ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25feb754

Electrical Vehicle Analizing Using Matlab

P. Sureshkumar[1]; N S Vijaykumar[2]; G Anandbabu[3]

[1]AP/Mechanical Engineering JCT College of Engineering and Technology Coimbatore.
[2]AP/Mechanical Engineering, Sri Sai Ranganatharn Engineering College, Coimbatore.
[3]AP/Electrical and Electronics Engineering, Sri Sai Ranganatharn Engineering College, Coimbatore.

Publication Date: 2025/03/21

Abstract: Because the globe's oil reserves are running out and because driving contributes to air pollution, many academics are exploring for alternative energy sources to power cars. One strategy is to employ an electric vehicle, sometimes referred to as an auto - ignition motor substitute. This study's initial step involves simulating the flow of power in the power system for electric cars in order to ascertain its characteristics. Power flow effectiveness is crucial since electric cars are so dependent on the battery's finite supply of electrical energy. This calls for careful handling. In order to verify that the amount of electrical energy consumed is acceptable, this research will evaluate power flow calculations. To provide the most effective electrical reactivity to the electric car energy system, a tiny electric vehicle model is created using the MATLAB/Simulink programme.

How to Cite: P. Sureshkumar; N S Vijaykumar; G Anandbabu (2025). Electrical Vehicle Analizing Using Matlab 2004. *International Journal of Innovative Science and Research Technology*, 10(2), 2370-2374.
https://doi.org/10.38124/ijisrt/25feb754

I. INTRODUCTION

High levels of population movement are the indications of development success. Services that increased mobility needed a way to get about. A car is one of the modes of transportation utilised in towns and cities. The majority of the time in Indonesia, oil is utilised to fuel the vehicle. The increase in gasoline-powered vehicles is a result of the time's low global oil prices as well as an excessive supply of fuel [3]. Fuel use for transportation is rising more quickly. Transportation accounts for more than half of all energy usage worldwide. Figure 1 shows the stark discrepancies between global oil output and gasoline demand beyond 2020 [8]. Fuel supplies are getting limited due to increased fuel oil usage for vehicles [8], [11]. Moreover, using fuel oil in automobiles results in exhaust fumes that may contaminate the environment. Vehicle exhaust contains 25% CO2, 18% solid particles, 27% volatile mixture (including 28% Pb, 32% NO, and 62% CO), and 25% CO2 [2]. The noise level is a further drawback of this kind of vehicle. Human health [5] and the environment [1] are two additional effects of air pollution. One solution to these issues is to switch from using fuel oil to using electricity to power vehicles. Electric vehicles are being created as a human attempt to lessen environmental pollution and reliance on fossil fuels [3, [6], [12]. The electric motor, which serves as the vehicle's drive system, electricity generation sources, control systems, which serve as the vehicle's centralized control, and power converters, which convert electrical energy sources to meet the variable necessities of the electric drive by switching devices, are its main constituents. As for electric cars, its primary energy source is often a battery [2], [3], [6]. Nevertheless, the batteries in electric cars have a flaw that limits their capacity and service life, making it difficult to make the required preparations for charging the batteries. To get the energy required by an electric car, a real power model of the vehicle's energy system. The battery's capacity has also been determined by tests [10] using the battery in operational state. Moreover, research has been done to produce hybrid electric vehicles that use both a flywheel and battery for power [7]. If the vehicle is in the acceleration phase, flywheel energy is employed as an alternative. The battery is used to store the energy that is not used for regenerative braking through the flywheel. A dynamic model of an entire electric car, including the traction motors, batteries, controllers, inverters, and braking, has also been built [9]. The model was created using Matlab and Simulink (Mathworks). Statistical techniques were also used to construct the MATLAB/Simulink prediction model for electrical energy in electric vehicles [4].

