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ELECTRIC VEHICLE CHARGING SYSTEM

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Abstract: Technological advancements always played a major role in transforming the automobiles; From hand-pulled carts to autonomous cars. The fuel powered vehicles are one of the greatest inventions the world has ever seen, but the negative impact caused by them on the environment has laid a new path for the invention of Electric Vehicles. The electric vehicles are emission less vehicles that are powered and run-on electricity solely. Like fuel pumps, these EV's require charging stations. This work provides infrastructure and maintenance of charging station. Charging stations have been installed in various parts of the world till date. Level 1, Level 2 and fast EV charging stations have been installed in various places respectively. Detailed infrastructure report on installation and maintenance is required. Maintenance is required for any EV charging station to run efficiently. The various factors which effect the efficiency of charging stations are frequency of usage, climatic conditions, exposure of charring unit to atmosphere. This work provides detailed overview of various power options, technologies, energy management techniques and maintained of charging stations that are optimal for the Indian market.

Keywords: Arduino UNO, Fast charging, RFID, Relays

I. INTRODUCTION

Electric vehicles are attracting the attention of consumers in various countries as this technology is advancing. It is envisaged a large-scale adoption of non-combustion engine vehicles to address the CO2 emissions and environmental concerns. These vehicles are either pure electric vehicles (EV), plug-in hybrid electric vehicles (PHEV), or extended-range electric vehicles (EREV). With the growth in electric vehicle industry, the need for the design and implementation of secure and reliable charging stations for public use is necessary. A smart electric vehicle charging station is considered a critical infrastructure that functions like a fuel station for a combustion engine vehicle and smart grid. These smart stations are computerized and connected through interoperable network systems which this trait places them in the vulnerable subset category with data privacy and security implications. Same as a smart grid with a great technological revolution, multiple threats can allow a malicious factor to elevate privilege. These threats are including, but not limited to harming the confidentiality, integrity, and availability of user and system information. These activities can be achieved maliciously through the actual physical interfaces connecting the electric vehicle to the charging station or wireless communication link for either billing or metering systems.

II. PROBLEM STATEMENT

The previously proposed systems prove to be effective and yet lack in several factors. In India, most of the electric vehicle charging systems are Level 1 and level 2, which consumes a lot of time and lacks user-friendly necessities in few factors. This proof of model is proposed, which provisions comparatively faster charging, facilitating the user for a less wait-time and a secure system. This includes the minimization of total costs associated with EV charging stations to be planned, including the investment costs, operation costs, maintenance costs, and network loss costs in the planning period.

III. LITERATURE SURVEY

The optimal planning of EV charging stations is becoming a big problem to be resolved. EVs cannot only increase energy utilization and reduce pollution emission, but also smooth the load curve by peak load shaving and, hence, enhance the safety and economics of the facility system concerned by coordinating with intermittent renewable energies, like wind power . However, inappropriate siting and sizing of EV charging stations could have negative effects on the event of EVs, the layout of the traffic network during a city concerned, and therefore the convenience of EV drivers. It could also cause a rise in network losses and degradation in voltage profiles at some nodes. [1]

EV charging stations is split into 3 stages (i.e., the demonstration stage, public promotional stage, and business utilization stage). Then, associate degree improvement model for the planning of EV charging stations is planned with the interval distance magnitude relation, charging capability redundancy, and charging power redundancy thought the

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feasibleness of optimally utilizing the potential of the Ontario's grid for charging plugin hybrid EVs (PHEVs) is analyzed for off-peak load periods by using a simplified zonal model of the Ontario's electrical transmission network and a zonal pattern of base-load generation capacities for the years from 2009 to 2025. Environmentally and economically property integration of PHEVs into an influence system is self-addressed beneath a robust optimization coming up with method framework with the constraints of the power system and thus the transport sector taken into account. A smart load-management approach for coordinating multiple plug-in EVs chargers in distribution systems is planned, with the objectives of shaving peak demand, up voltage profile and minimizing power losses conjointly as a result of the impact of EVs charging stations and typical daily residential loading patterns thought-about as constraints a reduced price model for crucial the locations and capacities of charging stations for regional EVs is developed considering some constraints, just like the distances between the station and candidate locations of work unit charging substations, the number of EVs, and thus the put in prices of work unit charging stations. [2]

