ENHANCING ELECTRIC VEHICLE RANGE AND COST THROUGH MODELING AND SIMULATION

Mr.VARAPRASADK.S.BM. Tech (Ph .D)
Asst Professor
Dept of Electrical & Electronic Engineering
Visakha institute of Eng.& tech. college, AP,India

KATTA HEMANTH SWAMY
B-tech student
Dept of Electrical & Electronic Engineering
Visakha Institute of Eng.& tech. college, AP,India

BOMMIDI GOPALAKRISHNA
B-tech student
Dept of Electrical & Electronic Engineering
Visakha Institute of Eng.& tech. college,AP,India

SIRIGIRI GAYATHRI
B-tech student
Dept of Electrical & Electronic Engineering
Visakha Institute of Eng.& tech. college, AP, India

MULAGAPAKA DILLESWAR RAO
B-tech student
Dept of Electrical & Electronic Engineering
Visakha Institute of Eng.& tech.
college, AP ,India

ABSTRACT*: As the technology is growing immensely in recent years. several extemporizations have been made for safer and greener planet electric vehicles have emerged as transformative force in the automotive industry, driven by environmental concerns innovations. By creating mathematical model. comprehensive an electric vehicle encompassing it's of various components such as the battery electric motor, power electronics and vehicle body and various controllers. Cost optimization is achieved through the examination of different aspects of EV production which is a major contributor to overall cost. The project identifies strategies to reduce and production costs. Electric Vehicle revolution by utilizing advanced modelling and simulation methods. By optimizing both cost and range consideration through a multidimension analysis. The electrical vehicle contributing to a sustainable and a eco-friendly transportation to future.*

1.INTRODUCTION:-

Electric vehicles (EVs) represent a groundbreaking innovation in the automotive industry, offering a sustainable and eco-friendly alternative to traditional gasoline and diesel-powered vehicles. These vehicles are designed As the world shifts towards a more sustainable and environmentally responsible future, electric vehicles are playing a pivotal role in shaping the way we move and interact with transportation. This introduction only scratches the surface of the exciting and rapidly evolving world of electric vehicles, which are poised to drive us into a cleaner, more efficient, and innovative era of mobility to run on electricity stored in rechargeable batteries, making them a significant departure from the conventional internal combustion engine vehicles that rely on fossil fuels.

EVs come in various forms, from fully electric cars like the Tesla Model 3 to plug-in hybrid electric vehicles (PHEVs) like the Toyota Prius, which combine both electric and gasoline power. The advent of electric vehicles has been driven by the urgent need to reduce greenhouse gas emissions, combat air pollution, and decrease our dependence on finite fossil fuels. This transition toward electrification has transformed the automotive landscape, spurring technological advancements in battery technology, electric drive trains, and charging infrastructure.

Key benefits of electric vehicles include reduced emissions, lower operating costs, quieter and smooth rides, and the potential for energy independence. Governments and organizations worldwide are promoting the adoption of EVs through incentives, infrastructure development, and research into next-generation EV technologies.

Environmentally responsible future, electric vehicles are playing a pivotal role in shaping the way we move and interact with transportation. This introduction only scratches the surface of the exciting and rapidly evolving world of electric vehicles, which are poised to drive us into a cleaner, more efficient, and innovative era of mobility

1.2 working of EV's:-

The working principle of electric vehicle in which the e-motor gets energy from a controller which collects the power from a battery. The e-vehicle works on an electric principle. Battery pack provides the power to the electric motor. Therefore, e-motor uses the energy received from the rechargeable battery to rotate the transmission system, thereby, wheels rotate. controller how much power is to be delivered to the electric motor.

