Design and Development of different control strategy analysis for EV charger

[1]Mohit, [2]Deepa GK, [3]Meghana P, [4]Noorjahan shivangutti, [5]Mr.Lakshmikanth Reddy

1,2,3,4UG Student, 5Assistance professor
Acharya institute of Technology
Bengaluru

***Abstract*- This project examines the design and analysis of fast charger for EV applications. The development for the cause is air pollution that is being caused by motor vehicles. To reduce the pollution anEV is developed but main problem with EV is that charging of the vehicle. The Vehicle should be charged ina electronic charging station as fast as the motor vehicle is being filled with fuel. In this project design Advanced PID controller, Fuzzy logic controller, and a Dual Active Bridge converter is present with which the speed of charging an electric vehicle will be increased. The electronic charging station must be able to provide charging of different electric vehicles with different capacities in less duration. Thisdesign provides the information about fast charging of an EV developed in MATLAB. The optimal performance of the circuitis represented with the help of simulation.**

Keywords: **Controller, Driver, and Main board.**

INTRODUCTION:

The main reasons for the invention of electric vehicles are the emission of toxic substances into the airby themotor vehicles such as cars, buses, trucks, and so on causing air pollution but the other reason for the development of electric vehicles is that the fossil fuels which are being employed in our daily life will be exhausted not beyond a few years considering the rate of usage. The EV's must be developed in such a waythat the vehicle must be charged within a few seconds [1]. The report begins with an overview of the project'shistory and significance, as well as a concise summary of the current state of research in the field. The sectionthen introduces the project's researchqueries and objectives, as well as the methodology employed to achievethese objectives [2]. In the first section of the report, a literature review of Controllers, Battery, and topologiesare presented.The purpose of the literature review is to determine the current state of knowledge in these areas and to identify literature gaps that will be addressed by the initiative [3]. The second section of the report details the project's methodology, including the design and simulationof the charger and controller circuit using MATLAB/Simulink. In addition, this section provides a comprehensive description of the experimental setup, including the equipment and materials used forthe endeavor [4]. The third section of thereport details the project's results, including the controller's efficacy under various operating conditions. The section includes tables, figures, and graphs to clearly and conciselypresent the data [5]. In the fourth sectionof the report, the project's findings and their implications for future research and practical applications are discussed. In addition, this section emphasizes the project's strengths and weaknesses and makes suggestions for future research [5]. The overall objective of the project is to investigate the analysis of different topologies/strategies for charger to create a more efficient and fast charging with less duration. The report provides an overviewof the project's methodology, the results obtained, a discussion of the findings, and suggestions for future research [6].

HARDWARE MODEL

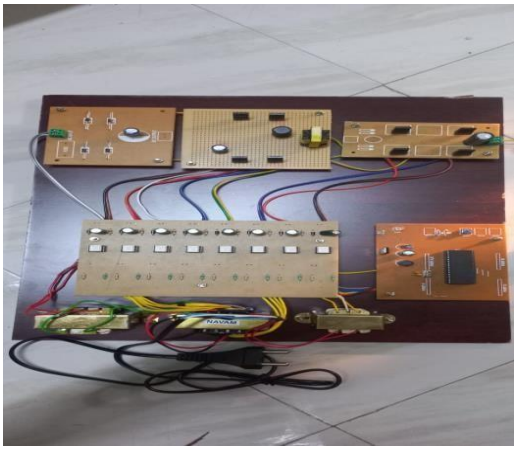

Fig-Hardware model

Dual active bridge is an isolated bidirectional DC-DC converter which consists of a high frequency transformer, Energy transfer inductor and DC link capacitors. The Topology of DAB is show in Fig. It consists of two H-bridgeswhich are isolated by a high frequency transformer. DC-DC DAB has several advantages such as it provides isolation between input and output unlike

bidirectional DC-DC converter which doesn't provide such characteristics. The other advantages of DAB include bidirectional power flow, high power density, easy implementation of zero voltage switching.

