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Simulation and Modelling of Electric Vehicle

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Abstract: *Today, electric vehicles are increased among all over the world. Transportation vehicles are playing a major role in many applications. Mostly all type of vehicles using energy sources such as oil and gas. This is an ecological and urban means of transport and it's source of energy is battery. Electric vehicles began to play an more important role Since 2000's. It is economic and simple means of transport and eco friendly. Over the past few years the electric vehicles have remained a frequent subject of the research community. In this article, we developed an EV setup using a DC motor. The model developed contains battery power, DC motor, H-Bridge controller, Wheel configuration (front and rear), PWM controller and vehicle body model developed on Simulink from Matlab. Through Simulink, the designed electric vehicle is simulated and various factors like State of Charge, Current and Voltage were calculated by providing driving cycle. The various factors were analysed for improving the model.*

Keywords: State of Charge of Battery, DC Motor, H-Bridge controller

I. INTRODUCTION

In the current situation, the energizes request is high, and their utilization increments. Because of the purposes of these energizes in the vehicles Co2 gas dispersed in the enormous sum.[1] The carbon dioxide gas impact the climate shifts seriously. The Co2 decrease is the principal challenge, and it very well may be accomplished by the Eco-accommodating vehicle or vehicle called Electric vehicle (EV). Because of the rising expense of the powers in the current days, the energy component vehicle isn't efficient. The EVs are exceptionally prudent because of their determined cycle accomplished by an electric engine.[2] They don't dirty the climate. The expense of the batteries and engines are steady, so EV likes than the fuel based vehicles. The Electric Vehicle created by the engine, battery, regulator, converters, and wheels. The engine associated with the differential of the wheels. Figure 1 shows the block chart of the electric vehicle development.

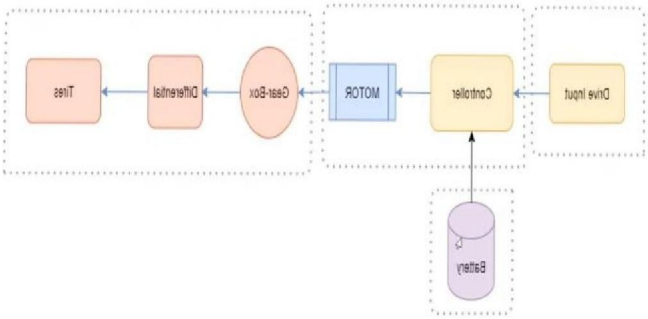

Figure 1: Electric Vehicle Block Chart

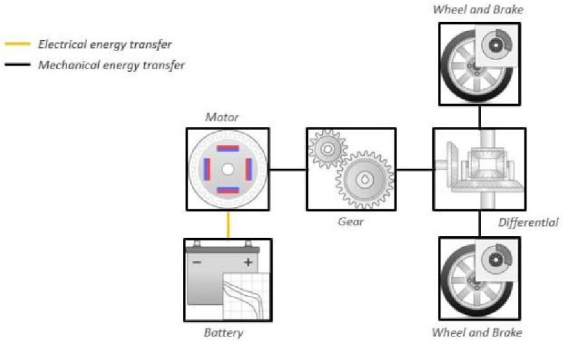

Figure 2 EV Schematic Arrangement

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Figure 1 shows the schematic arrangement of the Electric vehicle drive configuration. In this configuration, a battery pack is used to provide the dc energy to the circuit

In this fundamental design of EV, the two wheels are utilized. One wheel is associated in the front part called front wheel drive. Another wheel associated at the back part of the drive, so it is called genuine wheel drive. Rear wheel is associated through the differential. The differential is given the adjusting to the back and front wheel drive framework.[3] The differential piece addresses a stuff instrument that permits the determined shaft to turn at various velocities. The loyalty of the stuff model improved by indicating the boundaries of the differential stuff framework like stuff dormancy, coinciding, and thick misfortunes. A battery pack is utilized as the wellspring of the electric vehicle model. A lithium ion battery fixed in the displaying of Electric Vehicle (EV) which gives input supply to the Motor associated in the middle of the cycle.