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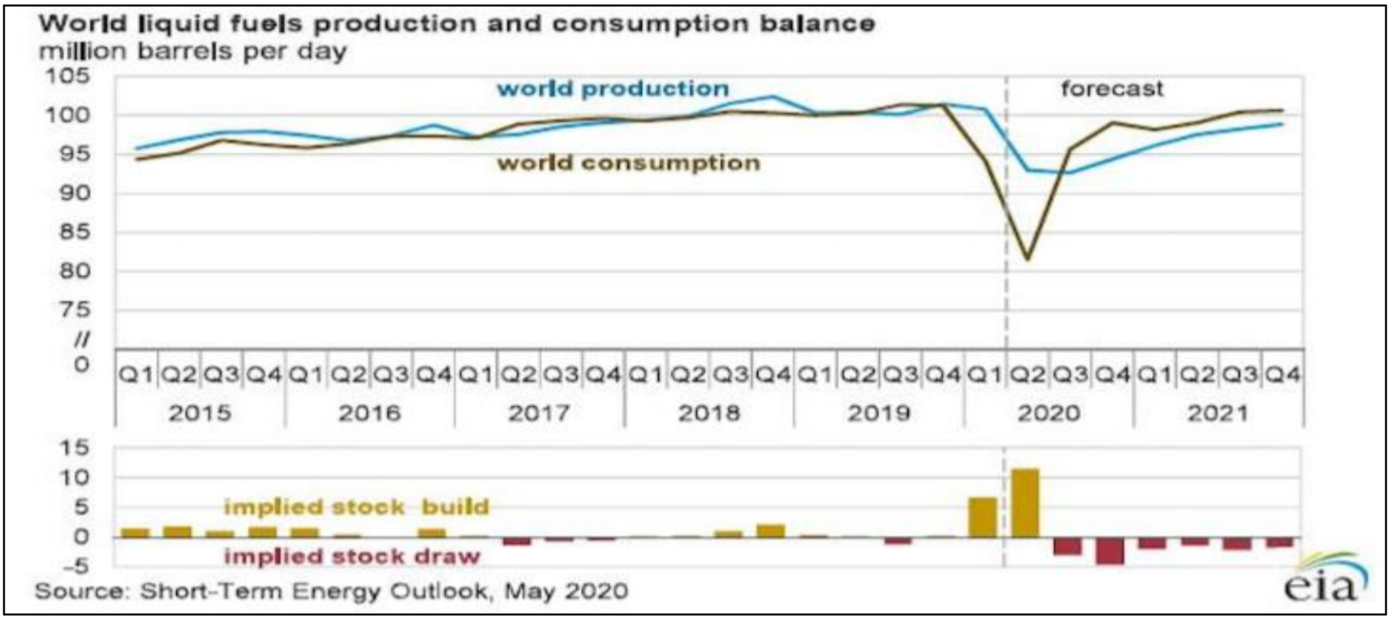

Fig 1 Stark Discrepancies Between Global Oil Output and Gasoline Demand Beyond 2020

II. METHODOLOGY

High voltage, motor voltage, temperature, and other variables are all simulated, from which we derive simulated outputs. Without having to carry a laptop around with the real programme results, these metrics are constantly monitored on a display that may be mounted in an EV.

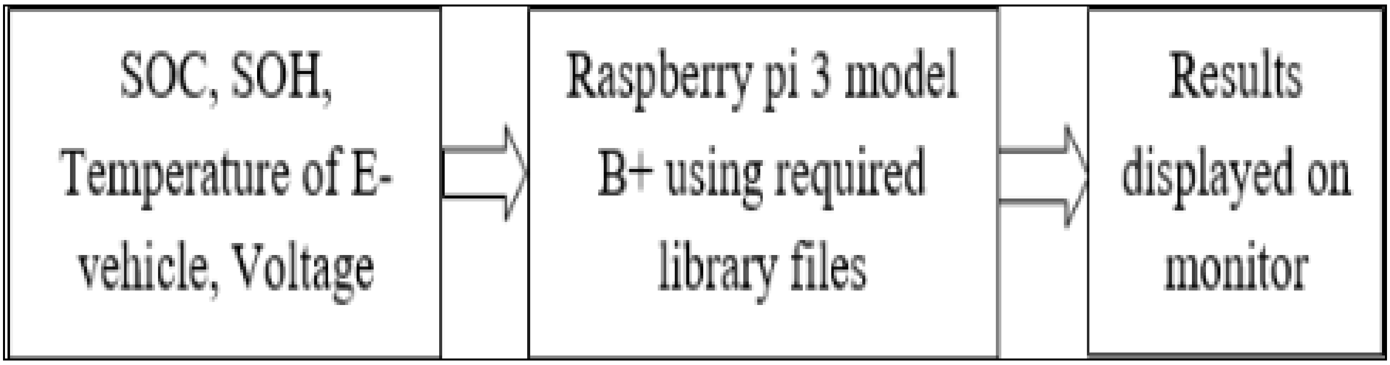

Fig 2 Display Monitor

Simulink software was used in this project to create a model that was tailored to our needs and produced outcomes like SOC and SOH. Once the necessary library files have been installed in Simulink software, these results are subsequently transmitted to a board, in this case, a pi 3 model B. The user is always able to see these outcomes on a display.

