Matlab/Simulink of EV Range on the Basis of Available Charging Percentage of Battery

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***Abstract*— Transportation is essential to modern living, yet the traditional combustion engine is slowly becoming obsolete. Fully electric vehicles are fast displacing petrol and diesel-powered automobiles because they are so much cleaner. Fully electric vehicles (EVs) have zero exhaust emissions, making them much better for the environment. The battery's capacity, or the quantity of electricity it can store, determines an electric vehicle's range in the first place. stated in kwh (kilowatt hours). It determines the energy reserves available to the motor and other components of the vehicle, comparable to the size of the fuel tank in combustion-powered cars. The remaining range of the electric car is consequently determined by the amount of energy in the battery at any particular time. This project aims to calculate the EV range based on battery charging. The MATLAB simulation is the foundation of this project. The users of this project can use it to solve battery charging-related problems and prevent subsequent charging-related inconveniences. When the vehicle's battery needs to be charged, we can keep the speed constant to cover the necessary distance.**

Keywords*— Power Train Control Module (PCM), Motor Torque Arbitration, Power Management, Regenerative Braking Control (RBC), Electric vehicles (EV), MATLAB*/ Simulink.

I. INTRODUCTION

Electric vehicles extremely low to zero carbon emissions, limited noise, great efficiency, and flexibility in grid operation and integration make them a useful technology for creating a sustainable transportation industry in the future. This paper gives a brief review of EV technology, together with associated energy storage systems and charging infrastructure. There is a showcase of the many electric vehicle models. Examples include battery electric vehicles, fuel cell electric vehicles, hybrid electric vehicles, and plug-in hybrid electric vehicles. The topology and supporting technology for each category are discussed.

Numerous charger converter topologies, novel battery technologies, and power train configurations are all introduced. In addition to accelerating the switch to sustainable energy, electrifying transportation also addresses the challenges of energy security and fuel mix diversity in the transportation sector. This can also be seen as a practical approach to dealing with issues brought on by climate change. Additionally, charging protocols, standards, and proportional grid impacts from charging cars are discussed.

An EV is a vehicle that creates power by igniting fuel and gases rather than an internal combustion (IC) engine, which operates on electricity. In order to solve issues such increasing pollution, global warming, the depletion of natural resources, etc., this sort of vehicle is therefore thought to be a viable replacement for the current generation of automobiles. Electric cars have been around for a while, but recently they've gained a lot of attention because of the expanding carbon footprint and other environmental implications of fuel-powered cars.

