Review of Energy harvesters to improve charge mileage of Electric Vehicle

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Abstract:

The use of electric vehicles (EVs) is growing rapidly due to their low environmental impact and cost savings. However, their limited range and long charging times are still a major obstacle for widespread adoption. Energy harvesting technologies have the potential to address this issue by converting ambient energy into electrical energy to charge EVs while driving. This review paper discusses Kinetic Energy Recovery System (KERS) in contrast to various energy harvesters such as solar, thermoelectric, piezoelectric, and electromagnetic, and their potential to improve the charge mileage of EVs. Additionally, the advantages and challenges of ongoing technologies are analyzed, and future research directions are explored to improve the efficiency and practicality of energy harvesters for EVs.

Key words: Energy harvesters, Kinetic Energy Recovery System, Micro-generator, Energy regulator.

I. Introduction:

"Energy harvesters" refers to devices that can generate electrical power from sources such as motion, heat, or light. Energy harvesters can be used to improve the charge mileage of an electric vehicle. When driving an electric vehicle (EV), it's important to understand the different modes available and how they can impact the vehicle's performance and battery life. There are several common modes found in EVs, including Eco, Sport, and Regenerative Braking mode.To make an informed decision on which mode to select, it's crucial to analyze the power consumption and performance of each mode. Eco mode is designed to conserve energy and maximize efficiency, while Sport mode provides more power and acceleration. Regenerative Braking mode captures energy during braking and reuses it to extend the vehicle's range.

Observing the changes in driving characteristics is also essential when selecting a mode. Modes can affect the vehicle's speed, acceleration, and other driving characteristics, allowing the driver to choose the mode that best suits their driving needs. Another factor to consider is the impact on battery life. Modes can impact the vehicle's battery life, and it's important to choose a mode that aligns with the driver's range requirements and driving needs.

Finally, it's always a good idea to consult the vehicle manual for specific information on the different modes. The manual can provide details on the purpose of each mode and how it affects the vehicle's performance and battery life. By familiarizing oneself with the different modes, analyzing their power consumption and performance, observing changes in driving characteristics, understanding their impact on battery life, and consulting the vehicle manual, EV drivers can make informed decisions when selecting the mode that best suits their needs.

II. Classification and Characteristics of Energy harvesters

Energy harvesters are devices that can generate electrical power from various sources such as motion, heat, or light. In the context of electric vehicles (EVs), energy harvesters can be used to improve the vehicle's efficiency and extend its range. Some common energy harvesters used in EVs include:

a) Regenerative Braking Systems: Regenerative braking systems capture kinetic energy during braking and convert it into electrical energy. This energy can be stored in the vehicle's battery and used later to power the motor. Regenerative braking systems can improve the overall efficiency of EVs by reducing the amount of energy that is wasted during braking.

Kinetic Energy Recovery System (KERS) is a system that captures and reuses some of the energy that is normally lost during braking in a vehicle. This energy is stored and can later be used to help power the vehicle, reducing the amount of energy that needs to be supplied by the engine. KERS can take different forms, such as flywheel-based, battery-based, or hydraulic systems.

b) Photovoltaic Panels: Photovoltaic panels are used to convert solar energy into electrical energy. These panels can be installed on the roof of an EV or on other parts of the vehicle's body to collect sunlight and generate power. Photovoltaic panels can provide a supplemental source of power for the vehicle's battery, thereby increasing its range.

c) Thermoelectric Generators: Thermoelectric generators convert heat energy into electrical energy. They can be installed in the exhaust system of an EV or in other parts of the vehicle's body to capture waste heat and convert it into power. Thermoelectric generators can improve the overall efficiency of an EV by reducing the amount of waste heat that is generated.

d) Piezoelectric Generators: Piezoelectric generators convert mechanical energy into electrical energy. They can be installed in the suspension system of an EV or in other parts of the vehicle's body to generate power from the vibrations and movements of the vehicle. Piezoelectric generators can improve the overall efficiency of an EV by capturing energy that would otherwise be lost.

e) Wind Turbines: Wind turbines can be installed on the roof or other parts of the vehicle's body to generate power from the wind. While not as commonly used as other energy harvesters, wind turbines can provide a supplemental source of power for the vehicle's battery and increase its range.