SIMULATION OF SPEED CONTROLLER

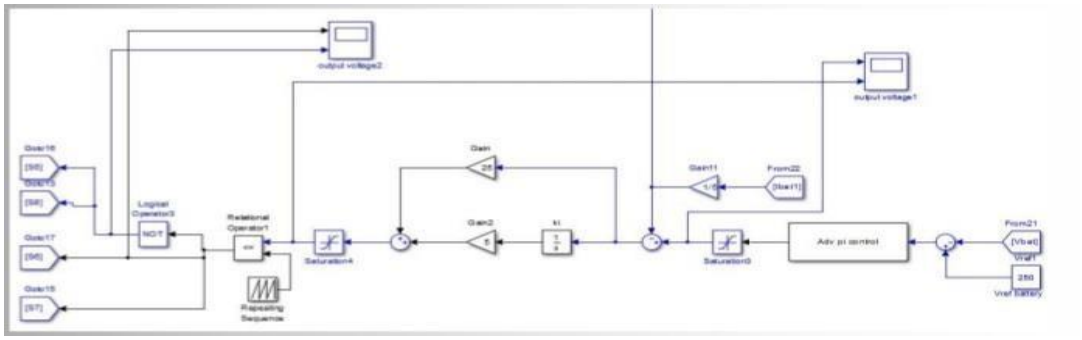

Fig 1. Advanced pi controller

The proportional Integral (PI) Controller is the AQM algorithm. It manages the queue at the output port of the router. It includes the major features which were absent in RED. The proportional Integral (PI) controller was designed to overcome the problems of RED. It uses 'instantaneous queue length' as a congestion metric.

PI operates during the 'enqueue' time just like the RED algorithm. Note this point and do not confuse this with 'input port' in the router architecture. PI runs on the 'output port', but during the 'enqueue' time PI 'does not operateon the arrival of every packet like RED does. RED works on the arrival of each packet during enqueue time. But PIruns once in every 6ms (variably called w). PI decides whether the incoming packet should be enqueued or droppedafter some calculation.

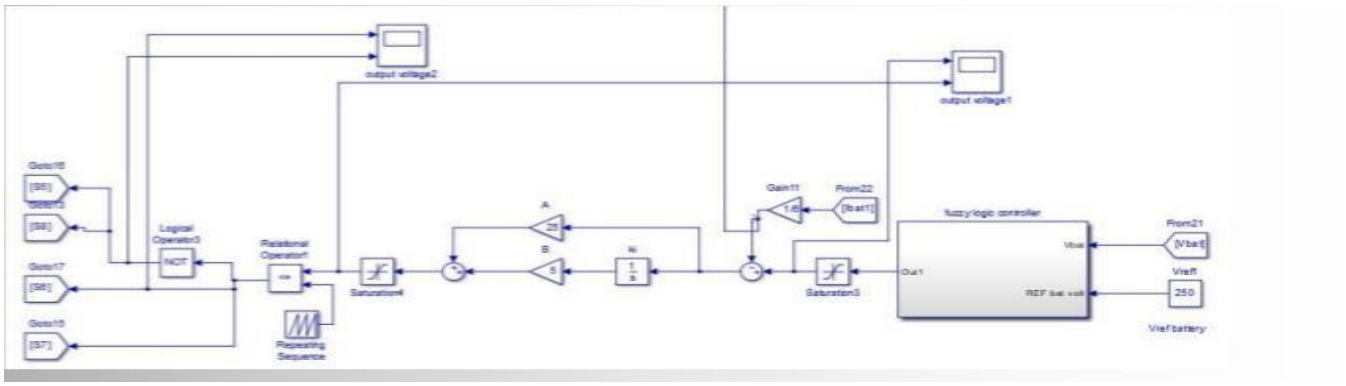

Fig 2. Fuzzy logic controller

Fuzzy logic control (FLC) is the most active research area in the application of fuzzy set theory, fuzzy reasoning, and fuzzy logic. The application of FLC extends from industrial process control to biomedical instrumentation and securities. Compared to conventional control techniques, FLC has been best utilized in complex ill-defined problems, which can be controlled by an efficient human operator without knowledge of their underlying dynamics.