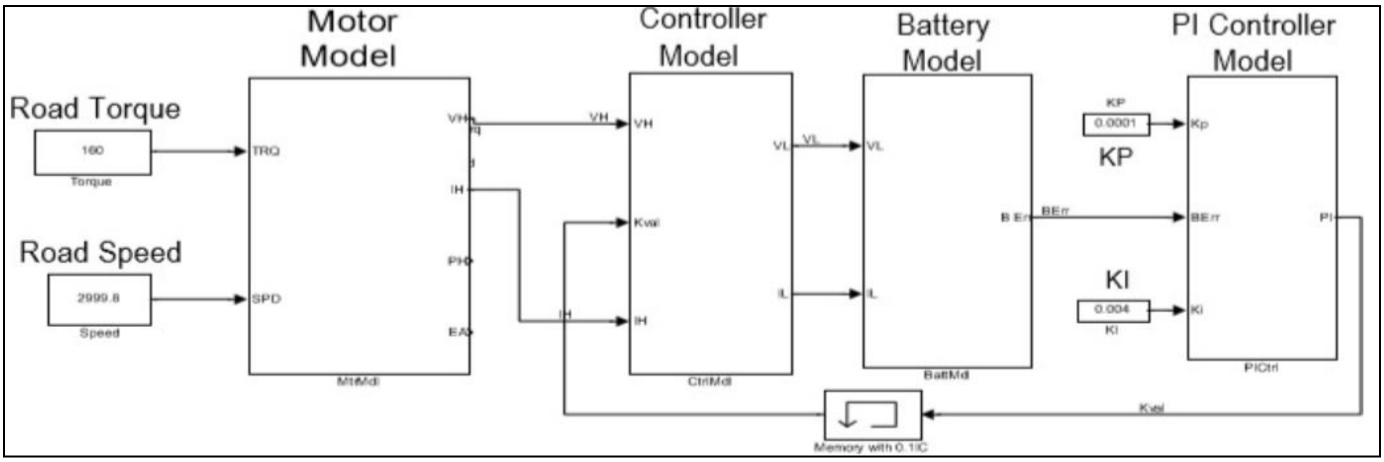

Fig 3 Soh in Matlab

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The aforementioned simulation model simulates a fundamental electrical vehicles motor-drive system and is employed to study power flow both during driving and regeneration. The electric vehicle battery, an ideal motor controller coupled with a proportional-integral controller, and a DC permanent magnet motor are all taken into account in the simulation. For certain speed and torque load circumstances, the model may be used to assess the energy flow and efficiency of the electric drive. Certain essential system parameters were predetermined, while others were idealised in models. The creation and validation of a reliable MATLAB/Simulink model. The system's performance and energy flow were then calculated under a specific set of driving and regeneration speed/torque parameters.

III. RESULT

When both speed and torque have positive values, the DC motor's generated torque is pointed in the direction of rotation. Driving like this is commonplace. Yet, when the motor's torque opposes its speed, the motor is pushed and acts as a generator.

