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PARALLEL CHARGING SYSTEM FOR EV'S

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Abstract— **Electric Bikes are in high demand in India because they produce less pollution, have cheaper maintenance costs, and produce less noise. We are concerned about the demand for nonrenewable resources throughout the world, this motivates us to transition to renewable sources of energy. Structural Investigation is applied to assist the product development team in verifying and upgrading existing designs. The goal of this research is to figure out how to develop a simple, cost-effective electric motorcycle with an intelligent control system. There are several ways to conserve energy in various areas.**

The most powerful way to reduce global warming and the Green House Effect is to drive an electric vehicle. It is a viable alternative to traditional transportation. A charging unit is utilized in a Power Electronic Circuit Battery to give an excellent performance while consuming minimal power. A built-in resistance compensator (BRC) approach has been introduced to reduce the time it takes for a lithium-ion battery to charge, thanks to advancements in technology and li-on batteries. To achieve a transition from the constant-current (CC) to the constant-voltage (CV) stage is seamless, a smooth control circuit (SCC) is proposed. The charger circuit moves from the CC to the CV stage without fully charging the cell, due to the external parasitic resistance of the Li-ion battery-pack system.

Keywords— **Electric vehicles, battery, li-on, charging time.**

I. INTRODUCTION

At present electric vehicles are the automobile industry hotspot, and with the rapid development of the economic issues such as energy scarcity and pollution have grown more significantly. Coal and natural gas are the primary sources of energy for the electricity grid. When electric vehicles are powered from such grids, here the emission from the vehicles is avoided and transferred to power plants. This makes the electric vehicles not 100 % green as expected. So, it is advisable for future EVs to switch to sustainable energy like wind and solar energy.

To avoid the frequent replacement of normal batteries, rechargeable batteries are the only solution for this reason. Battery chargers play an important role and Battery-powered devices have become an essential part of modern life, for example remotely operated sensor devices, navigation devices & communication devices. For a smooth transition to e-mobility, charging infrastructure for electric vehicles will be critical.

Most electric vehicles use their primary source of power as lithium-ion batteries. Lithium-ion batteries are commonly used to power movable electronics, electric automobiles, and hybrid vehicles (powered both by fuel and electricity). Because of its high power-to-weight ratio, great energy efficiency, good high-temperature performance, and minimal self-discharge, the batteries are regarded as suitable for electric vehicles.

Rapidly charging a battery with high currents, resulting in high temperature Both high temperature and high current are known to cause battery strain, which reduces the battery's efficiency over time. It's also difficult to deal with the battery system from a safety standpoint in a rapid charging system battery retreating issues and the long period of charging time create a way to adopt newer charging technologies, here in this paper we are discussing parallel charging techniques. In parallel charging the battery is divided into small cells, each cell charges individually, this process does not require a higher current to charge the smaller cell. After the completion of charging, all cells are connected to form a large battery. The goal of this paper is to reduce the charging time of EVs and help to cover more distance in a short time.

II. LITERATURE SURVEY

A. Based on the charging technique

The Battery charger is outlined to charge a lead-acid battery pack with a max current flow of thirty amp at one hundred fifty-volt dc. Tests on Battery Charging The charger's performance was evaluated when it was loaded with a pair of high-voltage electric vehicle batteries during testing. Charger with 12 phases as a battery charger, a twelve-phase alternating current to direct current converter is employed. The twelve phases are generated by two three-phase transformers.
The device typically applies voltage to the charged batteries for one hour. The charge is then halted when a triac between the secondary of the Ferro resonant transformer and the bridge rectifier is turned off by the microprocessor. After disconnecting the transformer from the battery pack, the microprocessor activates a MOSFET, which creates a resistive load across the battery pack's terminals. The monitoring circuitry evaluates the battery's response to this resistive load, and a voltage proportionate to the potential drop at the terminals of the batteries is delivered to the microprocessor's A/D [1].

It has been explored to use inductive and conductive coupling technologies to charge high voltage(v), and high power(w) batteries in electric cars. The use of conductive and inductive coupling methods to charge high voltage, high-power battery banks in electric automobiles has been investigated. While the electric vehicle market is still in its infancy, user-friendly, strong, safe, and efficient, battery charging systems will be required in the future. To date, both conductive and inductive systems have been commercialized at power levels of up to 10kW, with inductive coupling technology, that is user-friendly being shown up to 120 kW. Increased adoption of electric vehicles, as well as advancements in battery technology, will promote the development of battery charging methods and infrastructure [2].

