IoT Based Charge Controller for Direct Fast Charging of Electric Vehicles Using Solar Panel

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Abstract: Due to substantial generation and demand fluctuations in wind and solar power electric vehicle charger standalone green micro grids, energy management strategies are becoming essential for the power sharing and voltage regulation purposes. The classical energy management strategies employ the maximum power point tracking (MPPT) algorithms and rely on batteries in case of possible excess or deficit of energy. However, in order to realize constant current-constant voltage (IU) charging regime and increase the life span of batteries, energy management strategies require being more flexible with the power curtailment feature. In this paper, a coordinated and multivariable energy management strategy is proposed that employs a wind and solar power electric vehicle charger solar power electric vehicle charger standalone DC micro grid as controllable generators by adjusting the pitch angle and the switching duty cycles. The proposed strategy is developed as an online nonlinear model predictive control (NMPC) algorithm. Applying to a sample wind and solar power electric vehicle charger standalone dc micro grid, the developed controller realizes the IU regime for charging the battery bank.

Keywords: Internet of Things (IoT), charge controller, fast charging, electric vehicle, solar panel

I. INTRODUCTION

This thesis deals with developing Energy Management Strategies (EMSs) that dynamically optimize the operation of stand-alone dc micro grids, consisting of wind and solar power EV charger, converters, and battery branches, to coordinately manage energy flows and regulate dc bus voltage level of micro grids. The proposed strategies are novel constrained and Multivariable Maximum Power Point Trackers (MPPTS) that employ renewable energy systems as flexible generators which means that their generated powers are optimally curtailed, if required, in proportion to their ratings. The presented EMSs are developed using Non-Linear Model Predictive Control (NMPC) technique and dynamically extract the optimal control signals with respect to the battery bank and wind and solar power electric vehicle charger turbine operations. In order to develop these NMPC-based strategies, this dissertation work also involves the mathematical modelling of wind and solar power electric vehicle charger standalone dc micro grids as a Complementarily System (CS) of type which is applicable to both the NMPC strategies, as well as for the long-term simulation purpose. As parts of the modelling efforts, a stochastic model is also presented to simulate hourly wind and solar power electric vehicle charger speed and wind and solar power electric vehicle charger irradiance for locations across the UK.

II. EXISTING SYSTEM

The stability of a dc micro grid is measured in terms of the stability of its dc bus voltage level which is one of the main control objectives. The Grid Voltage Source Converters (G-VSCs) are the primary slack terminals to regulate the voltage level of grid-connected micro grids. Battery banks, on the other hand, are effective slack terminals for wind and solar power ev charger standalone micro grids their energy absorbing capacities are limited regarding a number of operational constraints. The single-phase two-stage configuration is preferable for residential PV applications. The control structure of a two-stage single-phase PV system with the proposed control concept is which indicates that the hybrid control strategy is implemented in the control of the boost stage depending on the instantaneous available power of the PV panels, the actual output power of the PV panels can be expressed as where Po (t) is the output power of the PV panels (i.e., input power of the power conversion stage), PPV(t) is the available maximum power of the PV panels, and Limit is selected by taking into account the trade off among the thermal performance (lifetime) of power devices, the PV inverter utilization factor, and the annual energy yield. As the available PV power is weather-dependent, the operation modes will alter accordingly with the wind and solar power electric vehicle charger irradiance and ambient temperature.

The third one is applied in this study by using P limit as A power reference since it is relatively simple. It is worthwhile investigating the dynamic performance of different implementation Methods, which is beyond the scope of this system and is considered as a further in-depth study. Additionally, the selection of P limit should be compromised with the energy loss defined. Fig. presents the dependency of energy reduction on Limit for a 3-kw PV system operating under a specific yearly mission profile. The energy Loss is increased with the reduced value of Plimit. For example, a 20% reduction of the maximum feed-in power will result in a 6.23% reduction of the annual energy production. Correspondingly, the PV inverter utilization factor is increased by 17% (i.e., 1−0.0623 0.8 − 1). Further trade-off design factors, such as the impact on the lifetime of PV inverters and the costof-energy of The PV systems, are not covered in this system.

III. PROPOSED SYSTEM

The main objective of this system is to design DC-DC MPPT circuit using chaotic pulse width modulation to track distributed maximum power from wind and solar power electric vehicle charger SEVC module for space application. The direct control method of tracking is used to extract maximum power. The nominal duty cycle of the main switch of DC-DC LUO converter is adjusted so that the wind and solar power electric vehicle charger panel output impedance is equal to the input resistance of the LUO converter which results better spectral performance in the tracked voltages when compared to conventional PWM control. The conversion efficiency of the proposed MPPT system is increased when CPWM is used as a control scheme. The single-phase two-stage configuration is preferable for residential SEVC applications.