In summary, energy harvesters can be used to improve the efficiency and range of EVs by generating electrical power from sources such as motion, heat, light, and wind. Regenerative braking systems, photovoltaic panels, thermoelectric generators, piezoelectric generators, and wind turbines are all examples of energy harvesters that can be used in EVs. By using these devices, EV manufacturers and drivers can reduce the vehicle's environmental impact and increase its overall efficiency.

KERS is a preferred energy harvester due to its efficiency, cost-effectiveness, performance, reliability, and safety. Its ability to recover up to 70% of the energy lost during braking makes it an effective way to improve the overall efficiency of a vehicle and extend its range. Furthermore, its performance benefits and safety features make it a popular choice for sports and performance vehicles.

A. Kinetic Energy Recovery System (KERS)

A Kinetic Energy Recovery System is a technology used in electric vehicles to recover energy that is typically lost during braking. KERS is used in electric vehicles to improve their performance and range. Electric vehicles have a limited range due to the capacity of their batteries. KERS can help to extend the range of electric vehicles by capturing the kinetic energy generated during braking and using it to power the electric motor when needed. This reduces the load on the battery and improves the overall efficiency of the vehicle. KERS is also used to improve the acceleration of electric vehicles. The electric motor can provide instant torque, but it requires a significant amount of energy to accelerate the vehicle from a standstill. KERS can provide the additional energy needed to accelerate the vehicle, thereby improving its performance. KERS is widely used in hybrid electric vehicles (HEVs) and electric vehicles (EVs). In HEVs, KERS is used to capture the kinetic energy generated during braking and use it to power the electric motor when needed. This reduces the load on the internal combustion engine and improves the overall efficiency of the vehicle

The mechanical structure of a KERS system typically includes the following components:
1. Electric Motor/Generator: This component is used to convert the kinetic energy of the vehicle into electrical energy during braking. It is typically located near the wheels and is connected to the braking system.
2. Battery: The electrical energy generated by the electric motor/generator is stored in a battery

Kinetic Energy Recovery System (KERS) is an essential technology for improving the efficiency of electric vehicles. KERS is a hybrid system that utilizes regenerative braking to store the kinetic energy generated during braking and then use this energy to power the electric motor when needed. KERS has been used in Formula One racing since 2009, and now it is widely used in electric vehicles to improve their performance and range.

B. The Mechanics of KERS:

KERS is a mechanical system that utilizes a flywheel, battery, or supercapacitor to store the energy generated during braking. When the driver applies the brakes, the kinetic energy generated by the vehicle's motion is captured by the KERS system and stored in the energy storage device. This stored energy can then be used to power the electric motor when needed, thereby reducing the load on the battery and improving the vehicle's overall efficiency. The KERS system consists of three main components: the energy storage device, the motor-generator unit, and the control system. The energy storage device can be a flywheel, battery, or supercapacitor, depending on the application. The motor-generator unit consists of an electric motor and a generator, which are coupled together. The control system manages the flow of energy between the motor-generator unit and the energy storage device.

The energy storage device is used to store the kinetic energy generated during braking. In a flywheel-based KERS system, the flywheel is connected to the wheels of the vehicle, and when the driver applies the brakes, the flywheel rotates, and the kinetic energy is stored in the flywheel. In a battery-based KERS system, the energy is stored in the battery when the driver applies the brakes, and in a supercapacitor-based KERS system, the energy is stored in the supercapacitor.

The motor-generator unit consists of an electric motor and a generator. The motor can be used to drive the wheels of the vehicle, and the generator can be used to charge the energy storage device. When the driver applies the brakes, the generator is used to convert the kinetic energy into electrical energy, which is then stored in the energy storage device. When the driver accelerates, the motor is used to convert the electrical energy stored in the energy storage device into mechanical energy, which is then used to drive the wheels of the vehicle.