Lead-acid batteries are the first to appear in the mid-nineteenth century. Nickel Cadmium batteries did not appear for almost a century. The rechargeable battery market is still dominated by these two types of batteries. New commercially viable chemicals have recently been created and are making substantial progress in the marketplace. Lithium Ion, Nickel Metal Hydride Rechargeable Alkaline Manganese, and Zinc Air are at the forefront of these novel chemistries. The process is reversed when the battery is charged, and the ions go the opposite way. A battery is made up of two electrodes, a cathode with a negative charge and an anode with a positive charge, separated by a porous separator. If the electrodes come into touch, the battery will be shorted and rendered useless. The electrodes and separator are submerged in an electrolyte solution that contains enough ions to support the chemical reaction while also acting as a medium for subsequent ion transport [3].

In actuality, charging electric vehicles (EVs) at battery charging stations in a given location can result in huge dynamic voltage variations in the electricity grid, resulting in voltage unbalance between various areas of the same electricity grid. To address this voltage imbalance, All EVs submit the battery-based energy information to the system at a consistent pace (i.e., once per second), and the system arranges recharging time and charging current for each EV. On a regular basis, reducing the peak demand of all [4].

The battery charger is designed to charge both lead-acid and lithium-ion batteries with a voltage source of 36 V and a battery-designed capacity dependent on charging time. This SMPC (switched mode power converter) can be used to charge electric cycle batteries. The electric vehicle (EV) market is growing at an exponential rate. A growing global carbon footprint, rising fossil fuel prices, advancements in battery technology, and effectively working motor and motor control approaches are all working in supporting the EV Eco-System. For a developing country like India, the size of the market and number of (L to M) low to medium speed Automotives are significant. As a result, the government and regulatory agencies are pushing hard for the electrification of such vehicles [5].

A reduction-oxidation (redox) reaction betwixt the active components of a battery turns into electrical energy using chemical energy. The anode, cathode, and electrolyte are these elements, with the cathode and anode serving as positive and negative electrodes, respectively, and the electrolyte serving as The redox process takes place in a shared medium. Because the system is initially positive, neutral charges (cations) gather in the electrolytic medium around them, forming an electric field between the anode and the electrolyte that inhibits the redox process. On the cathode side, a similar mechanism happens, with positive charges accumulating on the cathode terminal, making its electric potential positive. The difference between the anode and the cathode is referred to as the open circuit voltage of the energy storage element when there is zero current flowing in the battery terminals and the redox and electric forces at the cathode and anode sides have reached stability [6].

This study offers an upgraded variant of the "On Demand Generation Regulation Control (OGRC)" systems, which monitors unbalanced dynamo outputs as well as the state of all dynamo and batteries, including EVs, to achieve the requirement of regulation of unstable dynamo. Stable renewable generators, such as wind turbine (WT) and photovoltaic (PV) generators, were not identified and controlled similarly in our earlier version. To increase efficiency, the proposed updated version addresses each of them separately. Furthermore, EV charging systems have been improved to increase EV owners' pleasure and frequency control capability [7].

We investigate the scheduling charging problem of electric vehicles (EVs) inside a station in this paper, intending to minimize the total tardiness of the problem. Because of the charging station's physical and power limitations, such as the max power and the max power variable between the electric feeder and line, generating a realistic and efficient timetable is a difficult task. By establishing efficient schedules, the ant colony optimization (ACO) met heuristic is used to manage the process of charging the EVs inside the charging station. Based on a collection of real-world benchmark circumstances, the behavior and ACO performance are evaluated and compared to state-of-the-art techniques. The results of the experiments reveal that ACO is highly successful and outperforms other techniques [8].

Pure electric vehicles must still solve several issues before they can reach their full potential and become a viable alternative to conventional or hybrid automobiles. The most crucial is to improve the vehicle's autonomy and make the charging procedure as rapid and clean as feasible. Furthermore, as noticed by a large number of publications and patents, contactless charging is now possible; however, to adopt these systems in our daily life, we lack more exposure to the electric field here we are not meeting the benchmarks, as well as vehicles also have to properly covered it means covered with shield protector [9].

