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A two stage charging Facilities planning method For electric charging vehicle sharing system

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Abstract— *the development of an electric vehicle is a result of air pollution caused by automobiles. The goal of an electric automobile is to reduce pollution, but the major challenge with them is charging. The car should be charged at the same pace as it is filled with fuel in an electronic charging station. To enhance the charging speed of an electric car, a PID controller, a fuzzy logic controller, and a buck-boost controller are employed in this study. The electronic charging station must be able to charge a variety of electric vehicles with varying capacities in a short amount of time. The material in this article is about quick charging of an electric car that was developed in MATLAB. Best possible outcomes the circuit's performance can be improved with the aid of simulation. The best performance is shown in this article which is to use fuzzy logic which is supplied to 3 different chargers with their voltage levels such as 42v, 48v, 52v when charging EV batteries There is voltage difference, the switches are created are provided with a particular charger base this switching action can be controlled using the Fuzzy controller this result can be achieved using MATLAB simulation another advantage of this system that we have observed every results before the actual implementation of hardware and the purpose of this system we can store the charging and discharging of EV batteries and improves the maximum efficiency and life of EV batteries.*

Keywords— *AC/DC converter, DC/DC converter, Buck converter with PI Controlled, EV battery, Fuzzy Logic controller,*

I. INTRODUCTION

Pure-electric and plug-in hybrid electric cars, collectively referred to as Plug-in Electric Vehicles (PEVs), are becoming increasingly common on the road. They are a viable answer to the growing concerns about environmental pollution and the energy consumption of thermal cars. PEV batteries are recharged from the utility with the use of a residential connection or a recharging bollard. In Europe, the home connection uses a single-phase 230V outlet for electric energy, while the recharging bollard uses a three-phase 400V outlet. Almost all PEVs include battery chargers that are compatible with both outlets.

Electric Cars (EVs) of many forms, including Battery Electric Vehicles (BEV), Plug-in Hybrid Electric Vehicles (PHEV) in various configurations, and Fuel-Cell Electric Vehicles, are being developed as alternatives to Internal Combustion Engines (ICE) vehicles (FCEV). The battery charging methods for electric and plug-in hybrid electric vehicles are discussed in this chapter. To make reading easier and to aid comprehension, the terminology of Electric Vehicle (EV) will be used to define these two types of cars from now on in this chapter. EVs are becoming more popular, as seen by the large number of vehicles that have lately been released on the market by practically all automakers. Electrochemical batteries, ultra-capacitors, and full-cell batteries are the principal energy storage solutions in these vehicles. However, taking into consideration Because of the current limitations of energy storage in such technologies, the vehicles' range autonomy is restricted. Different energy storage system designs are possible; nonetheless, electrochemical batteries remain the most often utilized energy storage technology. They are, however, frequently employed in combination with ultra capacitors to store energy during transitory times, such as during vehicle regenerative braking Breathing In fact, ultra capacitors are utilized in this fashion to receive a large quantity of energy in a short length of time and then deliver that energy to the next acceleration or to assist in battery charging. The SEV systems may be separated into two kinds based on the position of the returning vehicles: free floating and none floating. The free-floating approach allows vehicles to be parked wherever within the coverage area. In a floating paradigm, vehicles should never be parked at SEV installation sites. Aside from that, the SEV system's "one way/round trip" function is a unique feature. The one-way model allows the user to drop off the car at any station, but the round-trip model compels the user to return the automobile to the same location where it was picked up. One-way tickets are less costly than round-trip tickets. Using this principle, the user's parking flexibility may be extended. In addition, the non-floating strategy can reduce the SEV enterprise's scheduling expenses as compared to the free-floating model. As a result, the SEV system is one-way and non-floating.

With the fast growth of electric vehicles, careful design of charging infrastructure is essential. n re and Fortz [14] suggested a collaborative planning model for electric car infrastructures and real-time fleet operations under time-varying unpredictable demand as a solution to this challenge. Simultaneously, an accelerated approach was presented to overcome the dimensionality curse in integer planning decisions. The example demonstrated that the SEV system's efficiency could be improved, and it offered a novel demand forecasting approach that allows for the generation of a large number of demand scenarios. The charging station location problem was treated as a mixed-integer stochastic programmer to account for cost and customer arrival time constraints. The study looked into how to make people and vehicle relocations more efficient. It presented a mixed-integer linear system with several objectives. Programming optimization for vehicle and people relocation decisions.

The placement and capacity of charging stations are investigated from the standpoint of SEV firms using various algorithms and models. However, the current study did not take into account the happiness of SEV users, which might improve the appeal of shared electric cars. The ease with which SEV users may charge on the road is dependent on whether the SEV is widely accepted by customers. As a result, more research into the specific planning strategy for the SEV system is required. This article focuses on SEV drivers' driving habits and the convenience of charging on the road for users in order to develop a two-stage charging facility design model. This article makes three distinct contributions. 1) The O-D set is based on the features of urban land use.SEV users are located in several locations. The charge demand model for SEV users is built by taking into account the driving inclinations of customers in various places. 2) A novel strategy for arranging charging stations is offered. The second stage plans distributed charging heaps as a complement to the charging stations planned in the first stage. 3) To account for the charging need of SEV users while driving, the notion of user discontent is established. SEV customer satisfaction can be improved using a two-stage design concept that combines charging stations and distributed charging heaps.