The control system manages the flow of energy between the motor-generator unit and the energy storage device. It determines when to charge the energy storage device and when to discharge it. The control system also ensures that the KERS system operates efficiently and does not overload the battery or the motor-generator unit.

C. Design of micro generator used in KERS

The design of a micro generator used in KERS can vary depending on the specific application and requirements of the system. However, some common design considerations include:

1. Size and weight: The micro generator should be small and lightweight to minimize the impact on the vehicle's overall weight and performance.

2. Efficiency: The generator should be designed to maximize the conversion of kinetic energy into electrical energy, while minimizing losses due to friction, heat, and other factors.

3. Durability: The generator should be able to withstand the vibrations and stresses associated with the vehicle's operation, and have a long lifespan.

4. Power output: The generator should be capable of producing enough electrical power to meet the needs of the KERS system and the vehicle's motor.

5. Integration: The generator should be designed to integrate seamlessly with the other components of the KERS system, including the battery or capacitor and the vehicle's motor.

The micro generator used in KERS typically consists of a rotor and a stator. The rotor is a magnet that rotates around the stator, which is a set of coils that are stationary. As the rotor spins, it generates a magnetic field that induces a current in the coils of the stator, producing electrical energy. The design of the micro generator is critical to its performance. The size and shape of the rotor and stator, as well as the number of coils in the stator, affect the amount of energy that can be generated. The efficiency of the micro generator is also affected by factors such as the strength of the magnetic field, the speed of the rotor, and the resistance of the coils.

In order to maximize the efficiency of the micro generator, it is important to optimize its design for the specific application. The size and shape of the rotor and stator can be adjusted to match the requirements of the KERS system. The number of coils in the stator can be increased to improve the amount of energy that can be generated. Additionally, the materials used in the construction of the micro generator can be selected to maximize its efficiency and durability. Another important aspect of the design of the micro generator is its integration with the KERS system. The micro generator must be designed to work seamlessly with the other components of the system, such as the battery and electric motor. The electrical output of the micro generator must also be carefully regulated to ensure that it is compatible with the voltage and current requirements of the KERS system.

In summary, the design of the micro generator used in KERS is a critical factor in the performance and efficiency of the system. The size and shape of the rotor and stator, the number of coils in the stator, and the materials used in construction all play important roles in maximizing the amount of energy that can be generated. Additionally, the integration of the micro generator with the other components of the KERS system is crucial for ensuring that the system operates efficiently and effectively.

Some common types of micro generators used in KERS systems include electromagnetic generators, piezoelectric generators, and electrostatic generators. Each type of generator has its own advantages and disadvantages, and the specific design of the generator will depend on the needs of the system and the vehicle.

III. Research of Energy regulator Controller

Energy regulator controllers are an essential component of electric vehicles (EVs) as they control the flow of energy between the battery, motor, and other systems. Ongoing research in this area aims to improve the efficiency, performance, and safety of energy regulator controllers in EVs.

One area of research is focused on improving the accuracy and speed of energy regulator controllers. This involves developing new algorithms and control strategies that can more effectively manage the flow of energy between the battery and motor. Researchers are exploring new ways to optimize the controller's response time, which can lead to faster and more precise control of energy flow.

Another area of research is focused on improving the reliability and durability of energy regulator controllers. EVs operate in a range of environments and conditions, and the controllers must be able to operate reliably and safely in all situations. Researchers are developing new materials and designs for the controllers that can withstand extreme temperatures, vibrations, and other stresses.

Efficiency is also a key focus of ongoing research. The energy regulator controller is responsible for managing the flow of energy between the battery and motor, and optimizing this process can improve the efficiency of the entire vehicle. Researchers are exploring new methods for reducing energy losses and improving the efficiency of the controller's components.