The effective solution for minimizing the Global Warming and Green House Effect is to utilize an electric vehicle. It is a non-conventional mode of transportation. The charging unit is utilized in Power Electronic Circuit Batteries to give great performance with low power consumption. With the EV's converter circuit battery charging unit, the LCC compensation network is utilized. It features a highly efficient and low circulating current, as well as a wide range of output voltage and current control. Bi-directional power flow is necessary for the design of a battery charging device for a vehicle from grid (G to V) power conversions or vice versa. The research concentrates on double-sided Bi-directional Converter LCC adjustment for EV charging topology. In this approach, the resonant frequency is independent of the coupling coefficient employed betwixt the receiving and transmitting coils to accomplish zero voltage switching. This technology is employed as wireless charging.[10]

B. Based on the design and Research of an Automatic Charging System

The issues of energy scarcity and pollution have become more apparent in recent years. As long as the benefits of the vehicle which pollute less and low power consumption and less emission, other forms of energy consumption vehicles, the electric cars are the most frequently utilized vehicles have piqued the interest of many governments, and many governments have risen to a strategic position. With the rapid development of the economy, issues such as energy scarcity and pollution have grown more significant. Because of the benefits of the vehicle which pollute less and low power consumption and less emission, new energy vehicles, electric cars are the most frequently utilized, have piqued the interest of many governments, and many governments have risen to a strategic position.[11]

At this time, the earth has a limited petroleum resource, this protects the living existence of the environment, lowers greenhouse gas emissions, and halts global warming, which has all become hot topics around the world. Cars, being a product of modern social industry, provide us with a great deal of convenience and comfort in our daily lives. However, there are certain drawbacks. Automobile fuel usage now become a topic of oil usage, & cars emit a considerable amount of off gas, which has a negative impact on the natural ecological environment.

Electric vehicles can minimize pollution, reducing our city's environmental impact as well as our need for petroleum. As a result, developing electric car technology is a common goal in the automotive world. Analyzing the impact of EVs on power lines(grid) is critical, and the model of electric vehicle charging is the cornerstone of simulation.[12]

In electric vehicles, dual-stage onboard lion charging system consists of an independent Current converter stage with a boost power factor adjustment stage. Traditionally, the direct current linking voltage at the output of the PFC converter onboard Li_{on} battery charging system has been kept at four hundred volts, restricting the output voltage of the charger to 36–48 V, 72–150 V, and 200–450 V, depending on the (direct current to direct current) converter selected. The suggested variable the direct current linking voltage of the PFC converter allows for a wide variety of charger output voltages with the same DC-DC converter. The requirement for the required output voltage to be constantly larger than the max of the input voltage is a restriction of traditional boost PFC converters.

A non-inverting two-switch buck-boost power factor correction (PFC) converter with a wide DC link voltage is presented in this work of onboard chargers. The working ways of the converter at output voltages lesser compare to the maximum voltage and larger than the input voltage max is detailed. In both modes, the topology maintains high power quality. PSIM (11.0) is used to simulate a 1 kW PFC converter with a universal input voltage of 85-265 V(RMS), and early experimental results are also reported in the study.[13]

The distribution system makes use of bidirectional chargers. In addition to the battery charge and Vehicle-to-Grid functionalities, the reactive power may be rectified using a known reactive power reference (V2G). The architecture employs 3-phase two-directional power factor correction (PFC) with a direct current (DC) connection. linked to a DC/DC dual directional isolated converter This paper describes the virtual flow control method utilized to determine the amount of injected reactive power. This functionality's necessary alleviates does not necessitate any extra added hardware, and it may be installed on previously present EV'S with merely a software correction. The same outcome shows how the reactive power is balanced. and how reactive current saturation is employed to keep the power within predefined limits [14].

Battery packs are an important source of energy for electric automobiles. With arrays of thousands of cells, the design complexity of the battery must be enhanced to work efficiently to its full potential. This will lead to an increase in the cost of battery packs, currently, these batteries are half the price of EVs. This gives the way to improve the efficiency of inductive wireless charging (IWC), which might rapidly charge the moving EVs hence there is no need for having big batterers, this will reduce the size of the battery if the capacity reduces then eventually the cost is also more aggressive. The goal of this work is to examine the self-charging system of electric vehicles which has been modeled as an optimization problem with constraints

The SCS has a set of power transmitters that enable self-charging and require optimization while switching between various power transmitter set-points. An Augmented Lagrangian-based cost function will be used to achieve this optimization. Furthermore, the proposal is based on the assumption that there are no traffic encounters. The suggested system's accuracy is ensured through performance evaluations under various limitations.[15]