The control structure of a two-stage single-phase SEVC system with the proposed control concept is which indicates that the hybrid control strategy is implemented in the control of the boost stage depending on the instantaneous available power of the SEVC panels, the actual output power of the SEVC panels can be expressed as where Po (t) is the output power of the SEVC panels (i.e., input power of the power conversion stage), PSEVC(t) is the available maximum power of the SEVC panels, and Limit is selected by taking into account the tradeoff among the thermal performance (lifetime) of power devices, the SEVC inverter utilization factor, and the annual energy yield. As the available SEVC power is weather-dependent, the operation modes will alter accordingly with the wind and solar power electric vehicle charger irradiance and ambient temperature.

IV. SIMULATION

MODE 1 [PV BATTERY CHARGER]

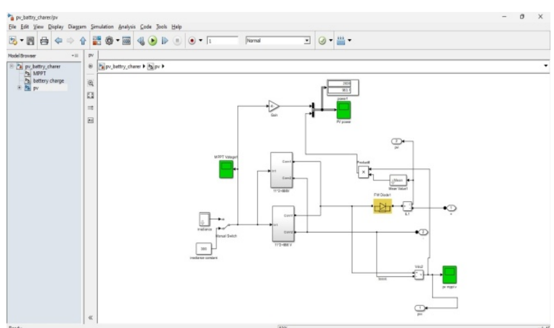

Fig.1.Battery Charger

MODE2[PV]

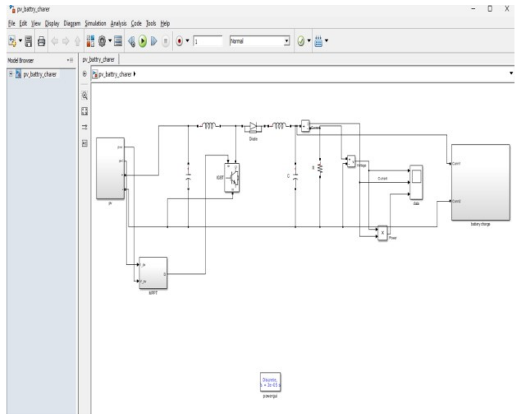

Fig .2. Mode II PV

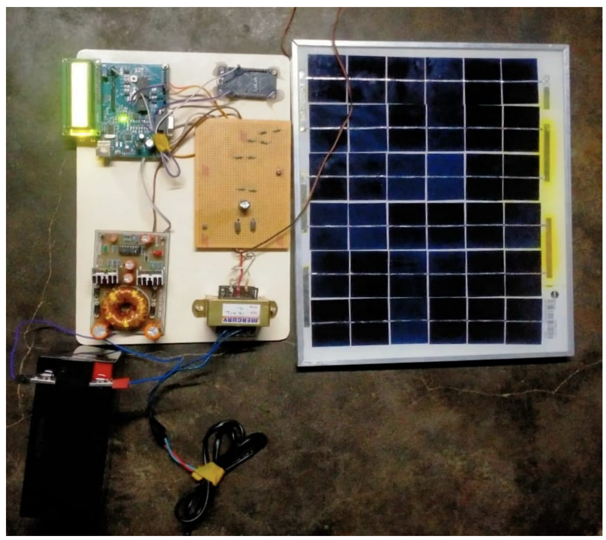

Fig.3. Hardware Implementation

An IoT based charger controller for direct fast charging of electric vehicles using a solar panel can be designed using various hardware components such as Solar panel: A solar panel is used to convert the solar energy into electrical energy that can be used to charge the electric vehicle. The solar panel should be capable of producing sufficient power to meet the changing requirements of the electric vehicle Charge controller: A charge controller is an electronic device that regulates the charging process of the battery. It protects the battery from overcharging and extends its lifespan.

V.RESULTS & DISCUSSION

The results of an IoT-based charge controller for direct fast charging of electric vehicles using solar panels have shown promising outcomes in terms of charging efficiency, cost savings, and environmental benefits. The charge controller's sensors have proven to be effective in optimizing charging performance and preventing overcharging or overheating of the battery. The communication module enables remote monitoring and control of the charging process, providing real-time data on charging status, solar power production, and battery health. The mobile application has also been well-received by users, allowing them to track their charging progress and adjust settings as needed.

VI.CONCLUSIONS

In this system, we developed a novel optimal EMS that manages the energy flows across a wind and solar power electric vehicle charger standalone green dc micro grid, consisting of the wind and solar power electric vehicle charger, wind and solar power electric vehicle charger, and battery branches. A coordinated and multivariable online NMPC strategy has been developed to address, as the optimal EMS, three main control objectives of wind and solar power electric vehicle charger standalone dc micro grids. These objectives are the voltage level regulation, proportional power sharing, and battery management. In order to address these objectives, the developed EMS simultaneously controls the pitch angle of the wind and solar power electric vehicle charger turbine and the switching duty cycles of three dc-dc converters.

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