The DC Motor is utilized for the determined part of the electric vehicle because of their few benefits as concentrated before. On the back tire, a DC motor is associated because of high effectiveness and high beginning force necessity. An DC motor has the two attributes productively.[4] The high beginning force request is finished by the enlistment engine which helps the electric vehicle in the underlying stage. At the Rear wheel segment, the DC Motor is associated because of their powerful thickness and consistent speed qualities. The control activity performed by the H-Bridge controller

II. SIMULINK MODEL

2.1. Modeling of Electrical Vehicle (EV)

We fostered a two-wheel drive model of an electric vehicle. One wheel place at the front part and the other one set at the back segment. Both genuine and front wheel are constrained by an DC Motor. The vehicle body put on the two wheels of the drive with beginning boundaries of conditions like breeze, slanted and choke. Prior to playing out the demonstrating of the Two-wheel electric vehicle drive , we settle the boundaries and conduct of the vehicle body. On the Back wheel side, the Motor is mounted by the side and battery settled in the centre Rod.[5]

III. RESULTS

Figure 1 shows the proposed EV prototype structure. It consists of an independently controlled rear-wheel drive system that improves driving performance in EVs, maintains expected torque and speed conditions, and is validated in the Matlab / Simulink environment. As mentioned earlier, low speed permanent magnet DC (PMDC) motors are used in Rear-wheel drive systems to increase maneuverability in heavy traffic and the need for efficiently generated torque.[6] The rotor of these motor is directly coupled to the respective differential gear, and with the help of these gear, the generated motor drive torque is transmitted to their respective wheel side. In addition, the wheel drive system is controlled using individual controllers and PWM inverters.[7]

3.1 Simulation

To describe the behavior, speed and torque characteristics of the proposed EV wheel drive system, simulations are carried out using the model built in Matlab/Simulink which is shown in figure 3. [8]

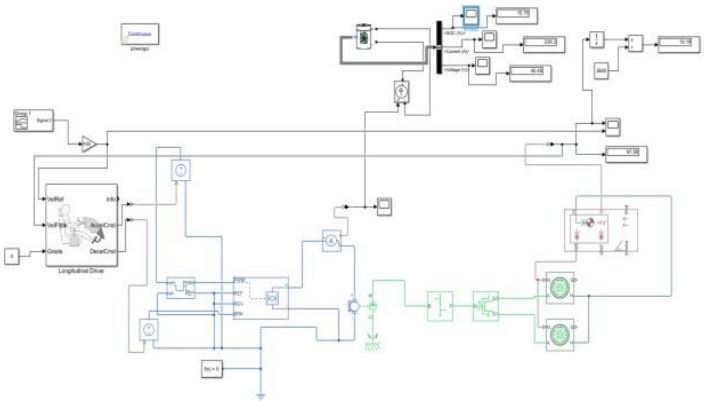

Figure 3: Simulation Model Of EV

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3.2 Signal Builder

First, with the aid of the signal builder block, the reference speed is created. Top speed is selected of 100 kilometers per hour. The model simulated for 1,000 seconds. The speed increases for the first 400 seconds.[9] The speed remains constant for the next 200 seconds, and the speed decreases for the remaining 400 seconds. The below Image will display the reference signal that generated with the signal builder block's aid.

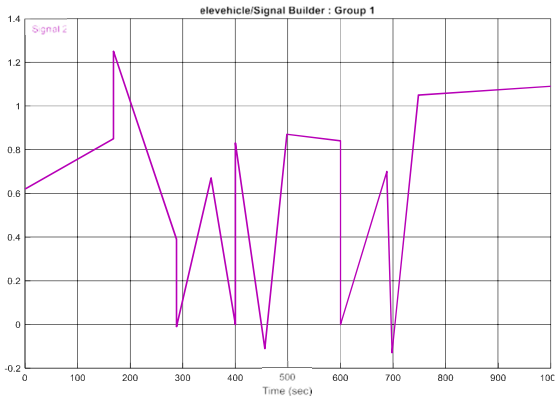

Figure 4: Signal Builder Graph

3.3 State Of Charge

Suppose we look at the graph of the SOC percentage. In that case, the battery will be discharged non-linearly for the first 400 seconds, discharged linearly for the next 200 seconds. For the remaining 400 seconds, the battery will be charged and discharged according to feedback.[10]