The hazardous status of global warming needs the total adoption of a renewable energy-based transportation system. However, establishing their long-term survival in a large-scale deployment has proven problematic. This article demonstrates the idea and actual execution of a modern solar-assisted level-2 electric car charging station controlled by a Type-1 vehicle connection. The designed model is constructed in the MATLAB/Simulink environment, the circuit functionality is explored, and a methodical model is generated to investigate the parametric design elements. Furthermore, a full hardware setup has been created to evaluate the performance of the power factor correction in steady-state conditions concerning load fluctuation for the input of 3kW, 230Vrms at 1-phase, 50Hz rated, and to produce a 48V buck converter dc output [16].

C. Fast Charging Based on Hybrid Energy Storage System

When vehicles accelerate or brake, the various need full things for providing or absorbing large amounts of energy for storage. Maximum power should not be delivered directly to the battery because this will affect the life cycle of the battery, considering the parameters. For the movement, supercapacitors are well-suited to high-power, high-efficiency applications. The primary concept behind a HESS is to use a combination of supercapacitors and batteries to improve overall performance.

The battery gets fully charged then the electrons pass through the external circuit from A to K (anode to cathode) In the electrolyte, the transport of electrons results in the formation of ionized particles Cations and anions in the electrolyte produce electric double layers, which cause an over potential to be forcefully implemented on the voltage of the battery, obstructing the charging process and lowering charging efficiency.

Pulse charging is gradually replacing conventional continuous current charging to avoid concentration polarization and increase crystal formation variability. Between pulses, an appropriate ion and crystal diffusion period is supplied to avoid the possibility of polarization and enhance efficiency.[17]

Due to its high predictability and availability, solar energy is the large form of renewable energy that has garnered worldwide acceptance. Using photovoltaic (PV) modules, converting solar energy to electrical energy is one method of harnessing it. When connecting devices to a PV module, one issue is that it acts as a current source when the O/P current flow is high and like a voltage source when the O/P current is low.

A PV simulator is a device with output characteristics that are identical to those of a real PV module. It can be utilized at any time of the year in a lab. A few ways for simulating an actual PV module have been developed. The first approach involves using analog circuitry to enhance the output of a PV cell or photodiode. This necessitates the employment of a gadget capable of generating or simulating natural sunshine. The second option is to use transistors and resistive networks to create a PV module equivalent circuit.[18]

With the development of electric cars, the automobile industry is transitioning away from traditional gasoline-powered autos (EVs). As a result, EV charging demand is gradually growing, and various types of electric vehicle charging stations (EVCSs) for commercial and residential usage are being installed to meet this need. This interdependence of electric vehicles, charging stations, and power grids create complicated cyber-physical interdependencies that may be utilized maliciously to disrupt each of these components.

The article examines and analyses cyber threats that develop at this juncture, as well as current and emerging weaknesses in the EV charging ecosystem's security. As electric vehicles increase in number throughout the world then the impact on the power grid is more viable. The goal of this article is to compile a list of all backdoors that could be used to cause substantial harm to either EV and EVCS equipment, the power grid, or both. The problems and challenges described here are intended to stimulate research into smart EV charging cyber security and enhance power grid resilience to demand-side cyber assaults in general. [19]

The fast growth of electric vehicles has accelerated the development of charging infrastructure. Meanwhile, smart charging station security risks are getting increasingly significant. We examine the construction of the charging system as well as protocols that connect electric vehicles and charging stations in this study. additionally, we discuss the charging station system's security difficulties and challenges, including the charging protocol, TCU connectivity, as well as contact between the charging station and the vehicle communication platform Our work is the first realistic and thorough security examination of a smart charging station system for electric vehicles that we are aware of.[20]

This paper discusses the electric vehicle design and development of hybrid charging stations. The charging station is powered by a combination of solar and grid electricity. The system is designed to operate together to optimize grid energy utilization. When solar energy is available, the system will use it to charge the electric vehicle immediately. The system will be powered by the grid if solar energy is not available. When solar electricity is available but no EV is connected to the charging system, the system will also power the grid with solar power.

