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REVIEW ON DESIGN OF INTELLIGENT CHARGING STATION FOR ELECTRICAL VEHICLES.

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ABSTRACT

Electrical vehicles (EVs) promote environmental protection and energy conservation due to their growing used. Plug-in electric vehicles (PEVs) powered by electricity from low carbon emission grids can provide significant benefits in terms of reducing the climate impact from transportation and minimizing transport grid's reliance on oil-based fuels. PEVs provide a cleaner and quieter environment; reduce operating costs at the same time. A careful selection of charging location and capacity of charging stations is the first step in planning the accommodation of large set of EVs. However this doesn't solve the problem fully and hence for day to day operations intelligent charging of EVs is essential. In less than half hour electric vehicles (EV) can fully charge by connecting the fast charging stations at electric grid. Charging strategy applied in large charging stations for PEVs (plug-in electric vehicles) using a smart algorithm, for the purpose of improving operational efficiency and meeting customer need.

Keywords: *electric vehicles (EVs), Plug-in electric vehicles (PEVs),Particle Swarm Optimization.*

I. INTRODUCTION

In recent years, PEVs (plug-in electric vehicles) and PEV charging stations have been rapidly developed for energy conservation. However, large scale of PEVs penetrating into the market will cause grid instability. For example, the aggregated load in a municipal parking station needs to be managed in order to avoid "peak plus peak" phenomenon when several thousand PEVs are introduced into the system over a short period of time (e.g., during the evening hours when people go back home). As a result, charging behavior control of PEVs is needed

.Researches on PEV issue mainly focus on rational organization of the charging power assigned to each vehicle to limit the total power to reduce the impact on the grid, improve power quality ,improve revenue of the charging station operators under the premise of considering the real-time pricing, to improve the charging efficiency, etc. Plug-in electric vehicles (PEVs) powered by electricity from low carbon emission grids can provide significant benefits in terms of reducing the climate impact from transportation and minimizing transport grid's reliance on oil-based fuels. PEVs provide a cleaner and quieter environment, and reduce operating costs at the same time. Due to their usage pattern in urban areas, PEVs can potentially operate as flexible electric loads to support the operation of power systems and the integration of renewable energy sources. The vision of using parked PEVs as storage devices for renewable energy has also attracted increasing interest in recent years. Although PEVs are considered to be an important part of the next generation smart grid system, their market penetration is still relatively low and faces a number of challenges. Firstly, drivers' range anxiety is a key issue which must be managed by organizing better communication with the smart grid interface, to facilitate timely and fast recharging at public charging stations. Secondly, uncoordinated charging strategies in a limited charging infrastructure can increase the average recharge time and contribute to an increase in peak loads. Currently, charging infrastructures are not widely available in all major cities, and because of long waiting times at charging stations, the recharging process can cause significant delays.

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Since charging optimization strategy in a charging station, certain restrictions of the total charging power must be given. Then algorithm to decide charging order and assign charging power to each PEV. The main problem to be solved is to maximize customer satisfaction under the real-time total power limit, while to improve the overall charging process efficiency of the station.

[1]Distribution network operators (DNOs) require appraisal apparatuses on the exchange offs plug-in hybrid vehicle (PHEV) innovation will have on their benefits. This paper utilizes a time coordinated optimal power flow (TCOPF) definition to demonstrate that, through the control of PHEV stockpiling units and tap changers (OLTCs), electric system administrators can impact investment funds in vitality misfortunes. Contextual analyses are performed in which PHEV units are compelled by different charging and releasing techniques. Results demonstrate how DNOs can esteem the capacity accessible in their systems by the manner in which it is dispatched for each time interim. The capacity assets farthest far from the lattice supply point (GSP) are overseen all the more deliberately because of their more prominent capacity to diminish transmission misfortunes at snapshots of pinnacle request. The TCOPF instrument offers a new point of view for partners wishing to assess the effects PHEVs can have on operational viewpoints, for example, stack profile variety, vitality misfortune decrease, and pinnacle shaving.