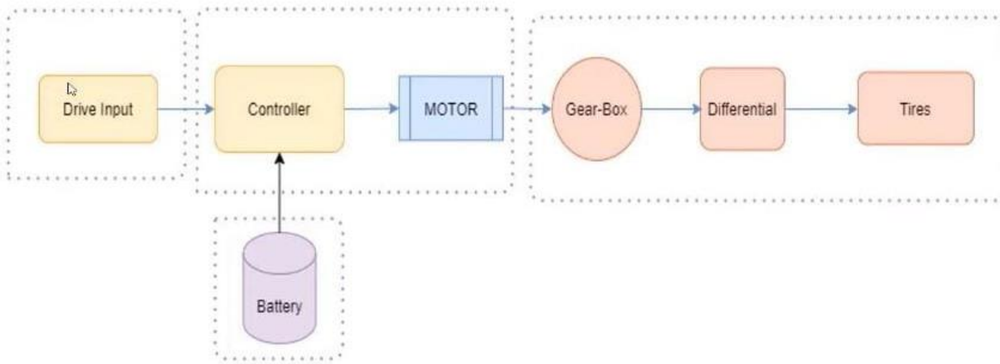
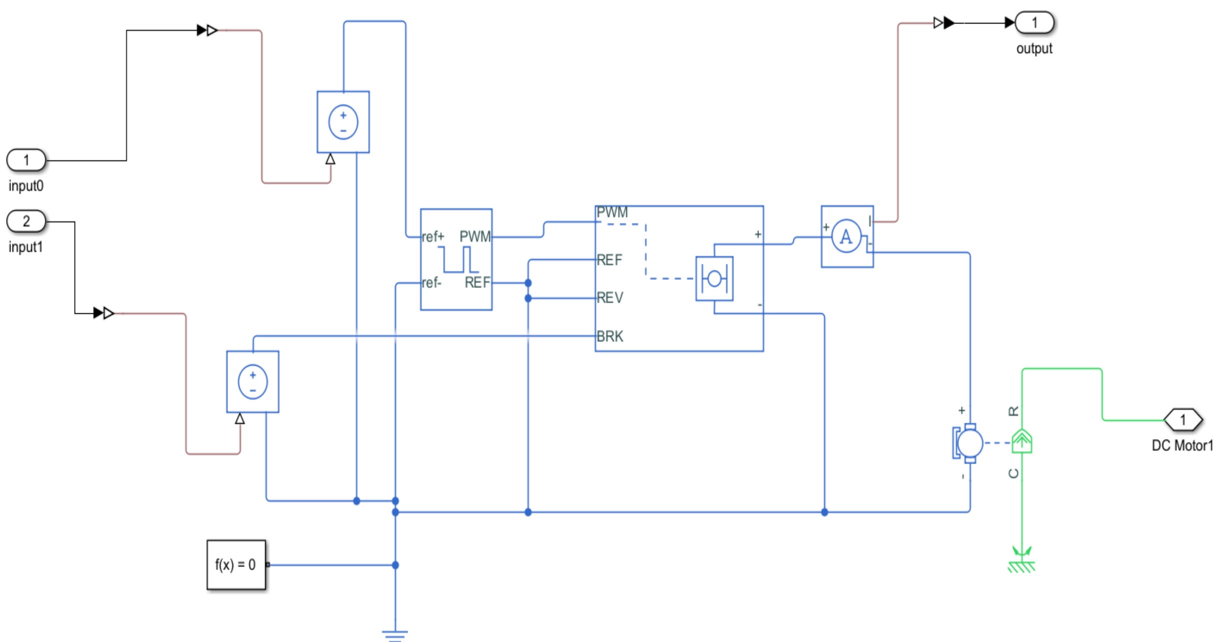


Figure 1. *Block Diagram*

II. MAIN SIMULATION PARTS

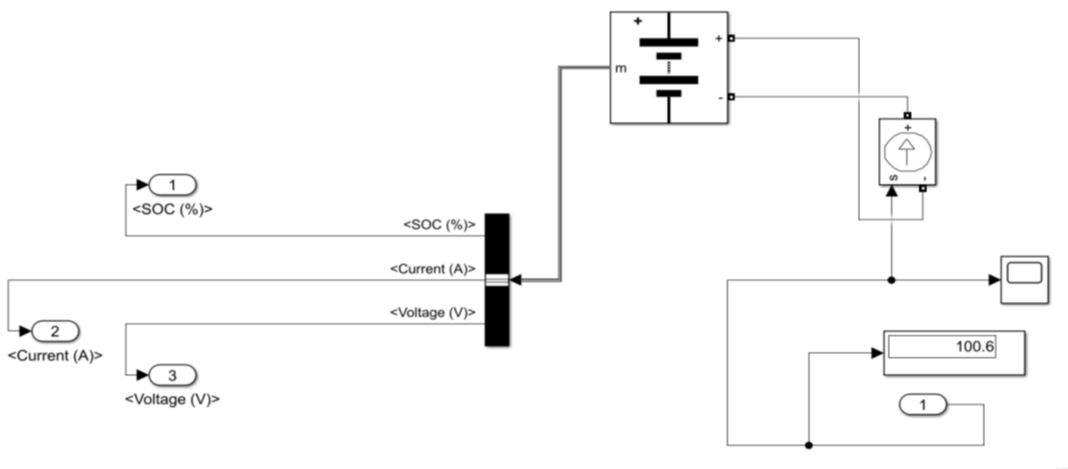
1. Motor and controller Simulation
2. Battery Simulation
3. Driver Input to Increase or Decrease Speed.
4. Vehicle Body and Tires Simulation

III. MOTOR AND CONTROLLER SIMULATION



1. Controlled PWM Voltage: The voltage of digital pulses is regulated with the aid of PWM signals. With PWM, a motor or other analogue devices are controlled by a digital output that alternates between high or "on" and low or "off" pulses.
2. Voltage Controlled Source: The Controlled Voltage Source block symbolises a perfect voltage source with sufficient strength to sustain the desired voltage at its output regardless of the source's internal current.