A transformer is normally used to feed low voltage solar power to the grid. but in this study, the transformer is replaced with an advanced high gain boost converter. This change cuts the overall system cost and size significantly. This article includes extensive simulation data to determine the effectiveness of the developed hybrid charging stations.[21]

This research aims to reduce the cost of EV battery charging deterioration while maintaining battery charging characteristics in a charging system. First, we create the system's performing model, taking into account the needs of both clients and the parking garage. Then, to capture the battery performance characteristic decline during the charging process, a battery degradation cost model is designed. The EV charging scheduling problem is investigated and a cost minimization problem is defined using the existing battery deterioration cost model.

We study the problem's characteristics and break it down into two sub-problems to make it tractable. To attain the best cost-minimization solution, an unoccupied provides a charging resource allocation technique as well as a dynamic power adjustment algorithm. To test the effectiveness and application of the suggested approaches in the discussed charging scenarios, several simulations are performed using actual EV charging parameters. When compared to other benchmark methods, simulation results show that the suggested algorithms achieve the highest degradation cost reduction for the consumers, and charging operators benefit from the lowest peak electricity load.[22]

Existing techniques for estimating electric vehicle (EV) used in the large-scale sector, charging needs to have taken into account a variety of parameters, as well as EV traffic data and EV power battery data. Based on the EV battery specifications and the probability density functions of the EV arrival time and driving distance, the EV charging loads were studied in depth in this work. The findings of large-scale EV charging loads were then calculated using various EV battery specifications. The findings of the investigation suggest that Electric vehicle power usage per 100 km is the most important factor impacting charging loads. Despite our expectations, the EV charging power has been rated as only a minor impact on EV charging on a big scale.[23]

A control technique is provided for a three-level single-phase rectifier with a high-power factor and low line current harmonic distortion in complete. A hysteresis current comparator is used to manage the line current following the line current command. The suggested three-level rectifier control technique has the following advantages: 1) Each power device has a low blocking voltage.; 2) harmonic content is low, and 3) a large power factor. The control technique uses a line voltage rectified region detector, hysteresis current comparator, and capacitor compensator. The suggested technology achieves good three-level rectifier steady-state performance, according to research outcomes from a laboratory prototype, which match the theoretical results.[24]

To reduce the lithium-ion battery charging time, a built-in resistance compensator (BRC) technique is given. To provide a smooth transition from the constant-current (CC) to the constant-voltage (CV) stage, a smooth control circuit (SCC) is proposed. The charger circuit moves from the CC to the CV stage without fully charging the cell because of the Li-ion battery-pack system's external parasitic resistance. To lengthen the CC stage, the BRC approach dynamically evaluates the external resistance. The testing results demonstrate that the CC stage's duration can be increased by 40% over the original design. The CV stage's deteriorating current squanders a lot of time when it comes to fully charge the battery. Because of the greater charging current, the BRC approach can obtain a virtually full charge at the CC stage but not during the CV stage.[25]

The characteristics of a battery cell made with lithium-ion that meets the "18650" dimension requirement and forms the In this study, the battery pack of a hybrid car is determined. The test equipment is ready to measure the instantaneous current, open circuit voltage, and circuit voltage of the battery cell while charging and discharging. On the test setup, the battery cell is regularly charged and discharged, and voltage, current, and open circuit voltage measurements are acquired. Internal resistance and efficiency values are computed using the "Equivalent circuit" and "Rint technique" based on the test results and the condition of the battery charge ratio. When the battery cell charge level is between 15% and 95%, the average internal resistance value is 51,452 m Ohm while discharging and 57,48 m Ohm during charging. It was also discovered that if the typical efficiency is between 15% and 95% of the battery cell charge level. when discharging (1A) is 98.58 percent and during charging is 98.496 percent (1A).[26]

D. Electric vehicles

All of the batteries take a long time to recharge for different reasons. Charging is accompanied by the evolution of gas in some types, and it must be done slowly enough for the gas to

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recombine as quickly as it is formed. Overheating is a major issue for others. Those figures do not imply that electric vehicles are either impossible or impractical. The electric automobile stands a fair chance of becoming a key part of the transportation landscape this time around. Many specifics are still up in the air, but automakers all over the world are preparing to sell electric vehicles in significant numbers by the end of this decade [27].

Plug-in rechargeable battery packs, as well as capacitors and flywheels, are commonly used to generate energy. The charging procedure is the same as for PHEVs. The three basic systems of BEVs are the electric motor, battery pack, and power controller. BLDC, PMSM, and, in rare cases, AC electric machines can now power a BEV [28].