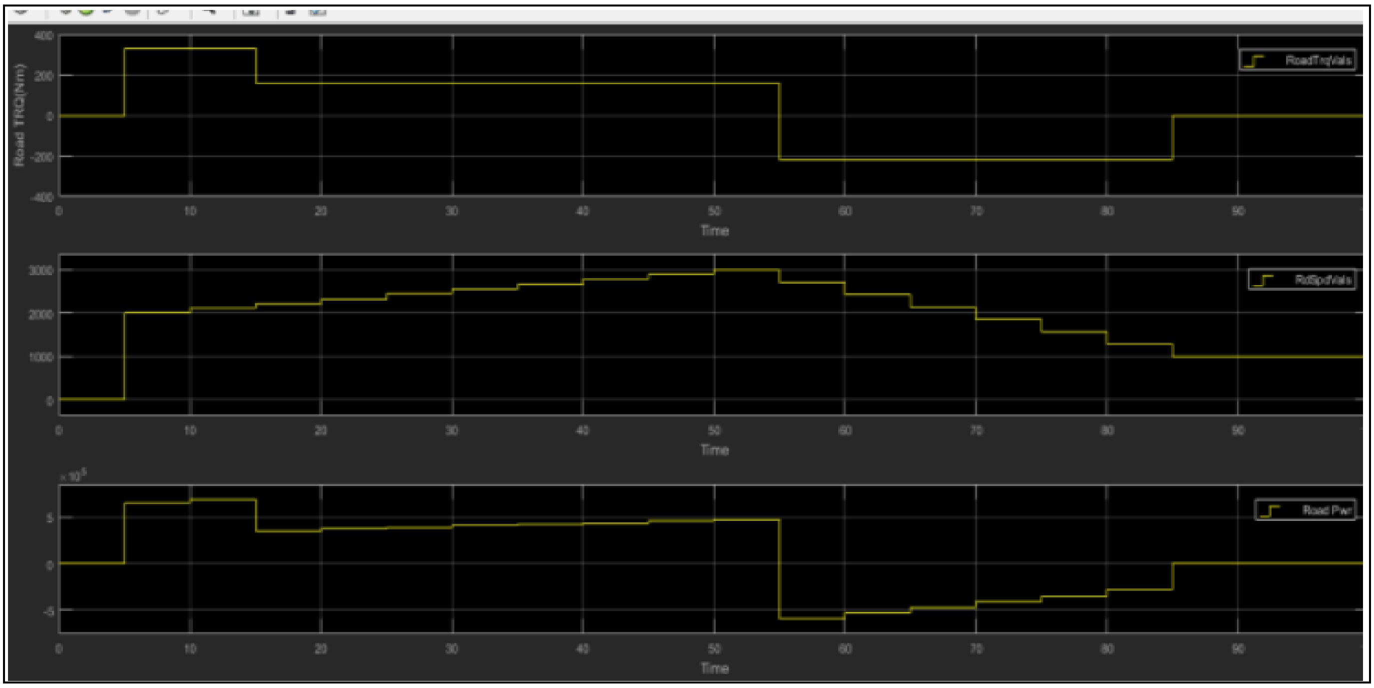

Fig 4 Motor Torque

When the rpm and torque have the same polarity, the motor is working in the driving mode, sometimes referred to in the first quadrant, which indicates power is being delivered from the ev motor to the load. When the torque is minus and the speed is favourable, the motor is being pushed by an external mechanical force. In doing so, the battery receives energy back.