This paper has point by point a TCOPF show that tends to the ideal way in which PHEV units and OLTC gadgets can be composed to enhance organize task. The arrangement of conditions used to speak to PHEV stockpiling gadgets at an accumulated level are exhibited. The capacity administration conditions are incorporated into the model and tackled as an improvement issue to evaluate how control gadgets can impact vitality misfortunes. The issue is coded and comprehended by playing out a piecewise time non-direct enhancement utilizing the PROMS TM programming bundle. Contextual analyses are performed in dispersion systems fluctuating the entrance of both installed advances and the charging situations of the PHEV units. The re-enactments show the productivity and curiosity with which the TCOPF device facilitates the control gadgets so as to enhance the conveyance of vitality. Yields from the apparatus demonstrate an expansion in the base load and a decrease of the pinnacle request. Consequently, the investment funds in vitality misfortunes is impressive. Moreover, the outcomes depict early signs of how ideal activity of PHEV gadgets can be pictured. This implies in hubs far from the slack transport, G2V task will occur at snapshots of low interest, while the V2G will happen at snapshots of pinnacle request. Thus, control misfortune decrease is invigorated by limiting influence exchanges from the slack to the peripheral hubs in the framework when influence request is high. Conversely, the capacity accessible in the hubs closer to the GSP does not have as vast an effect as in whatever remains of the hubs.

[2]Plug-in Electric Vehicle (PEV)charging stations couple future transportation frameworks and power frameworks. That is, PEV driving and charging conduct will impact the two systems at the same time. This paper thinks about ideal arranging of PEV quick charging stations thinking about the associations between the transportation and electrical systems. The geological focused on arranging region is a roadway transportation organize fuelled by a high voltage circulation arrange. To start with, we propose the capacitated-flow refuelling location model (CFRLM) to unequivocally catch PEV charging requests on the transportation organize under driving reach requirements. Then, a mixed-integer linear programming (MILP) display is defined for PEV quick charging station arranging considering both transportation and electrical imperatives in light of CFRLM, which can be explained by deterministic branch-and-bound strategies. Numerical tests are led to delineate the proposed arranging technique. The impacts of PEV populace, control framework security task requirements, and PEV run are investigated.

This paper examines PEV quick charging station sitting by considering the coupled connections between the transportation and power systems. CFRLM is proposed to expressly consolidate PEV driving extent and OD activity stream to appraise PEV charging request. What's more, M=M=s lining is embraced to demonstrate each charging station's administration capacity. A blended whole number straight programming (MILP) show for the arranging of PEV quick charging stations in coupled transportation and high voltage conveyance systems is proposed, utilizing the CFRLM. We consolidate circulation organize security activity requirements. Numerical examinations outline the viability of the proposed technique. Different sensitivities, for example, PEV populace, line limit, driving reach, landing and flight SoCs, and system granularity have outstanding effects on the ideal arranging results.

[3]In this paper, we proposed a smart charging strategy for a PEV network that offers multiple charging options at charging stations. Just as traditional gas stations have different capacities and pricing options, charging stations can have different capacities and pricing options, and the recharge price for each option can vary from one station to another. In a scenario like this, it is important to adopt a charging strategy that identifies the most suitable charging station for a PEV user, so that the user can recharge at the minimum cost and reach his/her destination without a significant delay. We modelled the research challenge as a multi-objective optimization problem where the goal was to reduce the charging time, travel time and charging cost. We used a queuing model to estimate the delay at various charging stations. To mitigate the challenge of longer waiting times and the potential overlap between the peak PEV and residential load periods, we also introduced the concept of partial charging. We showed that pricing could be used as a useful tool to encourage PEV drivers to choose the partial charging option during peak load hours. In light of the significant time complexity of the optimization solution, we solved the research problem by introducing an ACO-based meta-heuristic solution. The simulation results confirm that the proposed solution significantly reduces the average charging delay (up to 25%) and cost (up to 15%). In our future work, we will investigate the optimum dynamic pricing model to minimize the overlap between the peak PEV and residential.

[4]Plug-in electric vehicles play a vital role in countries future transportation. This paper presents a fast DC off-board charging station for plug-in electric vehicle. Charging station would be On-board and Off-board. For the charging of rechargeable batteries charger component is important. A DC level-1 off-board electric vehicle charging station that can employ multiple EV charging is presented. In this paper V-Control is implemented in the front end AC-DC converter provides power exchange between AC grid and DC bus. P-Control is implemented in back-end DC–DC converter.

