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Hybrid Charging Station

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Abstract: *A hybrid micro grid-powered charging station reduces transmission losses with better power flow control in the modern power system. However, the uncoordinated charging of battery electric vehicles (BEVs) with the hybrid micro grid results in ineffective utilization of the renewable energy sources connected to the charging station. Furthermore, planned development of upcoming charging stations includes a multiport charging facility, which will cause overloading of the utility grid. The project works on (1) the energy management strategy and converter control of multiport BEV charging from a photovoltaic (PV) source and its effective utilization; (2) maintenance of the DC bus voltage irrespective of the utility grid overloading, which is caused by either local load or the meagerness of PV power through its energy storage unit (ESU). In addition, the charge controller provides closed loop charging through constant current and voltage, and this reduces the charging time. The aim of an energy management strategy is to minimize the usage of utility grid power and store PV power when the vehicle is not connected for charging. To balance the load demand, the proposed system is connected to the grid through a three-phase bidirectional DC-AC (alternating current) inverter. The obtained results show that the proposed renewable charging mechanism is suitable for EV charging thus help creating pollution free environment.*

Keywords: Electric Vehicles, Synchronous Generator, Recharging Mechanism, Solar Energy, Wind Energy hybrid microgrid, battery electric vehicle, energy management strategy.

I. INTRODUCTION

India does not have adequate petroleum reserves. Therefore, it is heavily dependent on crude oil and natural gas imports. Presently, India is the third biggest oil importer after US and China. The total crude basket of India includes 82.8% import of crude oil and 45.3% import for natural gas. As, the petroleum products consumption contributes to the air pollution, there has been a huge demand to contain the consumption of petroleum products to address the pollution problem. Further, it also causes huge economic burden on the Indian citizens due to large size of crude oil import. Therefore, to reduce the dependence on petroleum products and save the environment, it is required to switch over to alternate clean fuel and clean technology. A major portion of the petroleum products is being consumed by the motorized vehicles. Hence, running these vehicles is causing major damage to our environment by adding air pollution. As the Indian transport sector is heavily dependent on petroleum products. Electric vehicles (EVs) are increasingly used all over the world due to global warming problem and the cost of fossil fuel for an internal combustion engine. EVs were used for various purposes such as a private car and a public transport vehicle. Increasing in electrical power demand is cannot avoidable. In India, electric vehicles have been growing developed resulting in the demand for electrical power. Due to this it is necessary to find other alternative energy sources for generating electricity to reduce the cost of fuel, pollution. For alternative energy sources, Solar PV and low-speed wind turbines are good options. Many researchers interested hybrid renewable energy to generating electricity for reduce energy costs and develop the power distribution systems become more stable. Also, currently, there are many researchers study on the charging station with electric power generation from hybrid renewable energy sources. They have purposed a techno-economic analysis of hybrid system comprising of solar and wind energy for powering a remote mobile transceiver station and investigation to find the effects of probable variation in solar radiation, wind speed, and diesel price in the optimal system configurations. Particle swarm optimization algorithm is used to determine the optimal position of the charging station in the distribution system. The method for optimal allocation and sizing of renewable energy sources (RES) and electric vehicles (EV) charging stations. In This project we developed optimal design of electric vehicle charging station integrated with Grid including solar PV and wind power generators to help generate electricity for the electric vehicle charging station system.

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In the 21st century, EVs saw a resurgence due to technological developments, and an increased focus on renewable energy. A great deal of demand for electric vehicles developed and a small core of do-it-yourself (DIY) engineers began sharing technical details for doing electric vehicle conversions. Government incentives to increase adoptions were introduced, including in the United States and the European Union. Electric vehicles are expected to increase from 2% of global share in 2016 to 22% in 2030.

A key advantage of hybrid or plug-in electric vehicles is regenerative braking, which recovers kinetic energy, typically lost during friction braking as heat, as electricity restored to the on-board battery.

II. LITERATE SURVEY.

Praveen Kumar et all (2013) This paper discusses about the potential need for electric vehicles (EV), charging station (CS) infrastructure and its challenges for the Indian scenario. Up to now the BEV's bottleneck is in the range of 100km per charge due to limited on board energy which can be optimized by introduction of plug-in hybrid vehicles along with real time road traffic management. With increase in liberalization, privatization and expansion of distributed and renewable power generation of Indian electricity market, transmission and distribution, as well as market processes related to the allocation of energy and energy mix are undergoing an evolutionary development with improved efficiency and reliability. Searching charging stations for electric vehicles is an important issue for the drivers which need the implementation of smart charging infrastructure network. Charging Station selection algorithms involve the overall information obtained through interactions between the EVs and EVs- Charging Station selection (CSS) server through the mobile network, delivering information regarding availability of charging slot at nearest CS, thus minimizing individual waiting time and provide improved efficiency. India should invest in small scale reinforcements to manage the load issues locally instead of going for a massive change. Home charging should be encouraged for long battery life and grid balancing. Proper planning of place, population, traffic density and safety should be taken in to consideration before implementing the largescale charging infrastructure for the second largest populated country of the world. Consortiums of companies in the transport, energy and power electronic sectors which are working on projects connected with the initiation of commercial charging terminals for electric vehicles, as well as fast-charging stations