II. LITERATURE SURVEY

Hoang Vu Nguyen et al. suggested a single-phase onboard battery charger (OBC) for plug-in electric cars (EVs) that makes use of the low-voltage (LV) battery charging circuit for active power decoupling. By sharing the transformer, switches, and capacitors, the OBC may work in three distinct modes. The LV battery charging circuit acts as an active filter to prevent low-frequency power ripple at the DC connection in a grid-to-vehicle (G2V) or vehicle-to-grid (V2G) mode. At the DC connection, small film capacitors can thus be used instead of huge capacitors. The dual active bridge (DAB) DC-DC converter provides isolation in the third operating mode (H2L), when the LV battery is charged from the HV battery. Because some of the components If the proposed OBC is used in a common manner, the size and cost of the OBC can be significantly reduced. The proposed system's validity has been confirmed by simulation and experimental results [1].

Hoang Vu Nguyen and Dong-Choon Lee proposed a single-phase multifunctional onboard battery charger for electric vehicles (EVs), which uses a low voltage (LV) battery charging circuit to provide active power decoupling capability. While the high voltage (HV) battery is connected to the grid, the buck converter for the LV battery charger is used as an active power decoupling (APD) circuit, which filters out the single-phase charger's inherent second-order ripple power component. As a result, compact film capacitors may be used instead of big electrolytic capacitors, lowering the cost and volume of the charger for EV applications [2].

In [3], the single-phase charging operation of an integrated three-phase on-board charger is discussed. Single-phase charging operation can be achieved without any hardware modification of an integrated three-phase on-board charger. The circuit topology, modes of operation, control strategy, and controller design for single-phase operation are presented in detail. A built-in three-phase battery charger designed by the authors is used and tested as a single-phase battery charger with an output power of up to 1.6 kW. Experimental results show that it is possible to achieve unity power factor (PF) with a peak efficiency of 93.7%.

In [4], an innovative single-phase on-board battery charger is proposed, which uses the PEV propulsion machine and the associated traction converter. The charger topology allows power factor correction (PFC) and battery voltage/current regulation with a single additional diode rectifier. The stator windings of the propulsion machine are used as inductors coupled together to develop a two-channel interleaved boost converter. Based on a permanent magnet synchronous machine (PMSM), detailed analyzes of the proposed integrated charger circuit are presented. A 3 kW prototype using a 220 Vrms three-phase PMSM is built to experimentally test the performance of the proposed integrated charging approach. A power factor (PF) close to unity and a total harmonic distortion (THD) of 3.96% of the AC input current are achieved with a maximum efficiency of 93.1%. Low voltage (LV) improved .

A single-phase onboard battery charger (OBC) is presented that can serve as both an active power decoupling circuit for filtering out ripple power and a current double rectifier for charging LV batteries from HV batteries. The suggested module is utilised as the active filter when the HV battery has to be charged from the grid. This circuit also becomes the LV charging circuit when the LV battery has to be charged from the HV battery. Without requiring any extra devices, the DC-link capacitance in the AC-DC converter of the HV charging circuit may be greatly lowered. In addition, several components of the proposed circuit are shared throughout the AC-DC converter, LV charging circuit, and other working modes. Filter with active power. As a result, the onboard battery charger's cost and space may be lowered.

For plug-in electric automobiles, K. A. Chinmaya and G. K. Singh suggested a CuK converter-based integrated battery charger (PEVs). During all modes of vehicle operation, the proposed bidirectional DC/DC converter may perform buck/boost functions. In plug-in charging mode, it acts as a power factor correction (PFC) converter, while in driving and regenerative braking modes, it acts as a normal single stage inverting buck/boost converter. The suggested multi-functional converter allows for the selection of a wide variety of battery voltages as well as suitable brake control. In addition, the charger's size, weight, and cost are lowered since it uses a less number of components than previous buck/boost converters in chargers. The suggested converter is ideal for use as a PEV onboard charger. Simulations are carried out. A laboratory prototype of the aforementioned converter has been created to test its viability using the MATLAB/Simulink environment [6].

Due to several major benefits over standard plugin methods, inductive power transfer (IPT) technologies have acquired widespread adoption in onboard battery charging applications. A programmable charging profile consisting of an initial constant current (CC) and a subsequent constant voltage (CV) is anticipated from an IPT battery charger. Two sets of IPT topologies with inherent load-independent CC and CV at the same zero-phase angle (ZPA) frequency are commonly combined into a hybrid topology with a wide load range during the charging process to avoid sophisticated control schemes while maintaining nearly unity power factor and soft switching of power switches simultaneously. The load independent CC and CV, on the other hand, are frequently bound by characteristics of a loosely coupled transformer (LCT), making the LCT difficult to use. To address this issue, this research methodically describes a strategy for constructing such effective hybrid IPT converters, which begins with several existing topologies with customizable CC or CV outputs and cascades a generic T network for mode transition. Fewer mode changes and compensatory techniques were used in the design. In this study, components are suggested, as well as several accessible hybrid topologies that are not constrained by LCT parameters. Also examined are the control logic and sensitivity of compensation parameters to input impedance and load-independent output. Finally, to verify the theoretical analysis, a 1 kW hybrid IPT battery charger prototype based on LCC-LCC and LCC-S topologies is created [7].