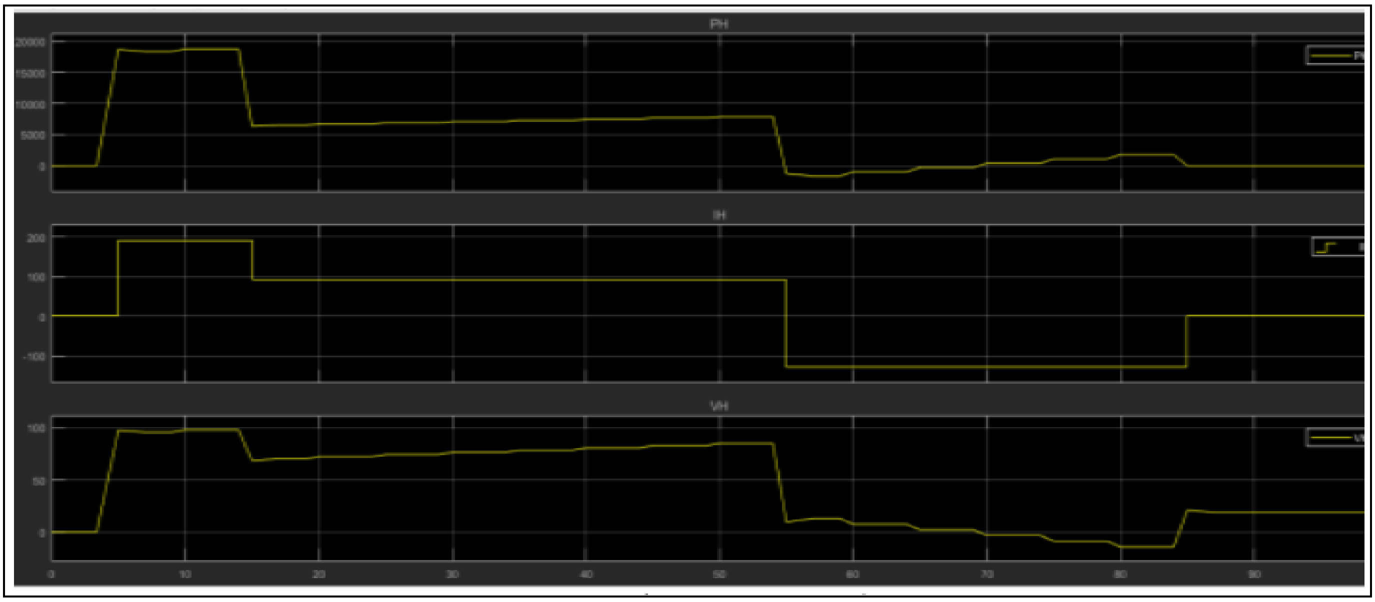

Fig 5 Motor Volt, Current, and Power

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Motor Volt, Current, and Power. The motor uses the battery to generate power. The voltage and speed curves and the torque and current curves may both be seen to typically follow one another in Figures 5 and 6. The formulae for voltage and torque are reflected in this basic connection. On the Motor Power figure in Figure 6, combined motoring and regeneration are shown. Positive numbers for current and voltage indicate that the DC motor is supplying power to the loads and generating torque in the rotational direction. Driving like this is commonplace. The motor is pushed, however, and working as a generator when the polarization of the motor voltage and current are the opposite, with current that passes back into the battery.