Testa, (2010)."Optimal design of energy storage systems for stand-alone hybrid wind/PV generators," in Power Electronics Electrical Drives Automation and Motion (SPEEDAM), 2010 International Symposium, 1291-1296.from this paper we learn about wind and solar charging station.

M.R. Mozafar, M.H. Moradi, M.H. Amini, "A simultaneous approach for optimal allocation of renewable energy sources and electric vehicle charging stations in smart grids based on an improved GA-PSO algorithm". Sustainable Cities and Society, 32 (2017) 627-637.we found here information and study about hybrid power management.

S. J. Park, et al. (2009). "A Study on the Stand-Alone Operating or Photovoltaic Wind Power Hybrid Generation System", 35th Annual IEEE Power Electronics Specialists Conference, Aachen, Germany. we learn solar power plant management

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2.1 Objective

This project is to developed the hybrid charging station by combination of renewable energy and grid power system to achieve the following objectives

- Smart Energy management
- Energy controlling
- Use of renewable energy for electric vehicles
- Manage peak time demand
- Supply energy to the grid

2.2 Motivation

Electric vehicles have been used in many countries around the world. However, the most critical infrastructure for using electric vehicles is the charging station. Therefore, the need to manage charging stations for electric vehicles is the high

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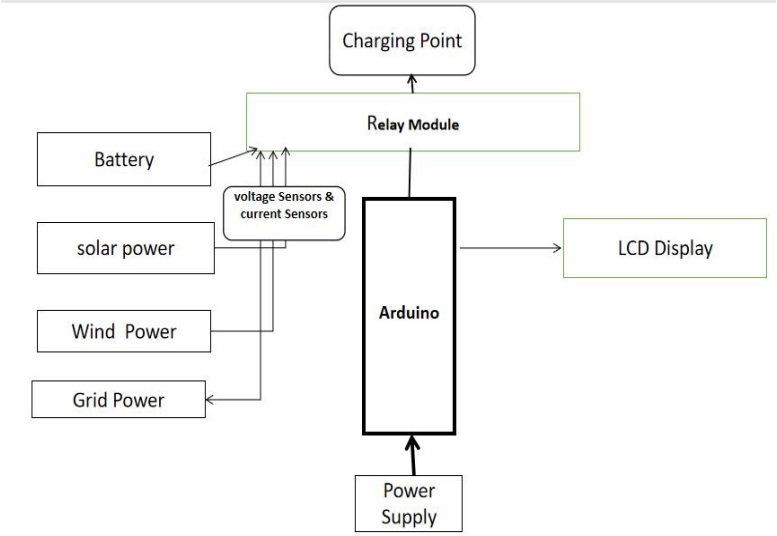
priority. by considering low pollution and fulfillment of peak hours demand without interruption. Growing market in this sector also a big motivation there for study and research on this topic is biggest motivation.

III. METHODOLOGY

3.1 Proposed Methodology

Technically, the hybrid charging station system refers to two generation sources such as renewable energy (wind and solar) and main grid system. However, the term "hybrid solar panels" refers to solar and battery storage which unlike off-grid systems is connected to the electricity grid.

3.1 Block Diagram



3.2 Classification of Plant

This Plant is mainly divided into the 4 parts

1. Solar power plant
2. Wind power plant
3. AC Grid system
4. Control circuit

3.3 Hardware Requirements

- Arduino Uno
- Lcd Display
- Relay
- Current Sensor
- Voltage Sensor
- Battery
- Rectifier
- Diodes
- Register
- Converter
- Voltage Regulator
- Led
- Capacitor
- Step Down Transformer