Hoang Vu Nguyen et al proposed a simple and effective method to reduce the bulky capacitor in onboard battery charger (OBC) where low-voltage (LV) battery charging circuit is utilized as an active power decoupling (APD) circuit to filter out the second order ripple power. When the OBC is connected to the grid to charge the HV battery, the switches on the primary side of the LV charging circuit are operated as those of an AC-DC converter with APD function. Consequently, small DC-link capacitors can be used instead of large capacitor banks. In the proposed OBC, the switching devices are shared for the AC-DC converter, APD circuit, and primary-side of the LV charger. For a simultaneous charging of the LV and HV batteries, a DC-DC converter is added, which shares the same transformer core and secondary side with the LV charging circuit. So, the functions of the OBC are maintained in the proposed topology whereas the volume and cost are decreased by 52.3 % and 46.9 % compared with the conventional non-isolated OBC, respectively. A 2-kW SiC-based prototype has been designed and tested to verify the validity of the proposed system. The peak efficiencies of the OBC and LV charger are 96.1 % and 95.3 %, respectively [8].

Mehdi Abbasi et al presented a novel single-stage onboard charger that consists of a CCM bridgeless boost converter integrated with an isolated CLL resonant converter and two magnetically coupled active voltage doubles. The proposed ac-dc charger achieves low THD and near unity power factor. The 800-V output voltage is regulated via variable switching frequency, with duty ratio control used to achieve PFC in the front-end CCM bridgeless boost circuit. The reduced number of semiconductor devices along with soft switching operations enhances the overall circuit efficiency. Simulation results are given on both level 1 and level 2 charging systems with 2~5 kW, 120~240 Vac /800 Vdc to highlight the merits of the proposed converter. Experimental results are also given on a 120 Vac/800 Vdc prototype to support this work [9].

In [10], the design of an onboard charger for electric vehicles with 800 V power system is described, built and set into operation. The device uses silicon carbide power MOSFETs operated at up to 150 kHz in a transformer less bidirectional charger topology, coupled filter inductors, small ceramic DC link capacitors and a Steinmetz circuit for single phase operation. The result is an innovative onboard charger unit with a very high power density (~7 kW/l) that can be the basis for future developments of AC onboard chargers. In the next step a detailed loss analysis will be performed to show the potential for efficiency improvements.

III. PROPOSED SYSTEM

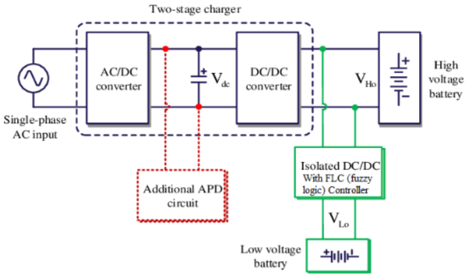

Fig 3.1 Block diagram of proposed system.

1)A TWO STAGE CHARGING FACILITIES PLANNING METHOD FOR EV BATTERIES:

As a consequence of stricter pollution, global warming, and resource constraints laws, electric vehicles (EVs) are gaining a rising amount of interest from automobile manufacturers, governments, and customers. In most plug-in EVs, the onboard battery charger charges the batteries from the grid (OBC). In electric cars, there are two sorts of battery uses. Traction motor drives are powered by the high-voltage (HV) battery, while lighting and signaling circuits, entertainment systems, automated seats, and other electronic equipment are powered by the low-voltage (LV) battery. Because alternators are not utilized, the auxiliary charger charges the LV battery from the HV battery, unlike ordinary autos with inbuilt alternators. fuel-burning engine In single-phase HV battery chargers, the DC-link ripple voltage In single-phase HV battery chargers, the DC-link ripple voltage is created by an intrinsic ripple power component in the DC connection that fluctuates at twice the grid frequency. To smooth out the low-frequency ripple power, large capacitors are typically necessary. Electrolytic capacitors, on the other hand, are inappropriate for EV applications due to their short lifespan, thus they must be replaced with a trustworthy film capacitor, whose size should be optimized at the very least. To do this, the DC link's ripple power must be routed to alternate energy storage devices that can handle large voltage changes. As a result, the size and weight of the DC-link capacitor may be considerably reduced.

