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A Smart Station to Charge Electric Vehicles

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Abstract: *Electric vehicles have gained a lot of attention lately as a cost-effective, sustainable, and environmentally friendly alternative to cars with internal combustion engines. It tackles issues related to pollution management, global climate change, and petroleum fuels. The design and construction of an electric vehicle hybrid charging station that uses both photovoltaic (PV) and grid power is covered in this study. Additionally, a novel control approach for energy management under various operating situations is suggested. The suggested control makes sure that the system functions as a whole to maximize grid energy utilization. When solar energy is available, the system uses Maximum Power Point Tracking (MPPT) to directly charge the EV. When solar energy is not available, it automatically switches modes of operation. The system exchanges power between PV and the grid. Furthermore, when solar electricity is available but the station is not charging the EV, the technology also feeds the grid with the energy. In the upcoming smart-E-grid model, where EVs share the grid load, reverse power feeding is also incorporated. Even for traditional EV charging stations, the suggested control approach is readily adaptable.*

Keywords: Electric vehicles

I. INTRODUCTION

As a relatively new technology, electric vehicles are trying to find a position in the market. Its ease of use, fuel savings, and less carbon emissions are just a few of its benefits[8]. As the number of electric vehicles on the road rises, concerns are raised over how they may affect the grid's power quality. Power balancing and the effect of an electric car charge on voltage, current, and total harmonic distortion are the primary factors to be taken into account here. Data on voltage, current, and active and reactive power for various charging profiles and battery charging states are obtained using an experimental charging station prototype for Modes 2 and 3[7].

Future smart grids are anticipated to follow two key trends in energy consumption:

1. Large-scale decentralized renewable energy production via photovoltaic (PV) systems.
2. Battery electric cars (EVs) are becoming the transportation of the future. First off, a larger audience may now utilize renewable energy sources like solar power due to the declining cost of PV panels [1].

The following are the work's new contributions in comparison to previous works[9]:

1. Identification of PV cell smart grid and commercial supply.
2. Battery monitoring based on charging time.
3. It is possible to charge four different kinds of cars.

II. METHODOLOGY

We will construct a charging station for newly introduced electrical vehicles as part of the "Smart Hybrid Electrical Vehicle Charging Station" project.Both renewable and non-renewable energy sources are used in this system; the former comes from solar power, while the latter comes from the State Electricity Board[4]. The Maximum Power Point Tracker (MPPT), which is essentially a DC to DC converter, receives one supply from the solar (photovoltaic cell) and uses this DC supply to optimize the energy available from the connected solar module arrays at any one time while it is operating[6].

Following that, apply for a changeover unit, have the state electrical board provide the source, apply for rectification, and then apply for a changeover switch[10]. The battery bank receives the output of the changeover switch, which is subsequently connected to a sine wave inverter, which is also connected to the battery bank[5].