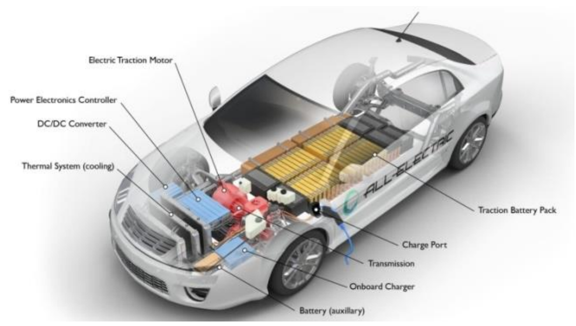

Fig 1:- Electric car

Battery is used to switch the DC motor. The battery is connected to the motor through a power converter to provide control action. The power converter changes

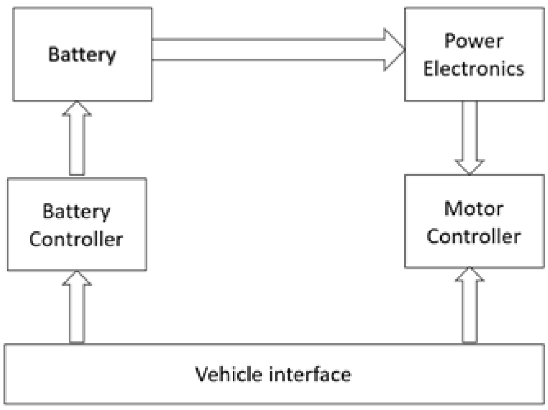

Fig 2:- Block Diagram of Electric Vehicle

2.PROPOSED WORK AND SIMULINK MODEL

2.1 Introduction

A simulation refers to the process of creating virtual representations of real-world systems or phenomena. Through simulation, these systems can be analyzed, studied, and manipulated in a controlled environment. This allows researchers, engineers, and practitioners to explore various scenarios, test hypotheses, and make predictions without the need for costly or time-consuming physical experiments. Simulation serves as a powerful tool for understanding complex systems, optimizing processes, and making informed decisions across a wide range of fields, from engineering and science to economics and healthcare.

2.2 Modelling flow of electric vehicle

The flow chart of the electric vehicle modelling is shown in Figure 5.1. The drive cycle source consists of throttle and brake pedal input. The longitudinal driver controller receives the input from the drive cycle source. The driver controller has three input, namely, reference speed, velocity feedback, and grade and three output ports, namely info, acceleration, deceleration. The output from the driver controller is given to H-bridge via Simulink to physical signal converter and controlled PWM voltage. The pulse width given for activation is five volts. The H-Bridge

the voltage applied to the motor. DC motor is connected to the axle of the vehicle. The vehicle body consists of velocity, hub, wind, beta, NR, and NF. Rear wheels of the vehicle are connected to the normal rear force of the vehicle body. The front wheels of the vehicle are connected to the normal front force of the vehicle body. Hub of the wheels is connected to that of the vehicle body.

Thus, the driver controller is required to track the actual speed of the vehicle for matching drive cycle input. It compares the reference speed with actual speed and calculates the error. The controller used is a Proportional Integral controller.

- If the error is positive, then there will be acceleration.
- If the error is negative, deceleration action will be taken in the vehicle.

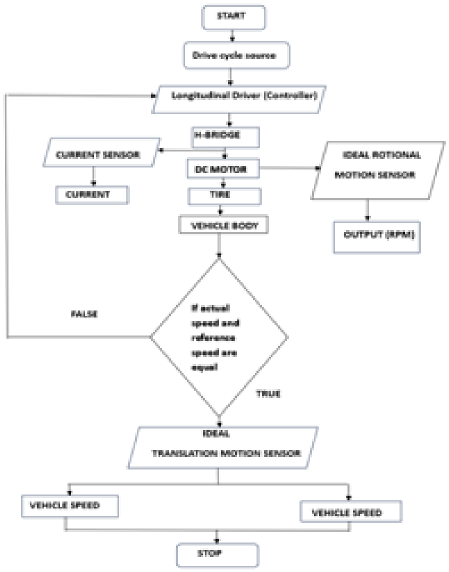

FIG 2.1 SIMULATION FLOW CHART OF AN ELECTRIC VEHICLE

3. RESULT

3.1:SIMULATION RESULTS:

The simulation of electric vehicle modelling is shown in is powered internally. The