As the electric vehicle industry is growing, the security concerns for public charging stations are increasing for both manufacturers and consumers. A robust, well- uniformed process is essential to assess and enhance the current security measures and offer an executable mitigation plan. Security assessments of potential vulnerabilities should be performed more frequently due to technology changes as well as various parts being integrated into the infrastructure of both electric vehicle and charging station without security been considered. This paper discusses the implementation of the multi-layer authentication using ANPR and Loop technologies to provide an in-depth security and mitigate the cyber-attack risks for electric vehicle charging stations. [3]

Such high-wattage demand-side appliances as Plug-in Electric Vehicles (PEVs) are proliferating. As a result, information on the charging patterns of PEVs is becoming accessible via smartphone applications, which aggregate real-time availability and historical usage of public PEV charging stations. This paper unveils a demand-side cyberattack that can imperil the power grid operations using PEVs and EVCS infrastructure. The attack uses publicly available EVCS and power grid data to design a data-driven attack strategy that can destabilize the power grid using partial eigenvalue relocation. Even though the current PEV penetration does not seem feasible to hamper the power grid stability, it highlights an emerging vulnerability as more PEVs are rolled out, which drives the need for high-capacity EVCSs and leads to more PEVs charged simultaneously. [4]

This project has evaluated the technologies and standards associated with Electric Vehicle Service Equipment (EVSE) and the related infrastructure, and the major cost issue related to electric vehicle (EV) charging -- the cost of utility power. The technology assessment report evaluated safety standards for infrastructure, highway and vehicles and the barriers and challenges of deploying an expanded network of EV charging stations. The report also made recommendations to help standardize and expedite EVSE infrastructure and charging network deployment. However, if the EVSE is properly managed, the EV "re-fueling" costs can be minimized. Methods to minimize the demand loads and resulting costs are presented for commercial building account environments and provide guidance to the proper use and management of EVSE equipment. [5]

Abstract Electric vehicles (EVs) represent one of the most promising technologies to green the transportation systems. An important issue is that high penetration of EVs brings heavy electricity demand to the power grid. One effective way to alleviate the impact is to integrate local power generation such as renewable energy sources (RESs) into charging infrastructure. Because of the intermittent and indispatchable nature of RESs, it becomes very challenging to coordinate EVs charging with other grid load and renewable generation. In this paper, EVs charging problem in the presence of smart grid technologies is investigated, and the interaction with renewable energy is reviewed. An overview about EVs and RESs is first presented, which mainly introduces major types of EVs and renewable energy estimation methods. Then, according to the objectives, the existing research works are divided into three categories: cost-aware, efficiency-aware, and emissions-aware interactions between EVs and RESs. [6]

This paper presents an overview of the existing and proposed EV charging technologies in terms of converter topologies, power levels, power flow directions and charging control strategies. An overview of the main charging methods is presented as well, particularly the goal is to highlight an effective and fast charging technique for lithium ions batteries concerning prolonging cell cycle life and retaining high charging efficiency. The charging strategies based on electrochemical models, considering the internal dynamics of the battery, also consider the aging of the battery and other constraints, hence resulting in greater accuracy and. All this is at the expense of cost and computational difficulty. [7]

This proposed Smart Electric Vehicle Charging System uses Vehicle-to-Grid (V2G) technology, in order to connect Electric Vehicles and also renewable energy sources to Smart Grids (SG). It is advantageous as this system explores the new paradigm of Electrical Markets (EM), with deregulation of electricity production and use, to obtain the best conditions for commercializing electrical energy. In this work is proposed the design of a system to create and handle Electric Vehicles (EV) charging procedures, based on intelligent process. [8]