Safety is another important area of research in energy regulator controllers. EVs require advanced safety features to protect the vehicle and its occupants. The energy regulator controller must be designed to detect and respond to any potential safety issues, such as overcharging or overheating of the battery. Researchers are developing new safety protocols and algorithms that can identify and address these issues quickly and effectively. Finally, research is ongoing in the area of integrated energy management. This involves developing new systems that can manage energy flow between the vehicle and external sources, such as charging stations or the power grid. Researchers are exploring new ways to optimize the use of renewable energy sources and reduce the dependence on fossil fuels.

In summary, ongoing research in the area of energy regulator controllers for EVs is focused on improving accuracy, reliability, efficiency, safety, and integrated energy management. These efforts are aimed at improving the overall performance and sustainability of electric vehicles, which are becoming increasingly important as we strive to reduce our dependence on fossil fuels and transition to a more sustainable transportation system

A. Algorithms and control strategies used in Energy regulator Controller

Energy regulator controllers are an essential component of electric vehicles (EVs) that control the flow of energy between the battery, motor, and other systems. Ongoing research in this area aims to improve the efficiency, performance, and safety of energy regulator controllers in EVs by developing new algorithms and control strategies.

One of the most important algorithms used in energy regulator controllers is the pulse width modulation (PWM) algorithm. This algorithm is used to regulate the voltage and current flowing from the battery to the motor by controlling the duty cycle of a high-frequency signal. By adjusting the duty cycle, the PWM algorithm can control the amount of power delivered to the motor and ensure that it operates within safe and efficient limits.

Another important algorithm used in energy regulator controllers is the maximum power point tracking (MPPT) algorithm. This algorithm is used to maximize the amount of power that can be extracted from renewable energy sources, such as solar panels or wind turbines. The MPPT algorithm continuously adjusts the voltage and current supplied to the battery to ensure that it is operating at the point of maximum power output.

Researchers are also developing new control strategies that can more effectively manage the flow of energy between the battery, motor, and other systems. One such strategy is the model predictive control (MPC) strategy, which uses a mathematical model of the vehicle to predict its future behavior and optimize the energy flow accordingly. The MPC strategy can take into account a wide range of variables, such as road conditions, traffic patterns, and driver behavior, to make real-time adjustments to the energy flow and improve the vehicle's efficiency.

Another important control strategy is the sliding mode control (SMC) strategy, which uses a sliding surface to guide the energy flow between the battery and motor. The sliding surface is designed to minimize the difference between the desired and actual values of the system, such as the motor speed or battery voltage. The SMC strategy can provide fast and accurate control of the energy flow, making it well-suited for high-performance applications.

Research is also ongoing in the area of adaptive control, which involves developing algorithms and control strategies that can adapt to changing conditions and environments. Adaptive control can be particularly useful in EVs, which operate in a wide range of environments and conditions. By adapting to changes in the environment, such as changes in temperature or road conditions, adaptive control can help to improve the efficiency, performance, and safety of energy regulator controllers in EVs.

In summary, ongoing research in the area of algorithms and control strategies for energy regulator controllers is focused on improving efficiency, performance, and safety by developing new algorithms and control strategies that can more effectively manage the flow of energy between the battery, motor, and other systems. These efforts are aimed at improving the overall performance and sustainability of electric vehicles, which are becoming increasingly important as we strive to reduce our dependence on fossil fuels and transition to a more sustainable transportation system.

B. Sensors and Power Electronic Devices in Control

Sensors and power electronic devices play a critical role in the control of energy regulators in electric vehicles. Ongoing research is focused on improving the performance, efficiency, and reliability of these components. Sensors are used to measure various parameters such as current, voltage, temperature, and speed, which are crucial for the proper functioning of energy regulator controllers. Researchers are working on developing advanced sensor technologies that are more accurate, reliable, and cost-effective. For instance, there is ongoing research on developing sensors that can operate at high temperatures, as well as sensors that can measure multiple parameters simultaneously. Power electronic devices such as transistors, diodes, and capacitors are used to control the flow of electrical energy in the vehicle's powertrain. Ongoing research is focused on improving the efficiency and reliability of these devices. For instance, there is research on developing new materials and manufacturing techniques that can improve the performance and reliability of power electronic devices. Additionally, researchers are investigating the use of advanced cooling technologies such as liquid cooling and phase-change materials to improve the thermal management of power electronic devices.