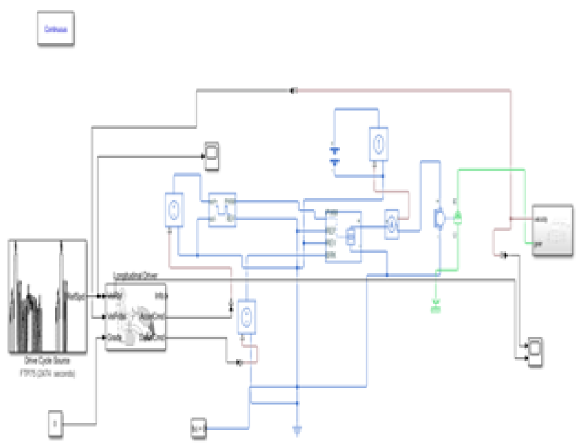

FIG 2.2 SIMILATION OF AN ELECTRIC VEHICLE MODELLING

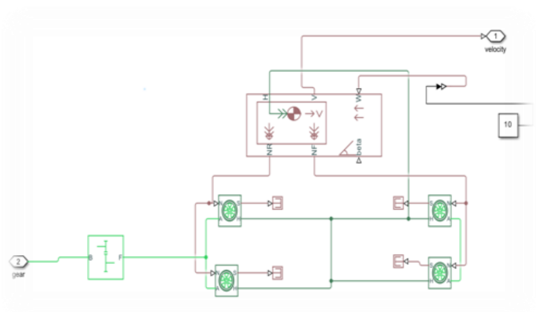

FIGURE :2.3 VEHICLE BODY SUBSYSTEM

The functioning of the electric vehicle modelling is plugged into a charge point for taking electricity from the grid and is stored in rechargeable batteries to power an electric motor which turns the wheel. The design consists of both electrical and mechanical systems.

The power converter is used to convert the energy from the battery to an ideal level as required by the motor. The converter is a bidirectional which helps in taking regenerative energy back to battery, thereby providing charging during deceleration of the vehicle. The vehicle body consists of the body of vehicle with wheels connected to the motor through a transmission system. As per the load requirement, the motor takes the power from the battery with the help of the controller and provides proportional control signals. The control signals are produced with the help of a feedback from the vehicle. The drive cycle source is taken a reference driving pattern taken for the simulation.

Figure.5.4 shows the simulation of the drivetrain system of the vehicle. The component group delivering power for driving vehicle corresponds to the vehicle. It consists of a vehicle frame and a drive wheel. The model is developed with a four- wheel-drive system. At the front and rear, two wheels are placed. A drive wheel is a vehicle's wheel, which transmits force and transforms torque as tractive force from tires to road, causing vehicle to move forward.

The output speed changes with respect to the input signal. Drive cycle source is given as an input to the longitudinal driver

controller. The proportional-integral controller is used to track the signal from the drive cycle source. The values of PI controller are Kp = 100; Ki= 50; . The output speed increases if there is an increase in input and vice versa.

The motor RPM of the vehicle. The number of times the DC motor's shaft completes a full spin cycle (when shaft turns a full 360°) per minute is the rated operating speed of motor. Ideal Rotational Motion Sensor is used to sense the rotations of the motor.

3.2:WAVEFORM:

The output wave forms

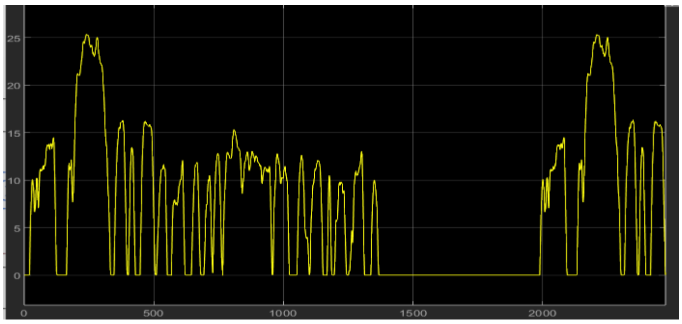

Figure.6.1 Waveform of motor speed (rpm)