As the number of electric vehicles in use grows, so that the demand for EV chargers. At the same time, EVs will not charge for the duration of their stay at public charging stations or at work. This suggests that the charging infrastructure for electric vehicles is underutilized. This report concentrates on five technologies that will be critical in this regard: EV charging from photovoltaic panels, smart charging, and vehicle to grid. By 2030, (500,000,000) electric automobiles (EVs) are predicted to be on the road. Electric vehicle charging technology and infrastructure will be critical enablers for this mobility shift [29].

Apart from charging large amounts of renewable energy EVs, fast charging stations can become a practical and grid-friendly alternative. Even while huge rapid charging stations require minimal area, they are an excellent way for cities to charge a big number of electric vehicles. Companies are currently concentrating on fast charging (> 150 kW). The Power flow management in a meshed HVDC grid is a serious concern. Several questions have been raised about the negative impact of fast charging on the electrical national grid. Scientific advancements and inventions continue to drive modern society forward. In the realm of electric vehicles (EVs), research and development are often necessary. There is a need for research to replace gasoline vehicles for a variety of reasons, including environmental effects, sustainable development, and so on.[30]

An internal battery charger is proposed for an electric scooter using Li-Ion batteries and an Interior-Permanent-Magnet (IPM) traction motor. The battery charger is included in the scooter's power hardware, along with the IPM traction motor, which acts as a three-phase dc-dc converter with Power Factor Correction (PFC) functionality. The Battery Management System included in the battery pack controls both current and voltage-controlled battery charging. In comparison to other onboard chargers, the alternating current is absorbed in a unitary power factor with low harmonic distortion and no extra filtering is required. because the PWM ripple is reduced by interleaving the converter's three phases other types of motors (IM, SMPM) are also considered and commented on.[31]

An integrated battery charger is proposed for an electric scooter using li-on batteries and an Interior-Permanent-Magnet (IPM) traction motor. The battery charger is built into the scooter's power hardware, alongside the IPM traction drive, which acts as a 3-phase dc to dc converter with PFC capabilities. The traction control code, which is carried out using a DSP fixed-point controller, also includes the PFC battery charger's command. The Battery Management System (BMS), which is incorporated in the battery pack, control Battery charging with current and voltage control. In comparison to other onboard chargers, no filtering is necessary since the alternating current is absorbed in a unitary power factor with no harmonic distortion. The suggested control algorithm for a three-battery model is designed in a dynamic simulation environment and confirmed on an equivalent experimental configuration [32].

The use of power grid and utensil charging in electric car charging for safety is investigated. the author tries to enhance the structural design in the manner of safe charging based on multiple charging modalities. In the future, electric vehicles will be connected to the power grid, and charging safety will be a priority. It examines charging equipment structure and introduces safe charging techniques in 2 areas: Safety of power grid charging and safety of device charging. The viability of improving electricity quality on the charging part of electric vehicles is investigated, and an ideal solution plan for safely charging electric vehicles in the power grid is proposed. The heat management system can efficiently regulate the battery system's internal temperature based on measurement data and battery usage conditions, allowing the battery charging and discharging operation to take place in an appropriate temperature range. Cumulative high and low-temperature activities produce battery hazards that should be avoided [33].

A charger for an electric vehicle (EV), also known as an Electric Vehicle Charging Station (EVCS), is a piece of the framework that provides electricity for charging electric vehicles. The article focuses on the development and production of devices that are used to charge EVs. for two-wheelers (escooters). The outline analyses the design of the product based on fabric ability, affordability, and mass manufacturing ability, taking into account. The suggested open charge point protocol serves as the foundation for the design and adheres to Level 2 charging requirements (240 volts) (OCPP). The suggested EVCS is designed with system managers, installers, consumers, government agencies, and other stakeholders in mind. Three industries are involved in the design of EVCS: equipment makers, software developers, and electric power networks. This paper discusses considerations for design by delving into the protocols, software and hardware, used to create the EVCS Level two charging protocol [34].

This paper summarizes the findings and suggestions of an electric bicycle (e-bike) evaluation project that took place in four Canadian cities. The main goal of the study was to assess the safety of e-bikes so that authorities could make appropriate restrictions. The project's developer, the Centre for Electric Vehicle Experimentation in Quebec (CEVEQ), enlisted the help of a number of partners and bicycle manufacturers to achieve this goal. E-bikes are divided into two groups. Electrically assisted and propelled bicycles were used, with a total of 55 e-bikes made available to 369 participants for testing. Participants in Quebec were required to ride their bicycles to work for two weeks and were also permitted to use them for recreational purposes [35].