Constant current/Reduced constant current is utilized in the P Control in order to avoid some of the issues in the constant V Control. V-Control maintains the DC link voltage constant and also regulates the grid voltage. Battery Management System controls the charging current, voltage, temperature etc of the battery. The proposed works look into the grid to vehicle mode (G2V). Simulations are done in MATLAB/SIMULINK. DC level-1 off-board charging station that can employ multiple EV. V-Control (Voltage regulation control) is implemented in the front end AC-DC CONVERTER provides power exchange between AC grid and DC bus. P Control is implemented in back-end DC–DCCONVERTER. Constant current/Reduced constant current is utilized in the P-Control in order to avoid some off the issues in the constant V-Control. The modelling of each element and the implementation in Matlab/Simulink model is also explained. The DC bus voltages, Battery voltages are steady ones. The SOC of the battery for different charging current is also shown. Results shows that charging time of the battery is reduced with the variation in the charging current.

[5]There is expected to be a large penetration of Plug in Hybrid Electric Vehicles (PHEVs) into the market in the near future. As a result, many technical problems related to the impact of this technology on the power grid need to be addressed. The anticipating large penetration of PHEV into our societies will add a substantial energy load to power grids, as well as add substantial energy resources that can be utilized. There is also a need for in-depth study on PHEVs in term of Smart Grid environment. In this paper, we propose an algorithm for optimally managing a large number of PHEVs (i.e., 500) charging at a municipal parking station. We used Particle Swarm Optimization (PSO) to intelligently allocate energy to the PHEVs. We considered constraints such as energy price, remaining battery capacity, and remaining charging time. A mathematical framework for the objective function (i.e., maximizing the average State-of-Charge at the next time step) is also given. We characterized the performance of our PSO algorithm using a MATLAB simulation, and compared it with other techniques.

In this paper, we described the performance evaluation of a PHEV municipal parking deck from a mathematical perspective. In order to manage the energy allocated to the PHEVs in real-time, we have applied PSO. PSO uses the previously stored system data in order to solve optimization problems. Any change to the system requires saving the new data and re-executing the algorithm. In order to achieve effective optimization, the simulation parameters are required at every time step. This requires a large amount of raw data to be processed in a short period of time. By integrating PSO with other stochastic methods, online analysis can be achieved.

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In our model, we considered the constraints imposed by energy cost, remaining battery capacity, and remaining charging time in our model. Our simulation results demonstrate that the algorithm converges to a solution in a reasonable amount of time, and is immune to the size and nonlinear nature of the problem. Furthermore, it is faster than GA and easier to implement than some of the more traditional methods.

[6]This paper presents a coordinated charging strategy applied in large charging stations for PEVs(plug-in electric vehicles)using a smart algorithm, for the purpose of improving operational efficiency and meeting customer needs. We applied PSO (Particle Swarm Optimization) algorithm to solve the problem. Then we simulated three kind of disordered charging in Matlab for comparative analysis. At last, simulation outcomes

validate d the coordinated charging strategy to be effective. The results of simulation demonstrate that coordinated charging meets the limitation of total power of the utility, balances the charging state of each PEV, imp roves the total charging progress, at the same time reduces the overall charging time of

the charging station. Further work will be to combine more objective functions to reach a better result on more aspects.

[7]New smart load management (SLM) approach for the coordination of multiple plug-in electric vehicle (PEV)chargers in dispersion feeders is proposed. PEVs are developing in prominence as a low emanation and productive method of transport against oil based vehicles. PEV chargers speak to sizeable and flighty burdens, which can inconveniently affect the execution of appropriation networks. Utilities are worried about the potential over-burdens, stresses, voltage deviations and power misfortunes that may happen in dispersion frameworks from local PEV charging movement and in addition from recently rising charging stations. Along these lines this examination proposes another SLM control technique for planning PEV charging in light of pinnacle request shaving, enhancing voltage profile and limiting force misfortunes. Moreover, the formed SLM approach contemplates the PEV proprietor favoured charging time zones in view of a need choice plan. The effect of PEV charging stations and run of the mill every day private stacking designs are additionally considered. Re-enactment results are exhibited to show the critical execution change offered by SLM for a 1200 hub test framework topology comprising of a few low-voltage private systems populated with PEVs.

This paper contemplates the effects of different irregular clumsy charging situations and in addition composed PEV charging for a conveyance framework with charging stations and private PEV charging action. A novel SLM calculation is produced in Matlab condition for organizing the planning of various PEVs while thinking about dissemination and private lattice exhibitions (e.g. voltage profile, framework misfortunes and pinnacle request shaving). Three charging time zones (red, 1800– 2200 h; blue, 1800– 0100 h and green, 1800– 0800 h), four PEV entrance levels (17, 31,46 and 62%), five PEV battery sizes and three PEV proprietor's needs (high, medium and low) are considered. SLM likewise thinks about the current load varieties over a 24 h cycle while calculating PEV proprietor inclinations for charging time zone and need. In view of this and the heap stream processed yields (e.g. voltage profiles and misfortunes), SLM plans when individual PEV chargers should start charging with the end goal that framework execution is augmented. The enhancements and advantages of SLM are looked at and shown by performing broad re-enactments for a profoundly point by point 1200 hub conveyance framework topology with a few low-voltage private systems populated with PEVs.