Another area of ongoing research is the development of new control strategies and algorithms for energy regulator controllers. These control strategies and algorithms are used to optimize the performance of the vehicle's powertrain, improve energy efficiency, and extend the vehicle's range. Researchers are investigating the use of machine learning and artificial intelligence techniques to develop advanced control strategies that can adapt to changing driving conditions and improve the overall performance of the vehicle.

Overall, ongoing research on sensors and power electronic devices in energy regulator controllers is aimed at improving the efficiency, reliability, and performance of electric vehicles. This research is critical for accelerating the adoption of electric vehicles and achieving a sustainable transportation future

C. Controller Development

Embedded firmware controllers are an essential component of energy regulators in electric vehicles, providing the software and control algorithms necessary to optimize energy flow and improve the efficiency of the vehicle's powertrain. Ongoing research is focused on developing advanced embedded firmware controllers that can improve the performance, reliability, and safety of electric vehicles.

One area of ongoing research is the development of advanced control algorithms and optimization strategies for energy regulator controllers. Researchers are working on developing control algorithms that can adapt to changing driving conditions, such as traffic and weather, to optimize energy flow and improve the vehicle's overall performance. Additionally, researchers are investigating the use of optimization techniques such as model predictive control and artificial intelligence to improve the efficiency of energy regulator controllers.

Another area of ongoing research is the development of embedded firmware controllers that can improve the safety and reliability of electric vehicles. Researchers are working on developing embedded firmware controllers that can detect and respond to potential safety hazards, such as overheating or component failure. Additionally, researchers are investigating the use of fault-tolerant design techniques to improve the reliability of embedded firmware controllers and minimize the risk of system failures.

Research is also focused on developing embedded firmware controllers that can support advanced features such as vehicle-to-grid (V2G) integration and battery management. V2G integration allows electric vehicles to provide energy back to the grid during peak demand periods, helping to stabilize the electrical grid and reduce the need for new power generation facilities. Battery management features help to extend the life of the vehicle's battery and improve the vehicle's overall range and performance.

Overall, ongoing research on embedded firmware controllers for energy regulators is critical for advancing the state of the art in electric vehicle technology. These controllers are essential for optimizing energy flow, improving efficiency, and ensuring the safety and reliability of electric vehicles. By developing advanced control algorithms, optimization strategies, and safety features, researchers are helping to accelerate the adoption of electric vehicles and pave the way for a more sustainable transportation future

IV. Powertrain Development

The development of powertrains for electric vehicles (EVs) is an active area of research and development. Powertrain development aims to optimize the performance, efficiency, and range of EVs by improving the design and integration of various components, including the battery, motor, transmission, and power electronics.

One major focus of powertrain research is on battery technology, with efforts being made to improve the energy density, safety, and cost-effectiveness of batteries. Researchers are exploring new materials and designs for batteries, as well as developing advanced battery management systems that can optimize the performance and lifespan of batteries.

Another area of research is the development of electric motors. Research is being conducted on new motor designs that can improve efficiency and reduce weight and cost. For example, researchers are exploring the use of new materials and manufacturing techniques for motor components, such as copper rotors and additive manufacturing.

Efforts are also being made to improve the efficiency of power electronics, which are responsible for controlling the flow of electricity between the battery, motor, and other components. Research is being conducted on new semiconductor materials and designs, as well as advanced control algorithms that can optimize the performance and efficiency of power electronics.

In addition to these components, powertrain development also involves the integration of these components and the development of advanced control strategies and algorithms. Research is being conducted on the design and implementation of control systems that can manage the flow of power between the battery and motor, as well as control the operation of other components such as the transmission and regenerative braking system.

