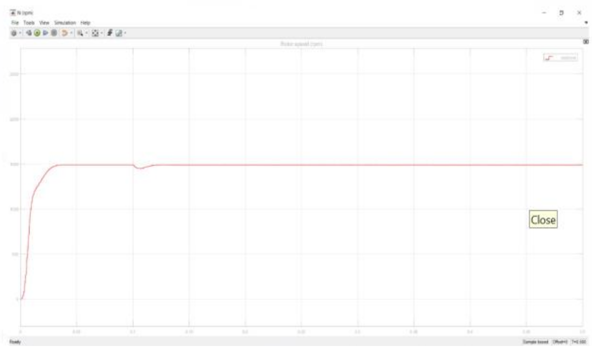

Fig. 8 Time VS rotor speed

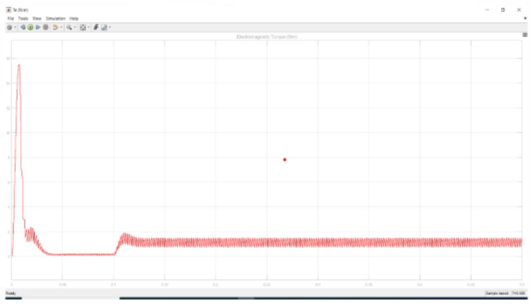

Fig. 9 Time VS electromagnetic torque

These results confirm the ability of hybrid electric vehicles to provide balance and solutions by combining the richness and simplicity of internal electrical systems with the quality of practicality and cleanliness of electric propulsion.

VII. HARDWARE DESCRIPTION

A battery is an energy storage device that converts electricity into electricity, providing portable, reliable power. A DC-DC converter is an electrical device that converts electricity from one level to another by establishing the relationship between different components in a system. Photovoltaic panel is the short name of the photovoltaic panel that produces electricity by converting sunlight into direct current through semiconductor materials. Turbines, often part of wind turbines, use the kinetic energy of moving air to spin and create mechanical energy

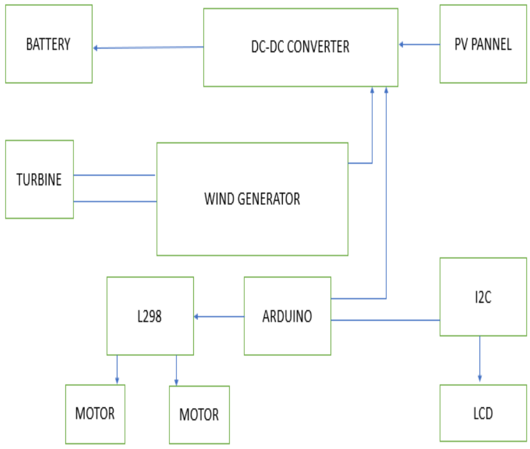

Fig. 10 Hardware block diagram

Wind turbines produce electricity from wind by converting all energy into electrical energy. Arduino is a versatile microcontroller platform that primarily uses sensors and actuators to facilitate programmable control and automation of various electronic devices. I2C (Inter Integrated Circuit) is a communications protocol that allows various devices to communicate over a two-wire serial interface. LCD (liquid crystal display) is a panel often used to display information. L298 is a dual-bridge driver IC that controls the direction and speed of a DC motor, making it an important part of motor control applications. These components come together to create a versatile device that can power, monitor and control a variety of electrical systems.

VIII. HARDWARE CIRCUIT DIAGRAM

In the hardware circuit diagram of renewable energy, a high-capacity battery is placed in the middle of energy storage. DC-DC converters facilitate the efficient distribution of electricity and the relationship between different voltage levels. Photovoltaic (PV) panels and wind turbines are connected together to harness solar and wind energy respectively. Wind turbines are combined with a generator to convert the kinetic energy of the turbine into electricity. The Arduino microcontroller uses the I2C communication protocol to act as a control center and receive data from sensors and controllers.