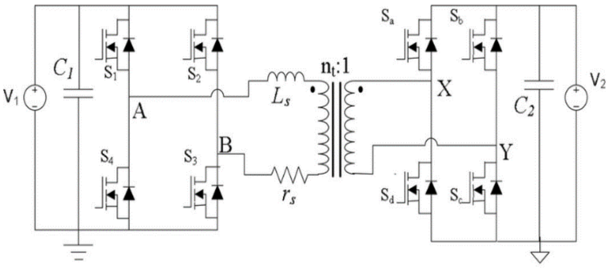

Fig 3. 2. Circuit diagram of dual active bridge converter

Figure 3.2: Dual active bridge converter circuit schematic A block diagram of the proposed system is shown in Figure 3.2. With an AC/DC power factor correction (PFC) boost converter, a non-isolated or isolated DC/DC converter is often employed. The main function of the second-stage DC/DC converter is to control the voltage and current of the HV battery. High power factor, sinusoidal grid current, and ripple-free charging current are all advantages of the two-stage architecture. We describe a single-phase OBC for plug-in EVs with a dual functional circuit that can work in three modes and includes an active power decoupling feature. When the charger is in G2V or V2G mode,

the LV battery charging circuit functions as an active filter to reduce low-frequency ripple power. To The LV battery charging circuit operates as an active filter to eliminate low-frequency ripple power at the DC connection. As a result, instead of large electrolytic capacitors, small film capacitors may be employed at the DC-link. With the suggested LV battery charger with active power decoupling capabilities, the size and cost of the single-phase OBC might be drastically reduced. We're using a fuzzy controller with PID control action for a dual-function circuit.

IV. FUNCTION OF EACH BLOCKS:

a) *RECTIFIER :*

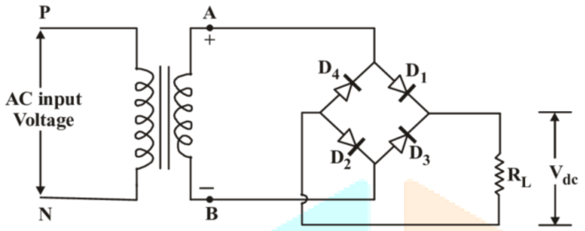

Fig 4.1 Full wave bridge rectifier.

A rectifier is a device that transforms two-way alternating current (AC) into single-directional direct current (DC) (DC). Rectifiers can be found in a variety of physical forms and sizes, ranging from vacuum tube diodes through crystal radio receivers to today's silicon-based devices.

As shown in Figure 3, the bridge rectifier is made up of four diodes. Forward-biased diodes D1 and D2 conduct current in the direction shown when the input cycle is positive, as shown in section 4.1. The voltage generated by RL is similar to the positive half of the input cycle. During this time, diodes D3 and D4 are reverse-biased. D1 and D2 are forward-biased, conducting current during the input's positive half-cycle. The skew in D3 and D4 is in the other way. Forward-biased D3 and D4 conduct current during the negative half-cycle of the input. D1 and D2 are the first and second letters of the alphabet, respectively.are tilted the other way around. When the input cycle is negative, diodes D3 and D4 are forward-biased and conduct current in the same direction along the same channel, as shown in Figure (b). RL is reverse-biased during the negative half-cycle, as half D1 and D2 are during the half-positive cycle.

Over RL, a full-wave rectified output voltage emerges as a result of this operation. A DC power supply, sometimes known as a unidirectional DC power supply, is a device that supplies DC voltage and current in one direction. One such power source is batteries, although their lifespan and cost are both limited. An alternative method of delivering unidirectional electricity is to utilise a rectifier to convert AC line power to DC power.

A rectifier is a device that converts AC to DC by allowing electricity to flow in one direction while blocking it in the other. Rectifiers are important components in electrical circuits because they only allow current to flow in one direction when a threshold forward voltage is reached across them. a diode, a silicon controller rectifier, or a variety of other componentsAll types of silicon P-N junctions can function as rectifiers. A diode's two terminals are the anode and the cathode, and current flows from the anode to the cathode. One or more diodes are used in rectifier circuits to convert bipolar AC voltages and currents to unipolar voltages and currents, which may then be filtered to create DC voltages and currents.

A) PID CONTROLLER:

One of the simplest and most widely used controller for decades is the PID controller. PID stands for proportional (P), integral (I) and derivative (D) controller. Fig. shows the block diagram of a typical PID controller.

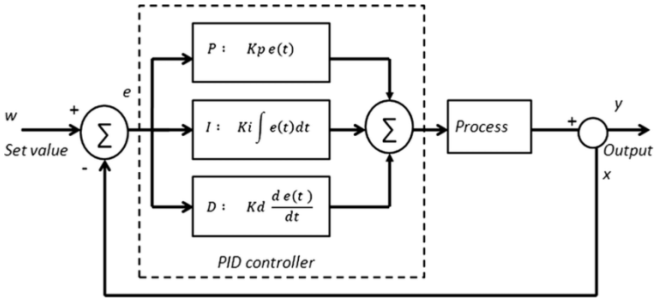

Fig 4.2 PID control structure

The system under study is the plant to which necessary excitation is provided thereby achieving overall closed loop control effectively. A PID can be expressed as –

$$C(s) = \frac{K_{DS^2 +}\ KP^S + K_1}{S}$$

C(s) =$K_p + \frac{K_1}{s} + K_D s$ ..(1)

Where,

1. KP- Proportional gain
2. KI- Integral gain
3. KD -Derivative Gain

The signal e(t) shown in Fig. 4.2 indicates the tracking error resulting from the difference between the reference signal R(t) and the actual output signal Vo (t). The tracking error is sent into the PID controller, which calculates the signal's derivative and integral. The proportional gain (KP) times the magnitude of the error signal plus the integral gain (KI) times the integral of the error signal plus the derivative gain (KD) times the derivative of the error signal is the output of the PID controller u(t) to be applied to the plant.