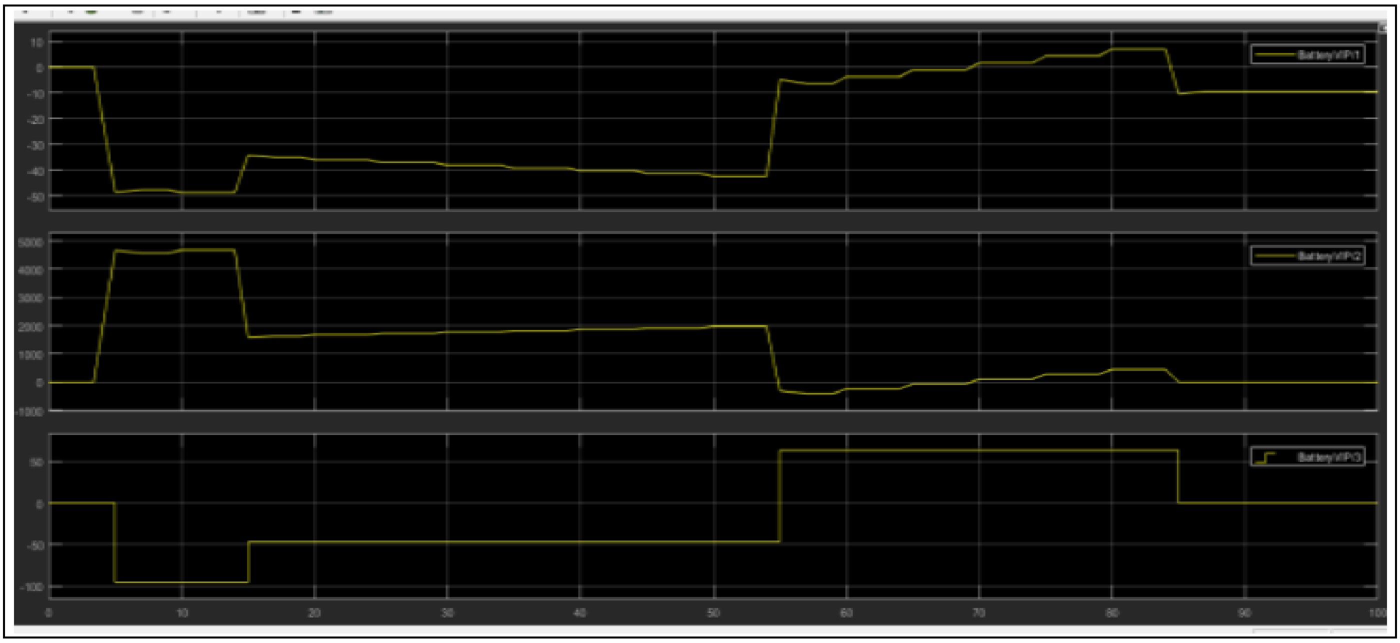

Fig 6 Motor Power

Fig. 7's depiction of the battery's voltage, current, and power shows how the motor obtains its power from the battery. Because torque is proportional to current, it is possible to see that the battery current, motor current, and current curves in Figures 5, 6, and 7 typically follow one another. As a result, the motor has to draw more battery current as the required torque grows.

Figure 7's battery power diagram demonstrates both motoring and regeneration. When both current and voltage have positive values, the DC motor is transferring power to the load and producing torque in the direction of rotation. This is standard driving behaviour. The motor is pushed and operating as a generator, though, with current flowing back into the battery when the polarity of the motor current and the voltage are the opposite.