While transportation electrification offers enormous promise for addressing the global pollution problem, market penetration of plug-in electric vehicles (PEVs) has been exceedingly low. In this study, we provide a smart charging approach for a PEV network that incorporates AC level 2 charging, DC fast charging, and power storage capabilities at charging stations. The topic of locating the optimal charging station for a PEV is approached as a multi-objective optimization problem, with the goal of locating a station that assures the shortest charging time, trip duration, and charging cost. We extend the concept to a meta-heuristic solution via ant colony optimization. According to simulation findings, the suggested approach significantly reduces waiting for time and charge expenses [36].

The goal of this study was to evaluate EV users' motives, daily activities, and vehicle management and operation. The concept was pushed by EMEL, it was publicized among the city's electric car owners by Lisbon's mobility and parking management agency, which was given a green that permitted people to park for free in the metropolitan area of the city center region as an incentive. Over the course of a year, through interviews and onboard diaries, data was obtained from 25 customers (private and fleet drivers) [37].

We are concerned about the world's expanding energy consumption; it encourages us to switch to green technologies (renewable energy). There are different ways to save energy in various sectors. Our main focus is on the automotive world, where we transform old gasoline motorcycles into electric bikes. In these electric bikes, we use an electric motor (BLDC motor) rather than a combustion engine since it emits less pollution, requires less maintenance, and makes less noise. These bikes are powered by the chemical energy contained in rechargeable battery packs. The purpose of this article is to discuss the design and development of an electric bike that runs on electricity as its primary energy source. [38]

India is the world's 2nd largest producer and manufacturer of two-wheelers. In terms of two-wheeler production and domestic sales, it ranks third behind Japan and China. In recent years, the Indian two-wheeler industry has experienced phenomenal expansion. The auto sector, which was forever changed by the advent of fuel-efficient technology, is about to enter a new era in the two-wheeler industry. Electric motorcycles and mopeds are popular modes of mobility in industrialized countries such as The United States, China, and Japan and the Indian two-wheeler sector has welcomed the new concept. The components of an electric two-wheeler will be described in this article, including the battery, charger, BLDC motor, controller, and dc-dc converter [39].

Consumer awareness and outreach operations for electric vehicles are among the best in the world. It examines the research on the relevance of consumer awareness and provides best practices in electric car markets around the world. Although the primary emphasis of this study is on how initiatives to raise awareness and knowledge may impact electric car adoption, It should be noted that a wide range of promotional actions is available. (For example, financial and non-financial incentives, deployment of charging infrastructure, high model availability, initiatives to raise awareness and understanding, and others.) are critical to growing the market. Our discussion is completed with the following findings on electric car consumer awareness activities [40].

III. FRAMEWORK OF THE PARALLEL CHARGING SYSTEM

EVs are the essential equipment to avoid the fuel crisis and to save natural renewable resources but EVs are not adopted by people as expected, because there are a few issues with it one of them is charging time, a normal 2.2 kWh battery requires 5 hr to charge and gives a range of 130-150 km but our method will increase the charging time by 75 % faster, hearer our technique requires 1.25 hr to charge the same capacity battery

In a technologically advancing world, we use to upgrade ourselves for the future of the automotive, to safeguard our environment for our next generations by avoiding pollution as much as possible

To avoid the pollution of 32% caused by conventional automobiles and to reduce the nitrogen oxide, carbon monoxide, and hydrocarbons in the air. The existing dc fast charging method will use the higher current to charge fast along with it they use BMS (battery management system) to protect the battery from low cut-off voltage & higher voltages and also by preventing overcharging.

But our approach is slightly different from this method hear we change the charging technique; the battery is divided into different individual cells. While charging the cells they are connected in parallel with the charger and while the battery is in use, they will connect together with all batteries to form a single battery, this can be achieved using the RELAY or SCR.