Time domain representation of the signal u(t) fed to the plant is given by –

u(t) =K_Pe(t)+$K_{1\int e_{(t)}} dt + K_{D} \frac{d_{e\,(t)}}{dt}$ ……(2)

	Real time	Overshoot	Settling Time	Steady State error
Proportional	Decreases	Increases	Small change	Decreases
Integral	Decreases	Increases	Increases	Eliminate
Derivative	Small change	Decreases	Decreases	Small changes

Table 1. Effect of PID on closed loop system .

B) DUAL ACTIVE BRIDGE :

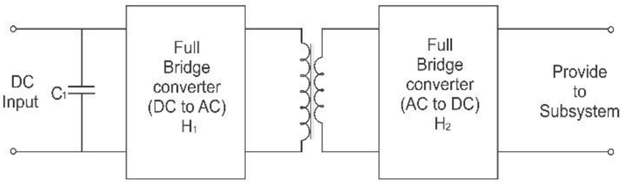

Fig:- Dual Active Bridge Converter

A dual active bridge is a bidirectional DC-DC converter that has identical primary and secondary full-bridges, a high frequency transformer, an energy transfer inductor, and DC-link capacitors. Energy transfer inductance in the model refers to the leakage inductance of the transformer plus any needed external energy transfer inductance. Both full-bridge legs are driven by complementary square-wave pulses. By using phase shift modulation to phase shift the pulses of one bridge with respect to the other, the power flow in the dual active bridge may be regulated. The control splits the power between the two DC buses, allowing the leading bridge to supply the following bridge. Square waves are applied to the bridges, causing a voltage difference across the energy transfer inductance and guiding it in one direction.. inductance and channel the stored energy In ideal situations, zero voltage switching (ZVS) may be accomplished using dual active bridge converters when the voltage transfer ratio (M) across the transformer is equal to one: Vout / (n*Vin) = M

The output voltage is Vout, the input voltage is Vin, and the transformer rotation ratio is n. ZVS is determined in non-ideal situations by the resonant link between each device's output capacitance and the circuit's equivalent inductance at various switching intervals. During switching events, current through one of the complimentary devices is interrupted, while current is given via the output capacitor and driven through the device's anti-parallel diode due to the energy transfer inductance. Control Each switch is turned on for half of the time it should be. The switching periods of the switch pairs in the two bridges are the identical, but they are managed in such a way that a phase shift is introduced between each bridge. alterations based on modulation This model was built using feedback measurements. To supply the phase shift ratio for the PWM modulator, a set point value is employed to generate an output voltage error signal, which is then supplied through a digital PI regulator. The twin bridge bypass feature allows each bridge to handle traffic differently, enabling automobiles to be accelerated on one bridge on the way in while skipping the acceleration management on the way out. Link aggregation is the process of combining many bridges into a single link.

The dual active bridge is an eight-semiconductor bidirectional, controlled dc-dc converter with high power capability that includes a high-frequency transformer, energy transfer inductor, and dc-link capacitors. A full-bridge with an adjustable rectifier is a more straightforward description of the converter. Because of the symmetry of this converter, which has identical main and secondary bridges, it can regulate power flow in both directions, which is why it was chosen for the smart green power node application. The topology is depicted in Figure 3. where and are the dc-link voltages, is the leakage inductance of the transformer plus any needed external energy transfer inductance, and is the number of controlled semiconductor switches

The twin active bridge has received a lot of attention in the past. apps tied to each other In the past, isolated gate bipolar transistors (IGBTs) were often utilised to support enormous amounts of data. Dc-link voltages (more than 300V) As a result, antiparallel diodes and snubber capacitors are commonly employed to direct current commutation on switching events while also allowing for zero voltage switching (ZVS) through the snubber capacitor.