[8]The goal of this work is the improvement of a controlled electric vehicle (EV) procedure under a unified engineering, considering a medium volt age electrical system. The technique created comprises of a Particle Swarm Optimization, which decides the time accessible to charger every EV, division of hubs of the system and their particular charging times, consider in gas imperatives the levels of activity of the conveyance organize. The technique is tried in a medium voltage arrange, considering entrance levels of10%, 30%, half, and the re-enactments are performed in MATLAB programming. The outcomes show that at high EV entrance levels, the incorporated procedures are very invaluable in contrast with an uncontrolled system and an Off Peak and somewhat over the decentralized charging methodology introduced in past works. As the new methodologies decide a window of time

that permits to appropriate the charge of the batteries in the long periods of less interest And in an out dated shape, maintaining a strategic distance from consequently enormous pinnacles of interest and of chargeability.

[9]Electrified transportation will help to reduce green-house gas emissions and increasing petrol prices. Electrified transportation demands that a wide variety of charging networks be set up, in a user friendly environment, to encourage adoption. Wireless electric vehicle charging systems (WEVCS) can be a potential alternative technology to charge the electric vehicles (EVs) without any plug-in problems. This paper outlines the current available wireless power transfer technology for EVs. In addition, it also includes wireless transformer structures with a variety of ferrite shapes, which have been researched. WEVCS are associated with health and safety issues, which have been discussed with the current development in international standards. Two major applications, static and dynamic WEVCS, are explained, and up-to-date progress with features from research laboratories, universities, and industries are recorded. Moreover, future upcoming concepts-based WEVCS, such as ‘‘vehicle-to-grid (V2G)” and in-wheel” wireless charging systems (WCS) are reviewed and examined, with qualitative comparisons with other existing technology.

This paper presents a basic overview of the WEVCS for stationary and dynamic applications with current researched technology. In addition, a variety of core and ferrite shapes have been demonstrated, which have been utilised in current wireless charging pad design. Health and safety issues have been raised and current developments in international standards are tabled for WEVCS. State-of-the-art stationary- and dynamic- WEVCS have been studied and tabled, with current research and development from a variety of public and private organisations. Finally, upcoming future technologies are investigated and simulated with the utilisation of FEM. Overall, the latest developments in the area of WEVCS are included in this article.

[10] The increasing number of electric vehicles (EVs) on highways calls for the instalment of adequate charging infrastructure. Since charging infrastructure has limited capacity, EVs need to wait at a charging station to get charged, and their waiting times may differ significantly from one location to another. This paper aims at developing a strategy to coordinate the queues among the charging stations, with only local information about traffic flows and the status of EV charging stations along a bidirectional highway, so that excessively long waiting times can be avoided. Specifically, a distributed algorithm is presented to schedule EV flows into neighbouring charging stations, so that EVs are all appropriately served along the highway and that all the charging resources are uniformly utilized. In addition, a distributed decision making policy is developed to influence the aggregate number of EVs entering any given service station, so that each EV makes an appropriate decision (i.e., whether or not it should enter the next charging station) by contributing positively to meeting the desired queue length at service stations and by considering its own battery constraint. Performance improvement of the proposed strategy is illustrated via one of the highways in the United States, namely the Florida Turnpike.

In this paper, we have developed a strategy consisting of a distributed scheduling algorithm and a cooperative control policy for individual EVs which optimize the operation of the overall charging network on a highway. First, a consensus-based distributed scheduling algorithm is presented which uses local information from the neighbouring service stations and is designed so that all the charging station uniformly utilized. Next, we develop a negotiation strategy among the drivers by means of the V2V and V2Icommunications and based on their current battery level in order to meet the published scheduling level. It is confirmed from simulations that the proposed strategy improves the overall system performance compared to the SoC-based random strategy. It should be noted that by using graph theory (with nodes and edges represent entrances/exits/service stations and roads respectively), the highway transportation network studied in this paper can be extended to general road networks. Future research can be done to incorporate traffic congestions into the model, consideration of price based strategy (game-theoretic approach), instalment of new charging infrastructure including additional batteries for replacement to further reduce the total waiting time, control of traffic congestions by the adjustment of the maximum speed limit for the EVs, and performance analysis of the proposed distributed strategy under communication failures or delays.