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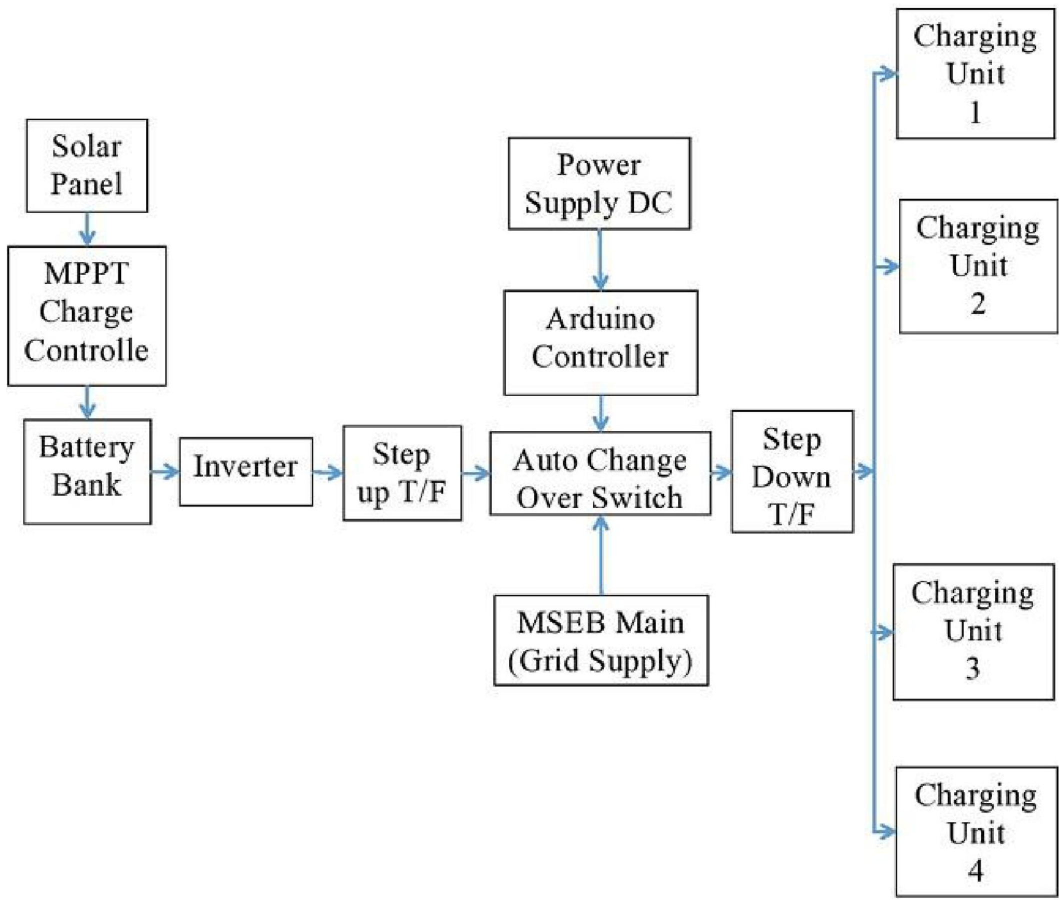
A 12V/230V transformer is connected to the output battery bank, and the transformer's output is connected to four parallel 230V/12V transfers[3]. The first transformer's output is connected to a 5 Amp charging circuit, the second transformer's to an 8 Amp charging circuit, the third transformer's to a 10 Amp charger circuit, and the fourth transformer's to a 15 Amp charging circuit[2].

BLOCK DIAGRAM



This project focuses on the development and functionality of a charging station designed specifically for electric vehicles, which will operate primarily using solar energy during daylight hours[11]. The charging station is equipped with a backup system that automatically connects to the commercial power supply in the event of a failure in solar energy production. This ensures a consistent and reliable power source for the electric vehicles, regardless of weather conditions or time of year[12].

The implementation of this charging station is significant for several reasons. First, it presents a practical solution for reducing pollution. Electric vehicles are known for their lower emissions compared to traditional gasoline-powered vehicles, and by utilizing solar energy, the charging process is even more environmentally friendly. The shift to solar energy not only supports renewable energy usage but also contributes to a cleaner atmosphere, helping to combat the effects of climate change[13].

Additionally, the establishment of this charging station can have a positive economic impact on the local community. By creating jobs related to the installation, maintenance, and operation of the charging station, this initiative can provide employment opportunities in areas where job options may be limited. As the demand for electric vehicles continues to grow, the charging station will not only support sustainable transportation choices but also boost the local economy by fostering new job creation. Overall, this project stands to benefit both the environment and the community, making it a crucial endeavor for the future.

ADVANTAGE

- Reduce carbon emission.
- Charging cost is reduce.
- The load on the grid reduce

APPLICATIONS

1. It can be used at parking.
2. It can be used at petrol pumps.
3. It can be used at gas station,
4. It can be used on National highway, State highway.

LIMITATIONS

1. As to sources are used so high
2. initial cost.
3. Battery bank capacity required is high.
4. Frequent maintenance is required.

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