C) PI CONTROLLED BUCK CONVERTER:

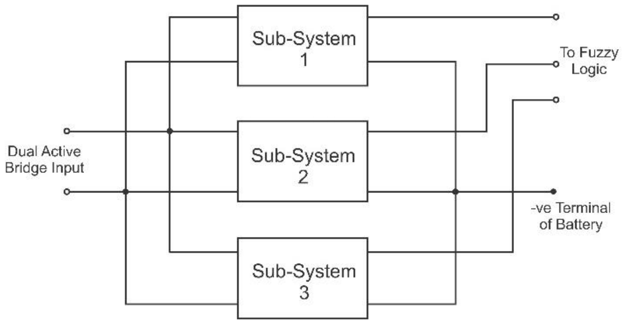

Fig 4.4. PI controlled buck converter

DC to DC converters are known as buck converters. This concept uses a switching power supply to convert a DC supply into a regulated DC supply. The converter is modeled with MOSFETs rather than ideal switches to ensure that device on-resistances are appropriately represented. The converter reaction from reference voltage to measured voltage includes the MOSFET switches. PID design requires a linear model of the system from the reference voltage to the observed voltage. The switches in automated linearization, on the other hand, result in a zero system. Instead of linearization, PID Tuner is used to find a linear model of the system in this case.

V. FUZZY LOGIC CONTROLLER:

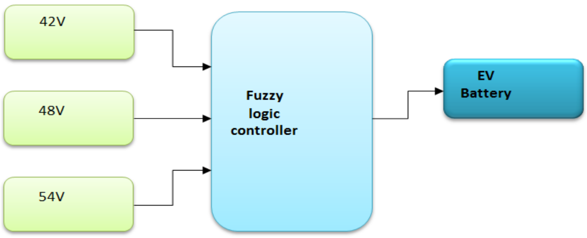

Fig 5.1. Fuzzy logic controller.

Fuzzy logic could be a variety of computer logic that's different from formal logic. The instruction that fuzzy refers to are the things that aren't clear or are uncertain. The real assessment may range in the middle of absolute truth and absolute false as fuzzy logic is utilized for the theory of partial truth. In contrast, informal logic, the real assessment of variables may only be the integer values 0 or 1. Fuzzy logic could be a way of guessing computers to form decisions more sort of a human would it not uses fuzzy rules and fuzzy sets to model the globe and make decisions about it. A different voltage levels such as 42v, 48v,54v, relies on fuzzy sets. Fuzzy sets allow us to pander to the situations that aren't precise. To use voltage level in higher cognitive process we want two things fuzzy sets and fuzzy rules.

A fuzzy set could be a collection of related items which belongs there to set to different charging rates modes According to EV batteries . Fuzzy rules are justified for asserting set of information in “fuzzy logic” as it is the key tool. However, there doesn't exist novel reasonably fuzzy rules, neither is there just one sort of “fuzzy logic”. In above fig 7 represents the different voltage levels and fuzzy logic controller where rule based to control charging and discharging of EV batteries. The input that is given to the system in the FLC is the change in between the desired value and the error which is the change in error.

The process of developing the mapping from an accustomed input to an output employing different voltage Level is thought of as fuzzy inference. The FIS is described as a system that employs fuzzy membership functions to form a call.

Fuzzification: FLC rule-based system assess linguistic if then rules employing fuzzification inference along with composition procedures. They produce fuzzy results which usually should be converted into crisp output. To move the fuzzy ends up into crisp defuzzification is performed.

Defuzzification: It is the method of converting a fuzzified output into one crisp value with relation to a fuzzy set. The defuzzified value in difference between battery charging or discharging value controller represents the action that should be taken in controlling the method. So different voltage level logic allows computers to mimic human decision-making. Fuzzy sets modern concepts and objectives within the globe. Proficiency is described by fuzzy sets combined using rules and when all of this information is considered into account a call made. These decisions are made using current battery status logic which suggests computing with words.

VI. RESULT AND DISCUSSION

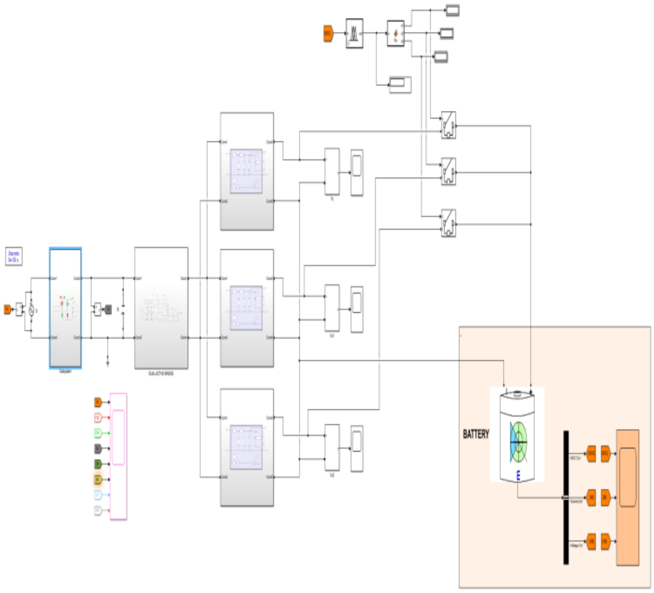

Fig 6.1 Proposed MATLAB/ simulation diagram

The simulation diagram presented above is coupled to several circuits that provide acceptable output. Rectifier, Dual-active bridge, PI controlled buck converter, and design Fuzzy logic are the only components.