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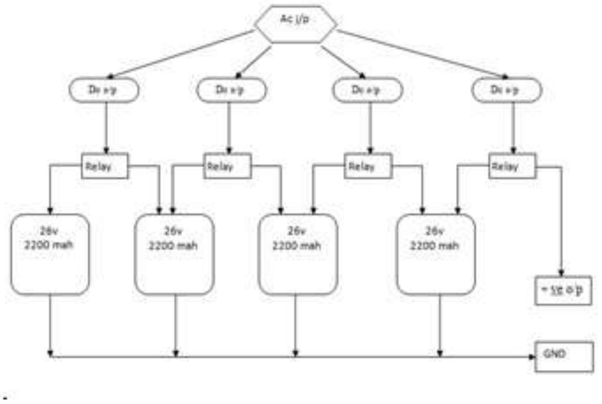

Fig. 1. Block diagram of cell splitting

In this technique we divide the 8.8 Ah battery (for example) into 4 different parts and charge each 2.2 Ah battery simultaneously then the charging time will be reduced to 75% faster compared to conventional charging. In the old charging method, they use to charge the whole 26v, 8.8Ah.=228.8 whr battery at a time with single charge but we divide batter into 4 part each of 57.2 whr so technically the time required to charge 57.2 whr, is very less

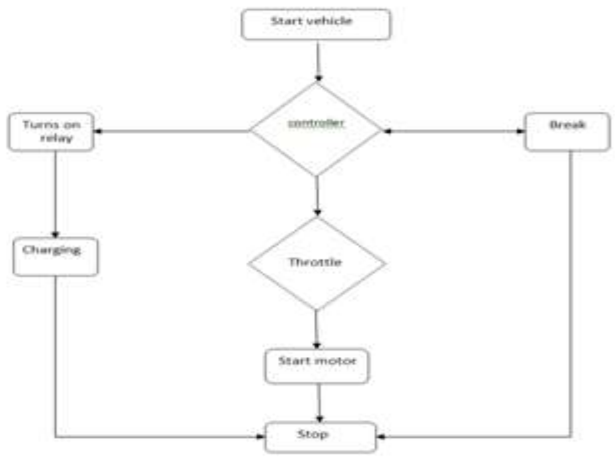

Fig. 2. Flowchart of electric vehicle working.

Initially, if we turn on the key then the whole system is turned on, the indicator will indicate the battery levels if there is enough power in the battery then the motor will run according to throttle. If suppose there is not enough power in the battery then it will indicate to charge the battery. Once the microcontroller (Arduino) turns on the relay then the charging modules will connect to corresponding battery terminals and starts charging here both the battery and chargers are custom designed according to requirements. If suppose the user applies the break then the motor control unit will stop the flow of voltage to the motor and stops the motor.

IV. RESULTS AND DISCUSSIONS

Example (Conventional charger)
Assume we need to charge a li-on battery in 1/2hr. As a result, our required wattage is 228.8 w.hr. According to the preceding condition, charger watt is calculated by = 228.8 w.hr ÷ 0.5 hr = 457.6w
As a result, the charger's current rating = 457.6w ÷ 26v = 17.6 A
To charge according to the above computation 26v, 8800 Ah battery in 0.5hr We must have **26v, 17.6 A** charger.

Expected result (parallel fast charging)
In our parallel fast charging method, we divide the hole 228.8 w.hr battery into 4 parts each of 57.2 w.hr (228.2/4)
57.2÷0.5=114.4 w.hr
114.4÷26=4.4 A
To charge according to the above computation 26v, 8800 Ah battery in 0.5hr We must have **26v, 4.4 A** charger of 4 units. (26v,4.4A)*4
Specifications for the battery
Voltage Rating = 26 v, Current Rating = 8.8 Ah
So, Battery wattage = Voltage Rating * Current Rating = 26 × 8.8 = 228.8 wh(watt.hr.)

V. CONCLUSION

Fuel vehicle usage is fast increasing these days, resulting in increased air pollution. To prevent this, electric scooters must be used since they have various advantages, such as being an environmentally friendly product, being more appropriate for cities because they may avoid the production of dangerous gases, and therefore reducing pollution. Due to the steady rise in fuel prices, an electric automobile is seen as the most cost-effective alternative when compared to a conventional vehicle. E-scooters are more suited to remote areas with few petrol outlets since they allow residents to charge their vehicles with electricity The electric bike's most important characteristic is that it does not use fossil fuels, saving billions of dollars in the process. The second most essential advantage is that it is pollution-free, environmentally beneficial, and silent when in use. The most realistic method for reducing pollution is to ride an electric bike on the road. If there is an emergency, it may be charged using an AC adaptor. The operating cost per kilometer is quite low, and it may be further reduced with the use of solar panels. It can be readily broken into little components since it has fewer components, and needs less maintenance.

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