[1] Fast charging stations are connected to the electric grid and can fully charge an electric vehicle (EV) in less than half an hour. The capacity and location of the charging stations bring the costs to the electric grid operator as well as

to the station owner and EV user. A zonal approach has been proposed in this paper to determine the optimal place and capacity of the fast charging stations. Station development cost as well as the expected costs incurred by the EV user and the grid operator due to EV charging have also been included in the proposed approach. The geographic characteristics associated with the electric substations, urban roads and city zones have also been considered in the proposed approach. EV user behaviour is also considered to determine the expected charging demand and the expected EV user cost. Expected cost associated with extra grid loss due to EV charging has also been calculated by AC power flow using hourly electric grid load scenarios. The problem is formulated as Mixed-Integer Nonlinear (MINLP) problem to minimize the total expected EV charging cost. The problem is solved using Genetic Algorithm technique to determine the optimal location and capacity of charging stations. The proposed approach has been applied to study charging station development for North-West area of Tehran and the robustness of the proposed approach has been evaluated

An approach has been presented in this paper to determine optimal capacity and location of EV charging station. Urban traffic circulations, EV user behaviour, hourly electric grid load scenarios and city zone are among the factors included in the presented approach. The presented approach has been applied for Tehran North-West area based on Tehran urban traffic data. Results have shown that the proposed approach is successful in determining optimal charging station location and capacity based on the daily urban traffic flow. The performance of the proposed approach has been evaluated using different study cases. It has been observed that electric load scenarios, EV circulation and EV user charging preference has important role on the optimal charging station location and capacity. These factors should be

suitably considered in the problem as do the proposed approach to provide practical results. The proposed approach is, then, suitable to determine optimal EV charging station in practical cases.

[4] A load-independent wireless power transfer system with constant current and constant voltage output for electric vehicles charging is designed and optimized in this paper. Wireless charging system based on LCL-S or LCL-LCL compensation topology is systematically analysed. And dynamic LCL -S/LCL switching topology is designed and simplified to achieve constant current in the transmitting coil and load-independent constant current and constant voltage output, which can be controlled easily. More over, the coupling structures composed of different coil shapes and shielding structures are comparatively studied to improve the coupling stability under misalignment. Figure-of-merit and coupling change rate Δk defined in this paper are the key parameters in the process of coupling structure design and optimization. The combination of rounded rectangular spiral coil and splicing magnet core units is optimized as the coupling structure of the wireless charging system. Finally, the resonant wireless charging system prototype is being built and tested. The experimental results show that the load-independent and other characteristics of the implemented system are well correlated with the theoretical analysis and design. LCL compensation topology in the transmitter can make the current constant in the transmitting coil even if the rejected impedance of receiver changes due to the parking deviation and misalignment of EVs. LCL-S compensated wireless charging system can achieve CV output and the LCL-LCL compensated wireless charging system can achieve CC output, both of which can realize ZPA. The designed topology scheme that includes LCL compensation in transmitter and LCL or S switching compensation in receiver can realize constant current in the transmitting coil and CC/CV output. Moreover, additional compensation inductance of LCL topology can be adjusted to regulate the voltage or current gain of the system. Square coil structure with the same diameter has greater self-inductance and mutual-inductance than circular coil structure. And the mutual inductance of square coil keeps more stable when horizontal offset happens. At the same time, coupling structures with plate magnetic core has a certain range of position fault tolerance compared to ``E" type magnetic core. The structure with plate magnetic core is more suitable for the wireless EVs charging system. Therefore, rounded rectangular spiral coil and splicing magnet core unit adopted to the construct coupling structure of wireless EVs charging to achieve a stable coupling performance and loss reduction. Finally, the resonant wireless charging system for EVs is built and tested according to the design and optimization of dynamic compensation topology and its coupling structure. The experimental results show that the system's load independent and other characteristics are well correlated with the theoretical analysis. The efficiency of the designed system with 12.5% horizontal offset decreases only less than10%, and output power of the well-faced system can reaches1297.69 W with the efficiency of 90.94%.