While the input supply has been given the Rectifier circuit, which converts AC to DC of input AC supply, and Dual active bridge, which converts DC to DC of voltage supply, is nothing but improves the maximum efficiency of the batter charging, and provide Buck converter with PI controlled, which provides a proportional-integral (PI) controller is designed for the DC-DC Buck converter to regulate its output voltage in the presence of load current and line voltage digression.

Fuzzy logic which is gives state of charging information of EV batteries and we have Provide or design 3 different voltage level circuits such as 420v,48v,54v such their voltage difference is created while charging of EV batteries the connected switch get activated with according voltage difference level and battery will be charge According to Fuzzy controller (FLC). The battery is does not fully discharge and by using proposed controller.

VII. *COUPLED SEVERAL CIRCUIT’S:*

a) PI –controlled buck converter :

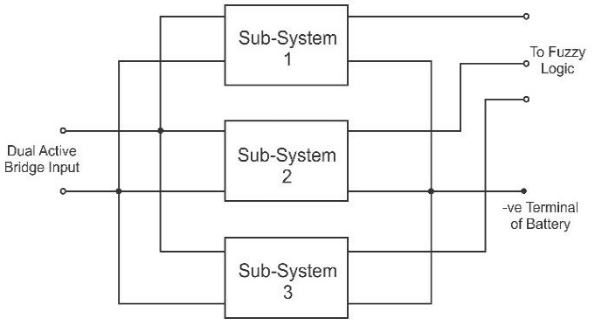

Fig 7. PI –controlled Buck converter

In system proposes about DC-to-DC buck converter design and control of output voltage by using a PI control technique and reference regulator technique.

b)Rectifier

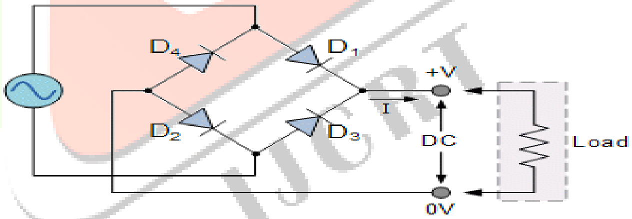

Fig 7.2 Rectifier circuit.

A rectifier is a device that transforms two-way alternating current (AC) into single-directional direct current (DC) (DC). When forward biased, a junction diode has a low resistance to current in one direction and a high resistance in the other (when reverse biased). How Both halves of the AC sine wave are converted to positive-voltage direct current by the full-wave rectifier. As a result, the DC voltage pulses twice as fast as the input AC voltage.

B) Dual -Active Bridge :

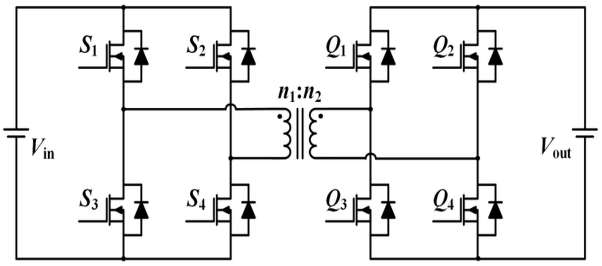

Fig 7.3 MATLAB/ simulation based Dual –Active bridge circuit.

A dual active bridge is a bidirectional DC-DC converter with identical primary and secondary side full-bridges, a high frequency transformer, an energy transfer inductor and DC-link capacitors. which is improves maximum efficiency.

D) Rectifier Output voltage Waveforms

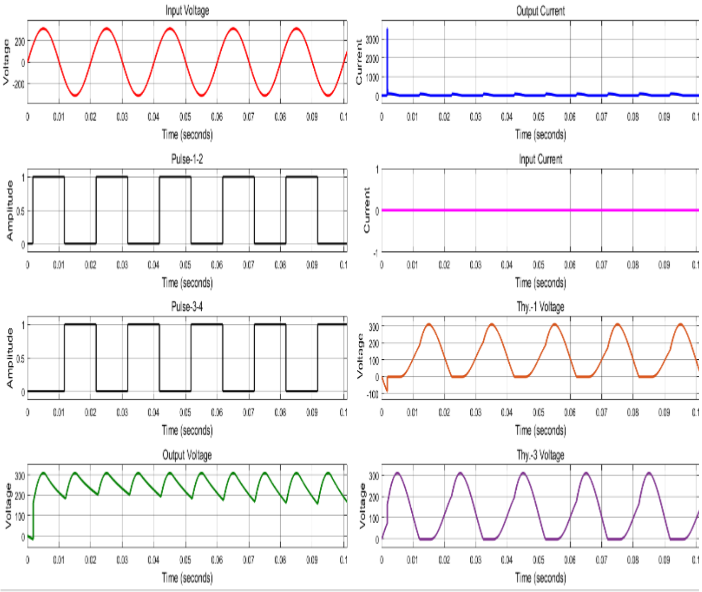

Fig 7.4 Rectifier output waveforms

The average (DC) output voltage of a full wave rectifier is greater than that of a half wave rectifier, and the output of a full wave rectifier has far less ripple than that of a half wave rectifier, resulting in a smoother output waveform. Two diodes are now utilized in a Full Wave Rectifier circuit, one for each half of the cycle.