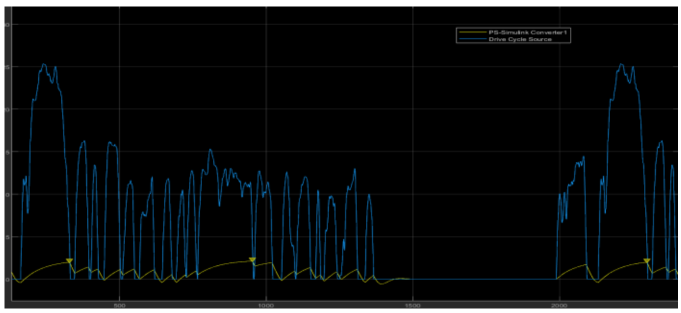

Figure.6.2 Waveform of velocity and drive cycle

REFERANCES

1.Kaushik, S., 2019. Modeling and simulation of electric vehicle to optimize its cost and range. Int. J. Eng. Adv. Technol, 8, pp.415- 419.

2. Y Mastanamma, Dr M ArunaBharathi, "Electric Vehicle Mathematical Modelling and Simulation Using MATLAB-Simulink" IOSR Journal of Electrical and Electronics Engineering (IOSR- JEEE), Volume 12, Issue 4 Ver. I (Jul. Aug. 2017), PP 47-53

3.J. J. Eckert, L. C. A. Silva, E. S. Costa, F. M. Santiciolli, F. G. Dedini and F. C. Corrêa, "Electric vehicle drivetrain optimisation," in IET Electrical Systems in Transportation, vol. 7, no. 1, pp. 32-40, 3 2017.

4'Wang, Y., Lü, E., Lu, H., Zhang, N., & Zhou, X., "Comprehensivedesign and optimization of an electric vehicle powertrain equippedwith a two-speed dual-clutch

5. M. W. Salehen, P &Su'ait, Mohd&Razali, H &Sopian, Kamaruzzaman, "Battery management systems (BMS) optimization for electric vehicles (EVs) in Malaysia" AIP Conference Proceedings, 2017, pp 1-7

6. TengkuMohd, TengkuAzman& Hassan, MohdKhair&a Aziz, Wmk, "mathematical modelling and simulation of electric vehicle using matlab-simulink"research gate, 2014, pp 1-10.

7. A. Bhatt, "Planning and application of Electric Vehicle with MATLAB®/Simulink®," IEEE International Conference on Power Electronics, Drives and Energy Systems (PEDES), Trivandrum, 2016, pp. 1-6.

8. David McDonald, "Electric Vehicle Drive Simulation with MATLAB/Simulink" Proceedings of North-Central Section Conference Copyright American Society for Engineering Education, 2012, pp. 1-24.

9. N. Mutoh, Y. Miyamoto, T. Horigome and K. Takita, "Driving characteristics of an electric vehicle system with independently driven front and rear wheels," IECON'03.29th Annual Conference of the IEEE Industrial Electronics Society (IEEE Cat.No.03CH37468), Roanoke, VA, USA, 2003, pp. 931-938 vol.1.

10. J. Kang, J. Yoo and K. Yi, "Driving Control Algorithm for Maneuverability, Lateral Stability, and Rollover Prevention of 4WD Electric Vehicles With Independently Driven Front and Rear Wheels," in IEEE Transactions on Vehicular Technology, vol. 60, no. 7, pp. 2987-3001, Sept. 2011.

11. X. Yuan and J. Wang, "Torque Distribution Strategy for a Front- and Rear-Wheel-Driven Electric Vehicle," in IEEE Transactions on Vehicular Technology, vol. 61, no. 8, pp. 3365-3374, Oct. 2012.

12. T. Hofman and C. H. Dai, "Energy efficiency analysis and comparison of transmission technologies for an electric vehicle," 2010 11IEEE Vehicle Power and Propulsion Conference, Lille, 2010, pp. 1-6. 12. 13.JiankunPeng, HongwenHeandNenglianFeng, "Simulation Research on an Electric Vehicle Chassis System Based on a CollaborativeControl System" Energies 2013, 6, 312-328.

13. R. Das, K. Thirugnanam, P. Kumar, R. Lavudiya and M. Singh, "Mathematical Modeling for Economic Evaluation of Electric Vehicle to Smart Grid Interaction," in IEEE Transactions on Smart Grid, vol. 5, no. 2, pp. 712-721, March 2014