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The growing use of electric vehicles (EVs) promotes environmental protection and energy conservation. The prerequisite in the use of EVs is that they should be adequately charged. The layout planning of charging station locations is therefore a key point in meeting the charging demands of EVs. This study presents three types of charging demands (i.e., conventional charging, fast charging, and fast battery replacement demand) by forecasting electric vehicle ownership with the use of the Bass model based on traditional vehicle development. This model for locating charging stations is built and optimized on the basis of the forecasted charging demands. The aim is to minimize the layout construction cost for charging station locations and the charging cost for customers. A practical example that applies the model to optimize the layout of charging station locations is presented, and the developed model is validated to work effectively. The model provides a theoretical way to optimize the layout of charging station locations and serves as a basis for layout planners and a reference for other researchers. Charging stations should be constructed to develop EVs. The construction of charging stations speeds up EV promotion. A planner can develop the layout of charging stations on the basis of charging demands in the future. This study presents three main types of charging demands that are predicted by forecasting EV ownership. An optimal model is developed on the basis of the forecasted charging demand to minimize the total cost of the charging stations and optimize the locations of the charging stations in the target district. Haidian District is taken as a practical example, and it indicates that the model can be effectively applied and can determine the location plan of charging stations with optimization. The proposed model can provide a practical way for planners to optimize the locations of charging stations. Some factors excluded in forecasting EV ownership can be considered in future research to improve model precision.

[8] Electric Vehicles (EV) is a current buzz in the automotive industry. This new buzz has both negative as well as positive impacts on the power system. The increased number of electric vehicles, when acting as loads imposes enormous power requirements on power grid and this leads to power imbalance and also weakens the stability of the grid. A careful selection of charging location and capacity of charging stations is the first step in planning the accommodation of large set of EVs. However this doesn't solve the problem fully and hence for day to day operations coordinated charging of EVs is essential. Hence stochastic behaviour of EVs is analysed and EV charging power is predicted. Further a two-stage model to reduce the loading peaks due to charging of PHEVs is developed using optimization and Demand Response (DR) strategies. In this paper, minimum cover algorithm is used to find optimal location and capacity of a PEV charging station considering the VSM of the system. After determining the locations free charging and orderly charging strategies of FAFC and FDFC for EV charging were obtained and corresponding charging power was forecasted based on the statistical model of initial SOCs and the start time of charging

II.PROPOSED WORK

To develop the real time pricing and reduce the overall charging time of electrical vehicles Particle Swarm Optimization is used. The flow chart of PSO algorithm is,

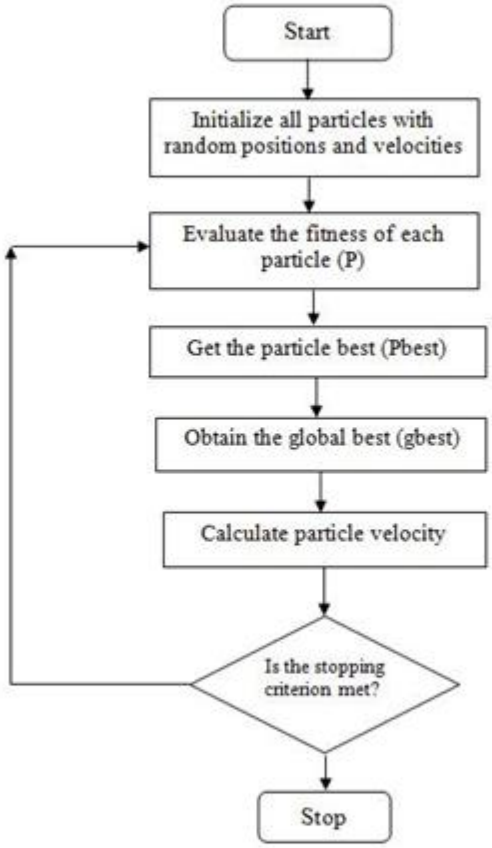

Fig. 1 Flow chart of system

For each particle, initialize the particle random number. Calculate the fitness value , if fitness value at time t is better than its previous best fitness value (Pbest) at time (t-1) and then set current value as the new Pbest. Choose the particle with best fitness value of all the particles as the gbest. Update the velocity and position of each particle while maximum iteration not reached.

III. CONCLUSION

The paper introduces particle swarm optimization (PSO) algorithm. It used to improve the total charging process by reducing the overall charging time of electrical vehicles, improve the charging efficiency and real time pricing .It meets the limitations of total power utility and balances the state of charge of each PEV. Challenge of longer waiting time is extenuated.

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