IV. BATTERY SIMULATION

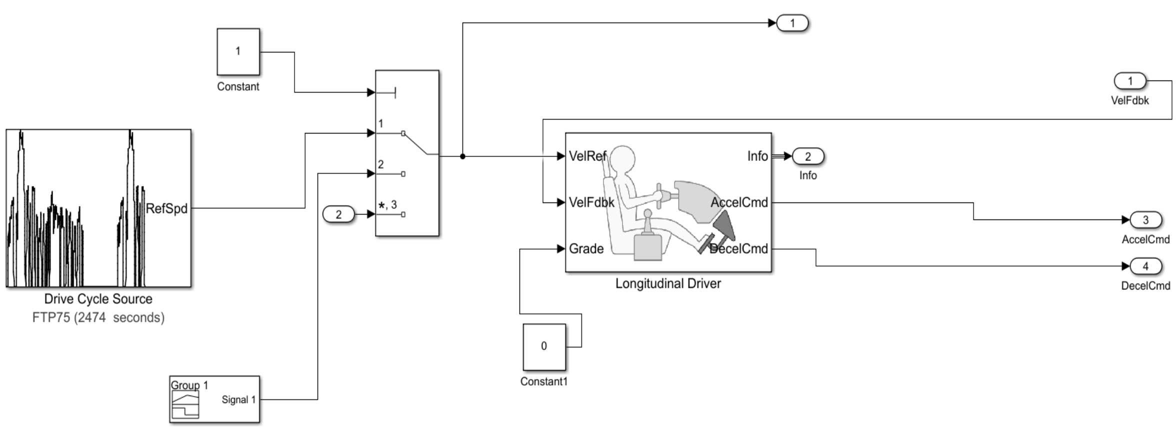


1. Battery: The Battery Electric Vehicle (BEV) model and its parts, including the motor, high voltage battery, and longitudinal vehicle, are included in this MATLAB project. Simscape's modular and multi-fidelity modelling technology is demonstrated in this project.

2. State of charge: Is a measure of the relative energy stored in a battery and is determined the ratio of the total capacity to amount of charge that can be extracted from the cell at a given time.

3. Voltage Measurement: Voltage measurement. The electrical potential difference between two points in an electrical or electronic circuit is known as voltage and is measured in volts. It gauges the electric field's potential energy to generate a current in an electrical conductor.

V. DRIVER INPUT TO INCREASE OR DECREASE SPEED



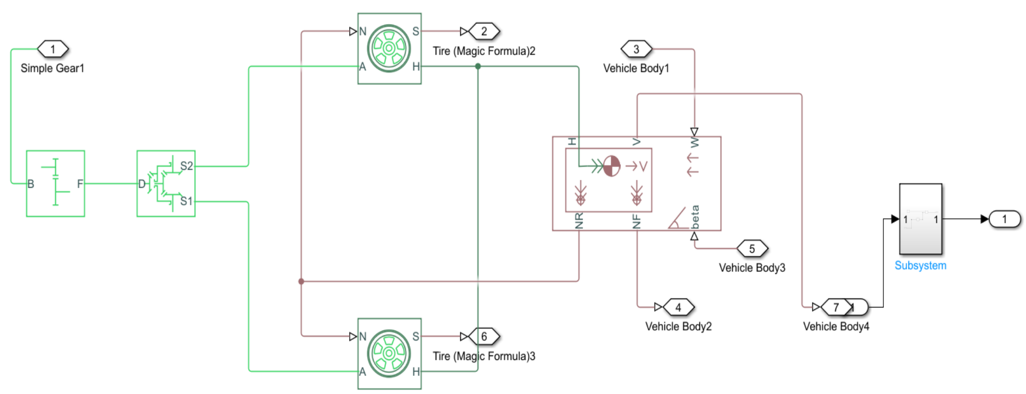
1. Drive Cycle Source: A longitudinal drive cycle can be generated using the Drive Cycle Source block according to user or industry standards. The block output is the stated longitudinal speed of the vehicle, which can be used to estimate the engine torque and fuel consumption needed by the vehicle to accelerate and reach the target speed.

For closed loop accelerating and braking orders for vehicle control and plant models, create realistic velocity and shift references. Study, tune, and optimize system performance, system robustness, and vehicle control over a variety of drive cycles.