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IV. WORKING

4.1 Circuit Diagram

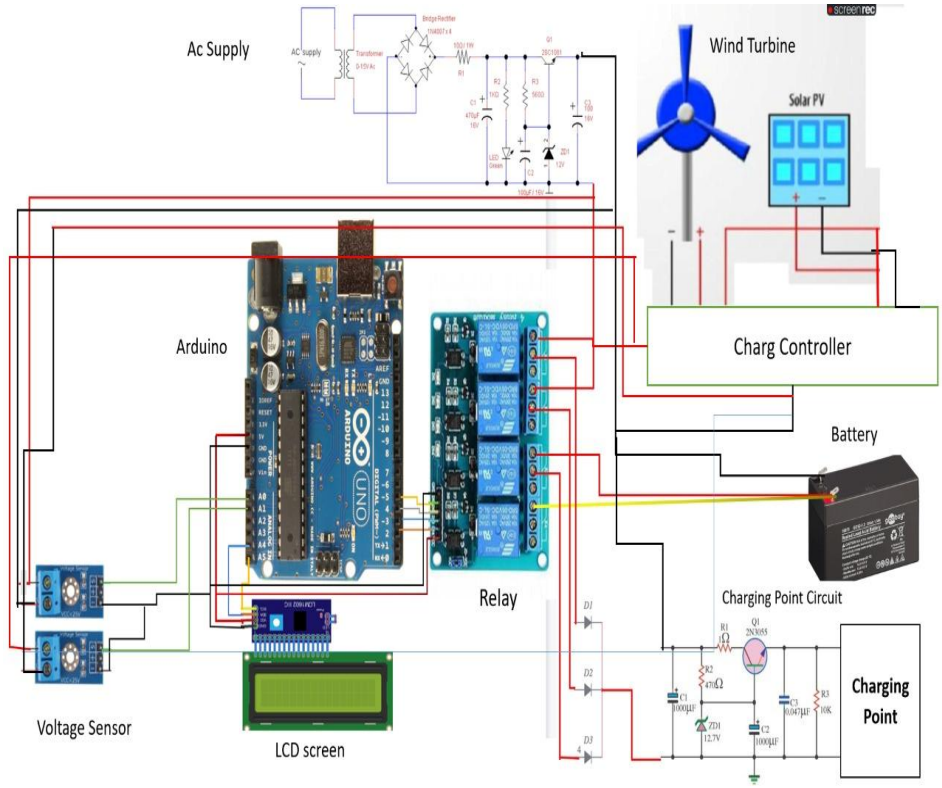

Fig 4.1: Circuit Diagram of Project

As you know the construction of system firstly during daytime the solar system is on and the wind power station is continuously during day and night time if the power produced by this both the system is sufficient to charge the vehicles then continuously power is supply from all those circuits to the system for the charging. If the system is not able to make the 12-volt constant supply at that condition the power taking from the grid that is 12-volt DC power after step down from 230 volt to 12 volt. That given to the system for the charging vehicle. all those things are is connected to the Arduino taking a data from voltage sensor and current sensor and comparing those data with required value that's it for the charging of the vehicle voltage sensor and current sensor for sensing the data from both the ends. Renewable source is failed to meet the pre requirements of charging supply then the relay circuit is switch on and supplied to the battery unit. Show all this operation is done by 2 relays switching their operation continuously according to the real-time input. Suppose solar and wind are providing full power then release in off condition for the grid supply if the 16 and win together not able to meet the power requirement then system is turned this renewable power to the battery charger and turn on the grid power for the charging station. Charging station consist voltage regulator and capacitor for the regulated power supply to charge the vehicles with the proper value.

4.2 Advantages & Applications

Advantage:

1. The best thing about hybrid systems is that they store solar energy and low-cost electricity.
2. Use of solar energy at peak usage times is made possible.
3. They can be used for advanced energy management.
4. Enables energy independence.
5. Is a great way to reduce power consumption from the grid.
6. Reduce pollution

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Applications:

1. Hybrid charging station
2. Hybrid grid system
3. Energy management system
4. Electricity board

V. FUTURE SCOPE

In future full computer measurement and control bus will be added to the system. Computer controlled relays will be added to allow all the major elements of the system to be switched in and out of the system through PLC. The measurement bus will be connected and control. computerizes data acquisition simultaneously of all the major signals in the system. These improvements will allow for the study of more complex issues like power faults caused by sudden breakdown. These improvements will also allow the same benefits to instruction realized in electricity and electronics classes to be extended to control and instrumentation classes.

VI. CONCLUSION

The optimal design of charging station electric vehicles integrated with Grid include wind power, and solar PV we developed in this project. The results show a potential of hybrid renewable energy sources. Using renewable energy integrated with electricity distribution systems can provide the system more reliable and suitable electrical vehicles charging areas. The developed idea can be applied to optimize the charging stations for electric vehicles in rural areas, and it would be a good topic for future studies.

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