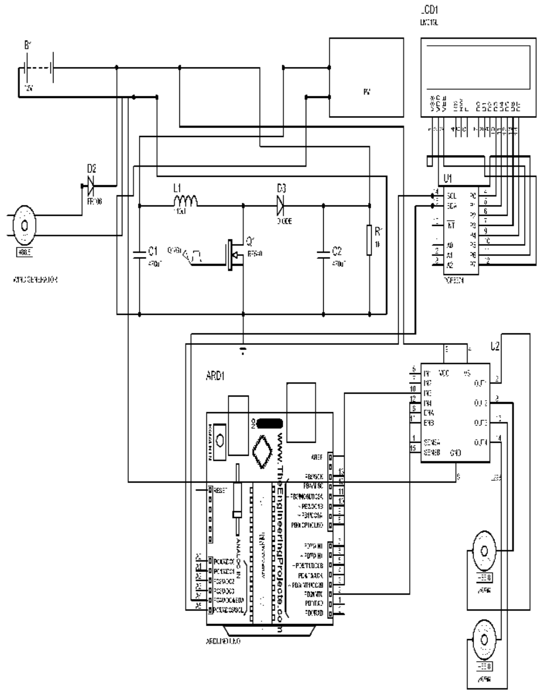

Fig. 11 Hardware circuit diagram

The LCD screen provides instant information on energy production and usage. Additionally, the L298 motor driver facilitates motor control for special applications such as adjusting the position of the solar panel or controlling the rotation speed of the wind turbine. This network of interconnected devices enables the use of renewable energy, stores excess energy in batteries and provides a versatile platform for sustainable energy production and management.

CONCLUSION

In summary, solar power generator is integrated, including solar panels, DC-DC converters, batteries, controllers, 230V AC power, power converter. Solar panels collect solar energy and DC-DC converters optimize voltage levels for improved power conversion. Batteries controlled by regulators to ensure energy storage and discharge. The power adapter makes it easy to connect to the power line and provides 230V AC stable power. The intelligent controller controls the body's operation by adapting to different conditions for optimum energy output. The generator, together with the generator, provides backup energy that ensures reliability during times when sunlight is insufficient. This combination results in a versatile and efficient solar energy solution that makes it energy efficient and flexible in different workplaces.

FUTURE SCOPE

The future of electric vehicles (EVs) is promising with the integration of electronic components leading to significant changes in their configuration. Hybrid systems, which combine battery-electric technology with other energy sources such as hydrogen fuel or internal combustion engines, offer solutions to these limitations. This hybrid approach solves many of the pain points associated with a fully electric vehicle, providing longer and more efficient use. It also provides consumers with a viable alternative to traditional vehicles, leading to widespread acceptance of electric vehicles.

One of the best things about hybrid electric cars is that they can provide better transportation and more. By combining the benefits of various energy technologies, hybrid electric vehicles can increase energy efficiency, reduce greenhouse gas emissions and improve overall environmental safety. The adaptability of hybrid configurations can be seamlessly integrated into existing infrastructure, reducing the need for extensive changes to payment infrastructure. As the auto industry continues to invest in research and development, hybrids need to become a key player in a broader strategy to transition to cleaner, more efficient transportation.

The future of hybrid electric vehicles will continue to be economic, technological and environmental benefits. Multi-energy integration requires advances in energy management and energy management that support innovation and encourage collaboration between vehicle manufacturers and technologies. Advances in smart electronics and the development of better solutions will help create a stronger and more reliable electric vehicle ecosystem. In addition, the hybridization of electric vehicles can have a positive impact on employment creation and economic growth as it creates new opportunities in production, construction and products. The rise of hybrid electric vehicles represents a significant step in cultivating a more urological future, as governments and international companies recognize the importance of leadership.

REFERENCES

[1] S. Amjad, S. Neelakrishnan, and R. Rudramoorthy,‘‘Review of design considerations and technological challenges for successful development and deployment of plug-in hybrid electric vehicles,’’ Renew. Sustain.Energy Rev., vol. 14, no. 3, pp. 1104–1110, Apr. 2010.

[2] J. A. Sanguesa, V. Torres-Sanz, P. Garrido, F. J. Martinez, and J. M. Marquez-Barja, ‘‘A

review on electric vehicles: Technologies and challenges,'' Smart Cities, vol. 4, no. 1, pp. 372–404, Mar. 2021.

[3] D.-D. Tran, M. Vafaeipour, M. El Baghdadi, R. Barrero, J. Van Mierlo, and O. Hegazy, ''Thorough state-of-the-art analysis of electric and hybrid vehicle powertrains: Topologies and integrated energy management strategies,'' Renew. Sustain. Energy Rev., vol. 119, Mar. 2020, Art. no. 109596.