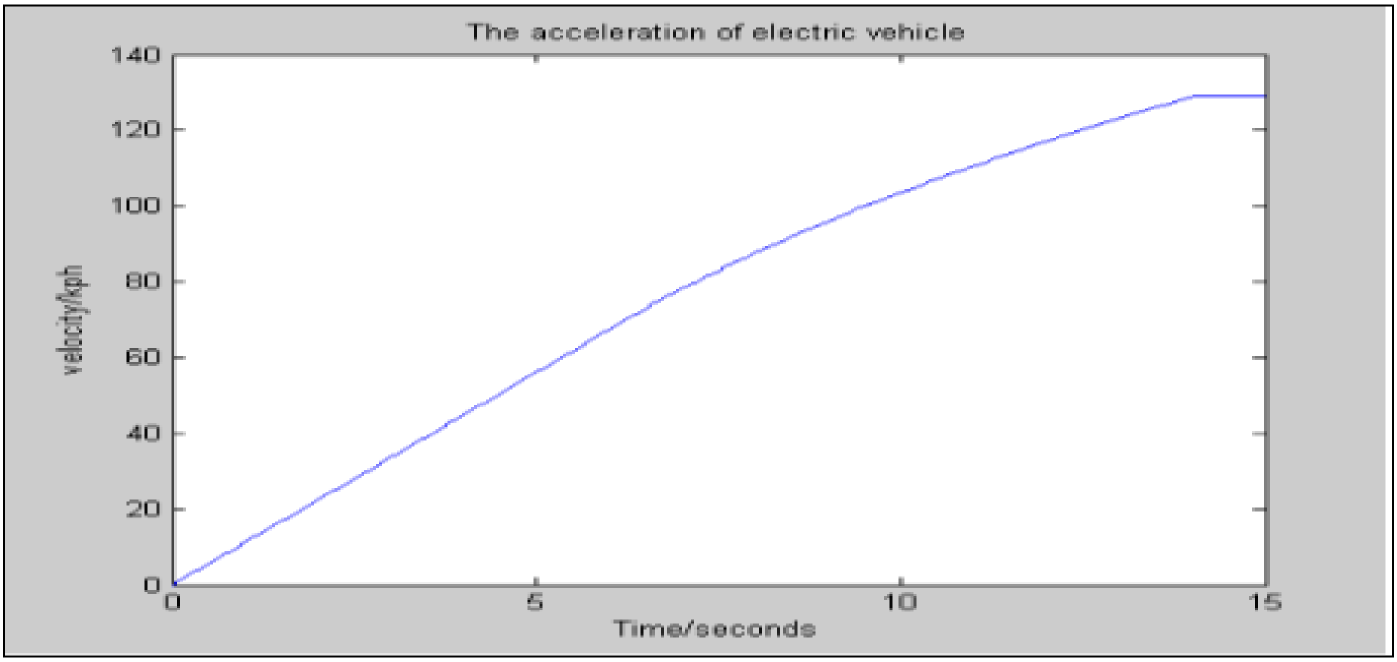

Fig 7 Depiction of the Battery's Voltage

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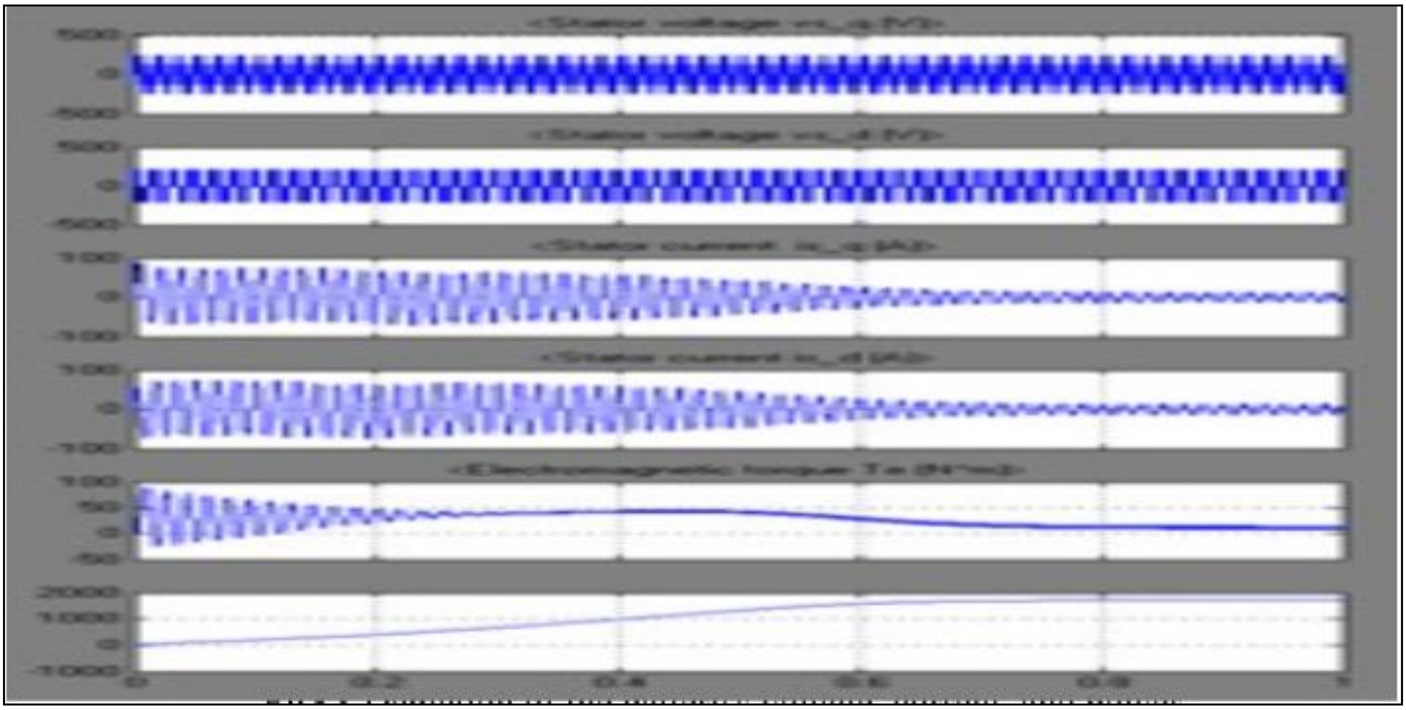

FIG 8 Depiction of The Battery's Voltage, Current, And Power

IV. CONCLUSION

The development of electric vehicles requires simulation, which must be included into engineering education's learning experiences. A critical component of modern engineering development is simulation-based testing, specifically Hardware-In-The-Loop testing. This is especially true for complex embedded system subsystem-dependent sophisticated systems like hybrid and electric vehicle drive systems. This project aims to create a virtual model of an electric car to evaluate and analyse various metrics, including SOC, SOH, battery temperature, etc. The primary goal of this project was to use a time and money-effective strategy. By experimenting with different Simulink parameters, the performance of EV was modified to meet the user's needs. Moreover, all of these outcomes allowed.

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