This paper describes a method for modeling the impact of increasing PHEV charging loads on the medium voltage electrical distribution infrastructure. The model is applied to circuit data from a distribution utility in Vermont. While their results are preliminary, and some modeling work remains for future work, they indicate that the deployment of PHEVs in a distribution circuit will have diverse effects on the distribution infrastructure. Careful modeling of these impacts can be valuable in the development of utility operations and maintenance plans given potential increases in demand due to PHEV or EV deployment. [9]

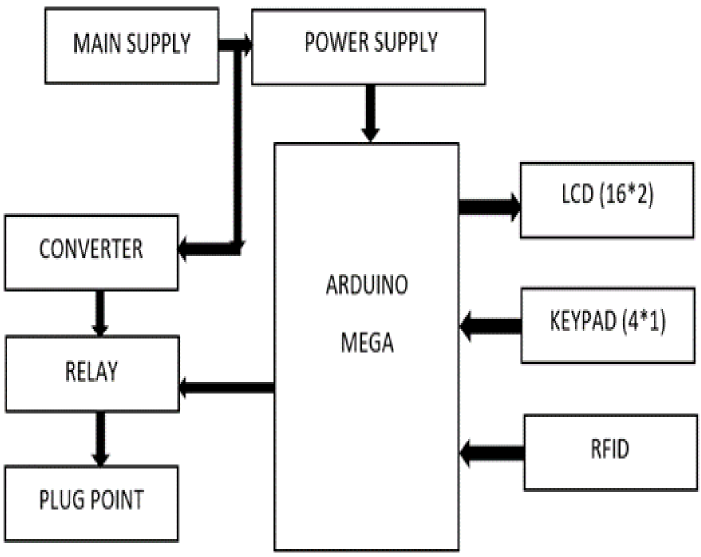
The technical challenges related to the market penetration of electric vehicles (EVs) in low voltage (LV) distribution networks are addressed. Steady state voltage profile of LV networks under different EV aggregation levels and penetration scenarios is investigated. A UK generic LV distribution network model and load demand figures from the electricity association were used to simulate EV impact on LV urban radial networks. Mainly, results show that the voltage profile is dependent on the aggregation level of EV and on the connection point. For 96 customers' equivalent aggregation of EV connection points, the voltage statutory limits are maintained. For low level of aggregation, equivalent to 24 customers, the voltage profile proves onerous. [10]

IV. METHODOLOGY

This Electric vehicle charging system is powered by the external power supply from the mains. The Electric Vehicle is connected to AC power, 120V or 240V, and a battery charger in the EV converts the AC power to the DC needed to charge the battery and controls the charging process. The input voltages for the various levels of charging stations like Level 1, Level 2 and Level 3, level 1 uses 110-120V, level 2 uses 208/240V and DC fast chargers i.e., Level 3 uses 200-600V. The Arduino Mega is the controller of the entire prototype, as all the functioning components are interfaced to it. The RFID reader and the keypad is taken as the input to the system. The RFID reader scans the card, and displays the information about the card holder, the vehicle, and the cash details on the 16*2 LCD display. This also acts as a secure system, as the person with the card will be authorized and only then, he/she will be allowed to charge the vehicle securely. The keypad in the system, is used to choose the timings for charging, say 5mins charging, half hour charging, 1 hour or fast charging and so on. The charging unit charges the vehicle based on the requirements or the timings chosen by the user on the keypad. We will be equipping the charging unit with fast charging circuit, which cuts down on charging time. The Wi-Fi module is interfaced to the system, to keep the database of the EV charging system as well as the User's card updated with charging and cost information.

V. BLOCK DIAGRAM

The entire system is powered by the power supply. Step down transformer is incorporated in the circuit to obtain 5V 1A supply. The AC is converted to DC using the rectifier circuit.



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We use the booster circuit which is the fast-charging circuit, where the current is increased. The Arduino UNO serves as the system's controller, with which all the system's working components are connected. The RFID reader is incorporated to scan the card and display the details on the LCD screen. The system includes a keypad that allows the user to select the appropriate charging timing based on their needs. In the charging unit, the relay charges the vehicle according to the user's chosen timing.

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