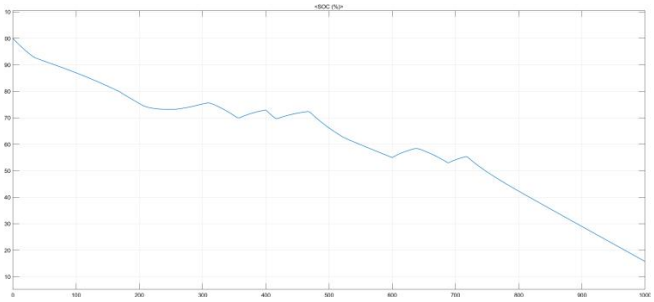

Figure 5: State Of Charge of Battery Graph

3.4 Voltage

Voltage drops and increases according to the Input. The input reference is given through the motor by the longitudinal driver. The signal builder give the reference input to the EV which varies the voltage continuously. Here Voltage decreases from the high and getting Stable at one point and started Waving.

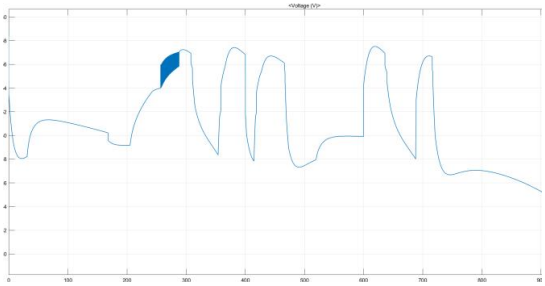

Figure 6: Voltage Graph of Battery

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3.5 Current

Current also drops and increases according to the Input. The input reference is given through the motor by the longitudinal driver. The signal builder give the reference input to the EV which varies the voltage continuously. Here Current decreases from the high and getting Stable at one point and started Waving.

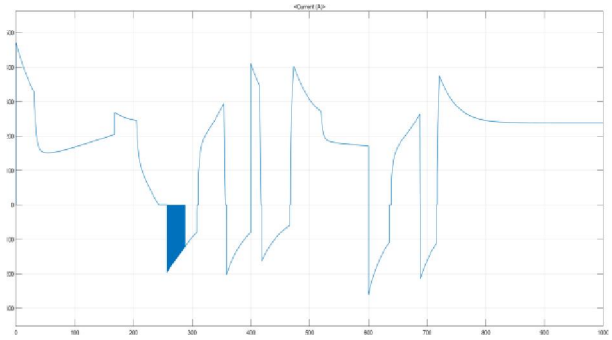

Figure 7: Current Graph of Battery

3.6 Input / Output Velocity

Input and Output Voltage Varies Proportionally. Here Input is varying speed by the Throttle. The output acts according to the input given by driver. Here in the graph the input and output gives almost same Values.

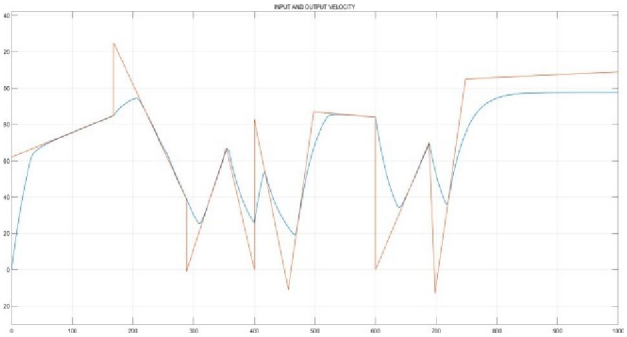

Figure 8: Input / Output Velocity Graph of EV

IV. CONCLUSION

Proposed EV wheel drive framework which is having individual front and back control, further develops the EV execution like force and speed solidness, drivability, and wellbeing at low speed and fast activities.[11] Likewise, the wheel drive frameworks were established so that above expressed EV execution prerequisites achieved all the more effectively. The drive framework is effectively synchronized. Afterward on the presentation of drive regulators are additionally expanded by the assistance of execution improvement review.[12]

The recreation results additionally show the viability of utilized advancement over H-Bridge regulator. Improved EV framework model accomplishes stable speed and force in beginning and ordinary running mode activities rapidly. Additionally, the outcomes with signal manufacturer advancement are extremely exact as contrast with un-streamlined controls. Subsequently the execution of sign developer in EV wheel drive control framework is viewed as effective.[13]

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