Overall, ongoing research in powertrain development for EVs is aimed at improving the performance, efficiency, and range of these vehicles, and making them more affordable and accessible to consumers. Through continued innovation and development, the powertrains of EVs are expected to become more reliable, efficient, and cost-effective, helping to drive the growth of the EV market in the coming years

V. Technical Innovation and Development Forecast of Energy harvesters with Electric Drive Systems

In the next 10 years, there is expected to be a significant amount of technical innovation and development in the field of energy harvesters with electric drive systems. Some of the key areas of focus for research and development include:

a) High-efficiency energy harvesters: There is a growing demand for energy harvesters that can recover more energy and operate at higher efficiencies. In response, researchers are working on developing new materials and technologies that can improve the efficiency of energy harvesters. For example, there is ongoing research into new piezoelectric materials that can generate electricity from mechanical vibrations with higher efficiency.

b) Integrated energy harvesting systems: Many researchers are exploring the integration of energy harvesters with electric drive systems to create more efficient and sustainable energy solutions. For example, researchers are working on integrating solar panels with electric vehicles to create hybrid energy systems that can power the vehicle and charge the battery simultaneously.

c) Smart energy management systems: To maximize the benefits of energy harvesters, there is a need for smart energy management systems that can optimize the use of harvested energy. Researchers are working on developing algorithms and control systems that can manage the energy flow between the battery, energy harvester, and other components of the electric drive system.

d) Lightweight and compact designs: As electric vehicles become more popular, there is a growing need for lightweight and compact energy harvesters that can be integrated into the vehicle without adding significant weight or bulk. Researchers are working on developing new materials and designs that can reduce the size and weight of energy harvesters while maintaining high levels of efficiency.

e) Enhanced durability and reliability: Energy harvesters need to be durable and reliable to withstand the harsh operating conditions of electric drive systems. Researchers are working on developing new materials and technologies that can improve the durability and reliability of energy harvesters, such as new coatings and protective layers that can prevent damage from moisture, heat, and other environmental factors.

Overall, the next 10 years are expected to bring significant advancements in the field of energy harvesters with electric drive systems. These innovations will help to improve the efficiency, sustainability, and performance of electric vehicles, making them more competitive with traditional gasoline-powered vehicles.

VI. Conclusions

In conclusion, energy harvesters offer an opportunity to improve the efficiency and range of electric vehicles by generating electrical power from various sources such as motion, heat, light, and wind. Regenerative braking systems, photovoltaic panels, thermoelectric generators, piezoelectric generators, and wind turbines are all examples of energy harvesters that can be used in electric vehicles. Among these, Kinetic Energy Recovery System (KERS) stands out as a preferred energy harvester due to its efficiency, cost-effectiveness, performance, reliability, and safety. By capturing the kinetic energy generated during braking, KERS can extend the range of electric vehicles, reduce the load on the battery, and improve their overall efficiency. KERS is widely used in hybrid electric vehicles (HEVs) and electric vehicles (EVs) to improve their performance and range. With the advancement of technology, energy harvesters will play an increasingly significant role in reducing the environmental impact of vehicles and making them more efficient.Also ongoing research in the area of energy regulator controllers for electric vehicles is aimed at improving their efficiency, performance, and safety. This research includes the development of new algorithms, control strategies, sensors, and power electronic devices. Pulse width modulation (PWM) and maximum power point tracking (MPPT) algorithms are essential in regulating the flow of energy between the battery and motor while researchers are exploring new control strategies such as model predictive control (MPC) and sliding mode control (SMC). Sensors play a crucial role in measuring various parameters that are crucial for the proper functioning of energy regulator controllers. The integration of renewable energy sources and the development of safety protocols are also important areas of research in this field. Ultimately, these efforts are aimed at improving the overall performance and sustainability of electric vehicles.

REFERENCES

[1] Jonathan Nadeau, Philippe Micheau, Maxime Boisvert. Collaborative control of a dual electro-hydraulic regenerative brake system for a rear-wheel-drive electric vehicle. Proc IMechE Part D: J Automobile Engineering 1–12_ IMechE 2018.. DOI: 10.1177/0954407018754678

[2] N. Sulaiman, M.A. Hannan, A. Mohamed , P.J. Ker, E.H. Majlan W.R. Wan Daud.. Optimization of energy management system for fuel-cell hybrid electric vehicles: Issues and recommendations. Doi.org/10.1016/j.apenergy.2018.07.087.