[4] R. Casper and E. Sundin, ''Electrification in the automotive industry: Effects in remanufacturing,'' J. Remanuf., vol. 11, no. 2, pp. 121–136, Jul. 2021.

[5] M. F. M. Sabri, K. A. Danapalasingam, and M. F. Rahmat, ''A review on hybrid electric vehicles architecture and energy management strategies,''Renew. Sustain. Energy Rev., vol. 53, pp. 1433–1442,Jan.2016,doi: 10.1016/j.rser.2015.09.036.

[6] E. Silvas, T. Hofman, N. Murgovski, L. F. P. Etman,and M.Steinbuch,''Review of optimization strategies for system-level design in hybrid electric vehicles,''IEEE Trans.Veh.Technol.,vol.66,no.1,pp. 57–7

[7] P. Zhang, F. Yan, and C. Du, ''A comprehensive analysis of energy management strategies for hybrid electric vehicles based onbibliometrics,'' Renew. Sustain. Energy Re.,vol. 48, pp. 88–104, Aug. 2015.

[8] P. Joonyoung, O. Jonghan, P. Youngkug, and L. Kisang, ''Optimal power distribution strategy for series-parallel hybrid electric vehicles,'' in Proc.1st Int. Forum Strateg. Technol. e-Vehicle Technol. (IFOST), Dec. 2006, pp. 37–42.

[9] S. Onori and L. Tribioli, ''Adaptive pontryagin's minimum principle supervisory controller design for the plug-in hybrid GM Chevrolet volt,''Appl. Energy, vol. 147, pp. 224–234, Jun. 2015.

[10] M. Ehsani, Y. Gao, and J. M. Miller, ''Hybrid electric vehicles: Architecture and motor drives,'' Proc. IEEE, vol. 95, no. 4, pp. 719–728, Apr.2007.

[11] A. Emadi, K. Rajashekara, S. S. Williamson, and S. M. Lukic, ''Topological overview of hybrid electric and fuel cell vehicular power system architectures and configurations,'' IEEE Trans. Veh. Technol., vol. 54, no. 3, pp. 763–770, May 2005.

[12] K. V. Singh, H. O. Bansal, and D. Singh, ''A comprehensive review on hybrid electric vehicles: Architectures and components,'' J. Mod.Transport., vol. 27, pp. 77–107, May 2019.

[13] S. Mahapatra, T. Egel, R. Hassan R. Shenoy, and M. Carone, ''Modelbased design for hybrid electric vehicle systems,'' SAE, Warrendale, PA,USA, Tech. Paper 724, 2008.

[14] S. F. Tie and C. W. Tan, ''A review of energy sources and energy management system in electric vehicles,'' Renew. Sustain. Energy Rev.,vol. 20, pp. 82–102, Apr. 2013.

[15] R. E. Drives and D. Y. Ave, ''Optimization of hybrid energy storage system for electric vehicles,'' Power Electron. Drives,vol.1, no.2, pp.97–111, 2016.

[16] H. He, R. Xiong, H. Guo, and S. Li, ''Comparison study on the battery models used for the energy management of batteries in electric vehicles,''Energy Convers. Manag., vol. 64, pp. 113–121, Dec. 2012.

[17] F. Bashir and F. Bakhsh, ''Energy management strategies in hybrid electric vehicles (HEVs),'' Int. J. Eng. Res. Electr. Electron. Eng., vol. 4, no. 1, pp. 42–45, Jun. 2018.

[18] T. Hofman, R. M. van Druten, A. F. A. Serrarens, and M. Steinbuch,''Rule-based energy management strategies for hybrid vehicles,'' Int. J. Electr. Hybrid Veh., vol. 1, no. 1, pp. 71–94, 2007.

[19] J. Peng, H. He, and R. Xiong, ''Rule based energy management strategy for a series–parallel plug-in hybrid electric bus optimized by dynamic programming,'' Appl. Energy, vol. 185, pp. 1633–1643, Jan. 2017.

[20] M. Ceraolo, A. D. Donato, and G. Franceschi, ''A general approach to energy optimization of hybrid electric vehicles,'' IEEE Trans. Veh. Technol., vol. 57, no. 3, pp. 1433–1441, May 2008.