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Design of Residential Plug-in Electric Vehicle Charging Station with Time of Use Tariff and IoT Technology

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Abstract:

Electric vehicles (EVs) pull in around the globe because it has a benefit of energy saving and environmental protection. High Penetration of Electric Vehicles in the world makes an additional demand on the power system at peak time. To overcome this problem, Smart Charging Station is designed for residential. At peak time the power required to charge Electric Vehicles is effectively handled by Grid connected PV generation and also Electric Vehicles acted as an Uninterrupted Power Supply (UPS) based on Time of Use (TOU) Tariff. All control functions are done by the Raspberry Pi controller. The whole process monitored and controlled by using Internet of Things (IoT). The proposed control system and their control functions are done in MATLAB/SIMULINK.

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I. Introduction

Electric vehicle (EV) pulls in worldwide consideration of late and is anticipated that would get more noteworthy selection of transportation division into most nations because of its significant leverage of zero tailpipe emanations. EV was first presented in the nineteenth century yet soon supplanted by inner burning motor vehicles. The reasons were the development of suppressor and electric starter, which diminished the commotion of internal combustion engine vehicles and evacuated the need of hand wrenches to begin the internal combustion engine vehicles [1]. The increased number of EVs could overload the existing power system especially at the distribution system which can cause voltage problems and frequency problems. Considering the increasing number of EVs, it appears important to build up an appropriate charging station to give their required electrical demand request. One solution is to charge EVs at home for Renewable Energy Sources (RES). Among all available sources PV system is the best solution. According to the report provided by the National Household Travel Survey (NHTS), vehicles are parked 5 hours of a day at a work place[2]. Electric vehicle charging with residential provides overloading of distribution transformer. As the upgrading of transformer is difficult one. Several literature to show the impact of EVs charging on the distribution transformer [3], [4]. Hence to build an electric vehicle charging station at residential is to be effective. So some researchers motivate that, charging of EVs at night time. Night charging challenge is the use of the TOU (time-of use) pricing. Several papers presented residential distribution network.[5], [6]. The charging station was fully automated by IoT technology [9]–[11].

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