[3] Akhil Bhatt, Saurabh Mundle, Suraj Deshmukh, Pranay Shah, Dhanvin Dhonde, Varun Sampat, Akash Singh. KERS-A GREENER APPROACH TO BRAKING. Imperial International Journal of Eco-friendly Technologies Vol. - 1, Issue-2 (2017)

[4] Hoseinali Borhan,Ardalan Vahidi, Anthony M. Phillips, Ming L. Kuang, Ilya V. Kolmanovsky and Stefano Di Cairano, MPC-Based Energy Management of a Power-Split Hybrid Electric Vehicle. IEEE TRANSACTIONS ON CONTROL SYSTEMS TECHNOLOGY.

[5] THOMAS MATHEWS, NISHANTH D. FLYWHEEL BASED KINETIC ENERGY RECOVERY SYSTEMS (KERS) INTEGRATED IN VEHICLES. International Journal of Engineering Science and Technology (IJEST)

[6] Jufeng Yang, Bing Xia ,Wenxin Huang, Yuhong Fu, Chris Mi.. Online state-of-health estimation for lithium-ion batteries using constant voltage charging current analysis. Applied Energy 212 (2018) 1589–16002018 Elsevier Ltd.

[7] D. N. T. How, M A Hannan, M. S. Hossain Lipu, K. S. M. Sahari, P. J. Ker, and K. M. Muttaqi. State-of-Charge Estimation of Li-ion Battery in Electric Vehicles: A Deep Neural Network Approach. DOI 10.1109/TIA.2020.3004294, IEEE Transactions on Industry Applications

[8] M. A. Hannan, M. M. Hoque, Aini Hussain, Yushaizad Yusof3, P. J. Ker . State-of-the-Art and Energy Management System of Lithium-Ion Batteries in Electric Vehicle Applications: Issues and Recommendations. DOI 10.1109/ACCESS.2018.2817655, IEEE Access

[9] Raziq Yaqub , Sadiq Ahmad , Hassan Ali , Azzam ul Asar, AI and Blockchain Integrated Billing Architecture for Charging the Roaming Electric Vehicles. IoT 2020, 1, 382–397; doi:10.3390/iot1020022 . mdpi.com/journal/iot

[10] Simon Howroyd , Rob Thring. An electric vehicle model and validation using a Nissan Leaf: A Python-based object-orientedprogramming approach. Advances in Mechanical Engineering 2018, Vol. 10(7) 1–7

[11] Jiweon Ko, Sungyeon Ko, Hanho Son, Byoungsoo Yoo, Jaeseung Cheon, and Hyunsoo Kim. Development of Brake System and Regenerative Braking Co-operative Control Algorithm for Automatic Transmission-based Hybrid Electric Vehicle. DOI 10.1109/TVT.2014.2325056, IEEE Transactions on Vehicular Technology

[12] Mostafa Shibl, Loay Ismail , Ahmed Massoud. Machine Learning-Based Management of Electric Vehicles Charging: Towards Highly-Dispersed Fast Chargers. Energies 2020, 13, 5429; doi:10.3390/en13205429.

[13] Craig K. D. Harold, Suraj Prakash , Theo Hofman. Powertrain Control for Hybrid-Electric Vehicles Using Supervised Machine Learning. Vehicles 2020, 2, 15; doi:10.3390/vehicles2020015

[14] Brahim Gasbaoui and Abdelfatah Nasri. The Uses of Artificial Intelligence for Electric Vehicle Control Applications. Bechar University, Faculty of Sciences and Technology, Department of Electrical Engineering, Algeria

[15] Xue Lin;Paul Bogdan;Naehyuck Chang;Massoud Pedram. Machine Learning-Based Energy Management in a Hybrid Electric Vehicle to Minimize Total Operating Cost. 2015 IEEE/ACM International Conference on Computer-Aided Design (ICCAD)