A rectifier is an electrical device that transforms alternating current (AC), which flips direction on a regular basis, to direct current (DC), which only travels in one direction. The inverter performs the reversing process. The procedure is called as rectification because it "straightens" the present course.

E) Fuzzy Input membership

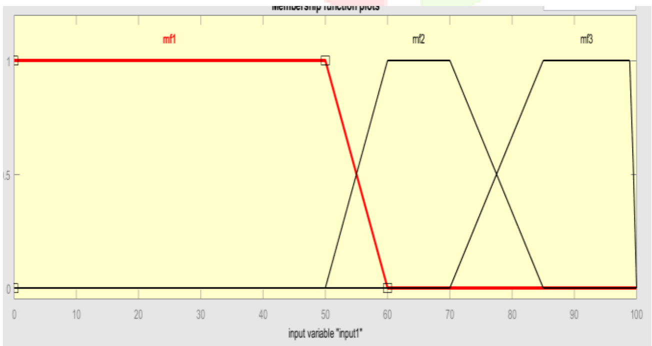

Fig 7.5Fuzzy input membership

Above graphical representation of fuzzy input membership which is depends on giving such 3 voltage levels such as 42v,48v,52v, to connect this charger while charging of EV batteries performs fuzzy rule.

F) Fuzzy output membership

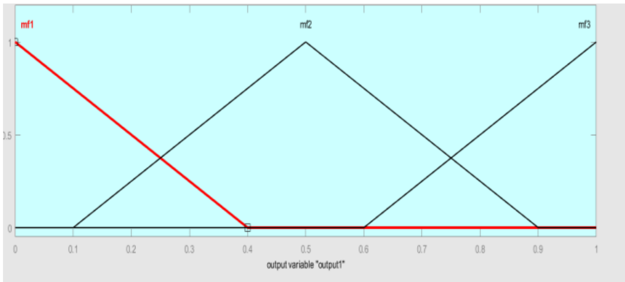

Fig 7.6Fuzzy output membership

Above graphical presentation of Fuzzy output membership which is there is provides switching Action connect 3 different charger According EV battery charge Levels .

G) Fuzzy surface

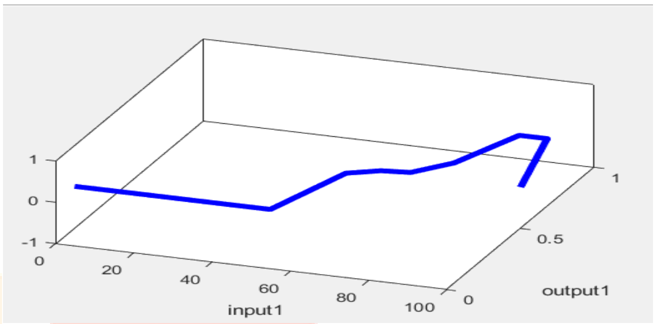

Fig 7.7Ggraphical representation fuzzy surface of input and output fuzzy membership.

Above is a graphical fuzzy surface of the input and output fuzzy memberships, which shows how the two memberships conduct logic at different voltage levels to charge the battery. This results in a performance impact.

h) Battery paprameter Outpuut

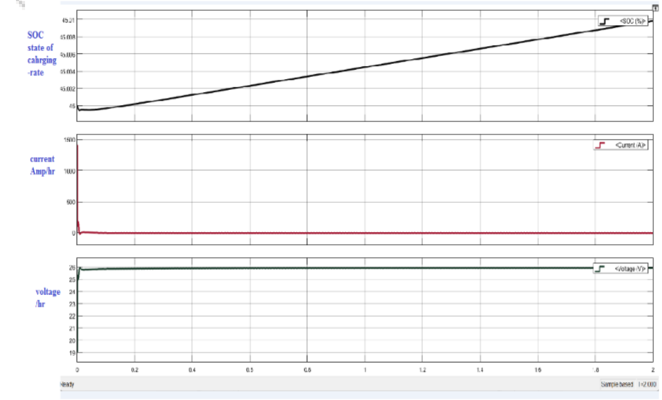

Fig 7.8Output battery paprameters EV batteries

The output parameters of batteries from a MATLAB-based modeling circuit that offers information on the state of charge (SOC) of EV batteries as well as the present status of the battery Amp/hr while also providing voltage regulation information.

V.CONCLUSION

In view of this paper with the utilization of fuzzy logic the total model of EV charging system is presented. By using MATLAB, the total simulation design has been advanced. Here it explains about the issues interrelated with fast charging. Slow EV charging time is one of the essential problems with EVs. There will be different electric vehicles with different capacities in an electronic charging station and the customers requires less time for charging the battery. This paper has introduced a system which takes less time (within half a minute) to change the capacity and to charge an electric vehicle. It is also to be known that the manufacturing of EVs and batteries related to EVs would also lead to increase in GDP and will also create new jobs. It is very essential to spread awareness about the EVs. It can be concluded that there will be an immense possibility for EVs in the future.

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