SIMULATION RESULTS:

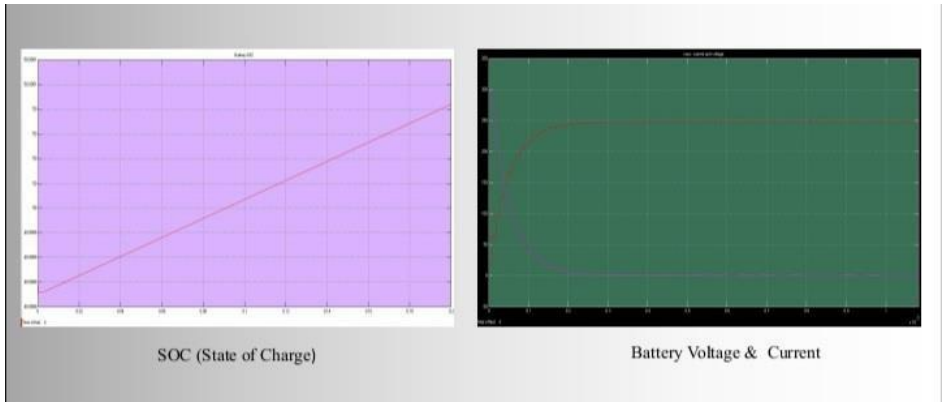

Fig 1. Advanced pi controller

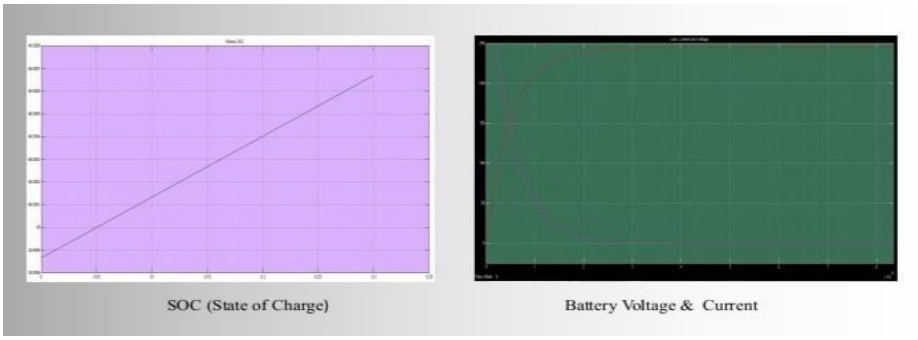

Fig 2. Fuzzy logic controller

The above graph show that the RED and GREEN color represents the CURRENT and VOLTAGE of the individual phaseof the STATE OF CHARGE.

COMPARISON TABLE:

SLNO	PARAMETERS	Advanced PI	Fuzzy Logic Controller
1.	Overshoot	Increase	Minor Decrease
2.	Settling	More	Less
3.	Transient	Present	Not present
4.	Stability	Less	Good
5.	Efficiency	90.2%	94.5%

RESULT AND DISCUSSION

After comparison of all the four controllers FUZZY LOGIC CONTROLLER is the best controller topology with high efficiency, low voltage stresses. Hence, we are implementing this topology controllerin hardware. And comparing the simulation and hardware results.

CONCLUSION

A comprehensive model of an EV charger that uses both a fuzzy logic controller and an advanced PI controller is shown. The Fuzzy Logic Controller is the best with the high efficiency, low voltage stresses, and reduced transient voltage when analyzed in comparison to the Advanced PI Controller. MATLAB/Simulink has been used to create the full simulation model. The obtained simulation results demonstrate how straightforward it is to use FLC for fast charging in comparison toPI and Advanced PI.

REFERENCES:

1. Harish Ramakrishnan, Jayanth Rangarajan's Power Topology Considerations for Electric Vehicle ChargingStations, Texasinstrument.
2. Shuaishao,Linglinchen,Zhenyushan,ModelingandAdvancedControlofDual-Active-BridgeDC–DCConverters, IEEE.
3. Marco Bindi, CarlosIturrinoGarcia, Fabiocorti,Comparison Between PIandNeuralNetworkController forDualActiveBridgeConverter,IEEE.
4. Shahjalal,M.;Shams,T.;Tasnim,M.N.;Ahmed,M.R.;Ahsan,M.;Haider,J.ACriticalReviewon ChargingTechnologiesofElectricVehicles.Energies2022,15,8239.
5. Safayatullah,Md&TamasasElrais,Mohamed&Ghosh,Sumana&Rezaii,Reza&Batarseh,Issa.(2022).AcomprehensiveReviewofPowerConverterTopologiesandControlMethodsforElectricVehicleFastChargingApplications.IEEEAccess.11.10.1109/ACCESS.2022.3166935.