2. Longitudinal Driver: A longitudinal speed-tracking

controller is implemented via the Longitudinal Driver block. The block creates normalized accelerating and braking commands that range from 0 to 1 depending on the feedback and reference velocities. The block can be used to simulate a driver's dynamic response or to produce the commands required to track a longitudinal drive cycle.

VI. VEHICLE BODY AND TIRES SIMULATION

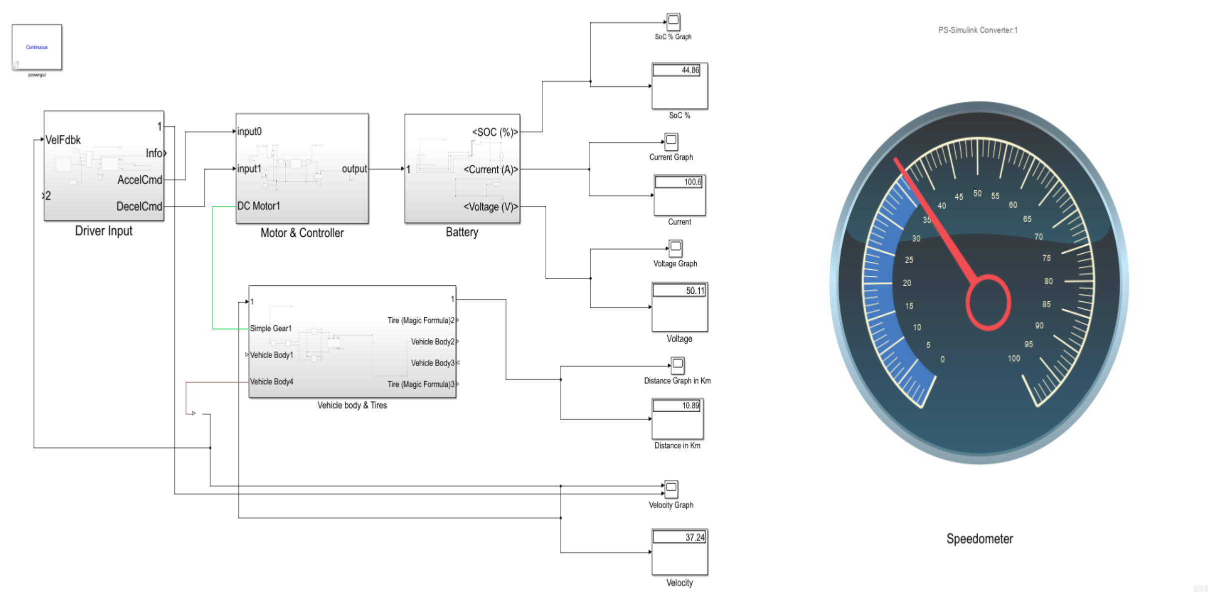


1. H-Bridge Drive: Propulsion is provided by the H-H Bridge drive. Using two separate input combinations, this drive enables the user to control the car in both the forward and backward directions. Additionally, a vehicle's speed can be managed with such a sophisticated driving.

This section discusses the motor's speed and armature current in various combinations. The behaviour of the vehicle with a sudden change in speed is finally demonstrated and analyzed.

VII. SIMULATION RESULT

Results of Simulation After running a simulation, we assessed the battery's SOC and speed under both drive cycle sources. For 1,000 seconds, we simulated an FTP source, and the results are as follows:



VIII. CONCLUSIONS

The success that the electric car industry has seen in recent years is not only heartily welcomed, but also vitally needed, given the rising amounts of greenhouse gases in the atmosphere. The sections of this website's economic, social, and environmental evaluations demonstrate that the benefits of electric vehicles far outweigh the costs.

Cost is the key factor preventing the widespread adoption of electric-powered transportation, as petrol and the vehicles that run on it are more accessible, practical, and less expensive. According to our schedule, we believe that over the next ten years, technology advancements and alterations in policy will make it easier to move away from traditional fuel-powered vehicles.

The success of this business is also significantly influenced by the global population. Our goal is to empower and inspire people to drive electric vehicles through mass marketing and environmental education programmes. Everyone can help bring about change, so get electric and do your part.

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