Integration of Renewable Resources for Electric Vehicles and Implementation of Artificial Intelligence

Dipraj Ghosh, Mohammad Aheraz Bin Muslim, J. Ajay Daniel, V.N. Ganesh

Abstract--- Renewable energy in electric vehicles are the current research in the market. The implementation of artificial intelligence in the electric vehicles enhances the control and gives a better experience. Apart from that the interfacing of artificial intelligence system in the integeration of renewable resources for electric vehicles provides a better life security to the Electric Vehicles (Evs).

In the above proposed idea of integeration of renewable resources it has a prospective of energy saving with a cleaner environment.

In this paper the authors have proposed the model of integeration of renewable resources for electric vehicles and implementation of artificial intelligence in the electric vehicles , it contains simulation of the solar power plant and wind turbines which shows us the state of energy production and utilisation.

It also includes the synchronisation of both the powers coming from the solar plant and the diesel generating station. Power synchronisation is a very important factor and a vital part of the EV grid.

The proposed system will help us to improve the working of the Electric Vehicles (Evs) and provide an alternative source for energy for charging of electric vehicles other than non-renewable source of energy.

Keywords--- Integeration, Artificial Intelligence, Renewable Resources, Electric Vehicles.

I. INTRODUCTION

In the current modern era the energy which is used to supply the electric vehicle grid is itself generated from non-renewable sources of energy, such as by burning of coal and diesel and other non- renewable resources.

The climate change due to the greenhouse gases evolved due to this process is causing the environment to become worse due to global warming and greenhouse effect. So, to compensate the above stated loss and harm to the environment the system of using renewable source of energy as the primary source is proposed to feed the electrical grid for electric vehicles. The secondary system which is used to supply power to the grid will be conventional source of energy which will be used as a backup in case of interrupted supply from the renewable source of energy. So far the goal of this paper is to address the new methods which can be taken into account to make use of the renewable source of energy into a new direction. According to the reports of 2019 of air quality index [1] of india the pollution level of india is very high and its cities are one among top polluted in the world with a suspended particulate matter of more than 150.And according to the above air quality index the city which ranks first is the national capital of india [2] having around more than 200 suspended particulate matter in its air. The above stated dilemma is caused due to the use of fossil fuels in the transport system instead of cleaner fuel The amount of carbon di oxide emitted from the automobiles in the cities in India [4] (mumbai) accounts to about more that 52% of the total pollution. [5]The goal of India is to achieve about 30% sales of two wheeler electric vehicles by 2030 which is now 1%.Now this goal can only be achieved by the installation of proper charging stations which are fed by cleaner source of energy instead of fossil fuel.

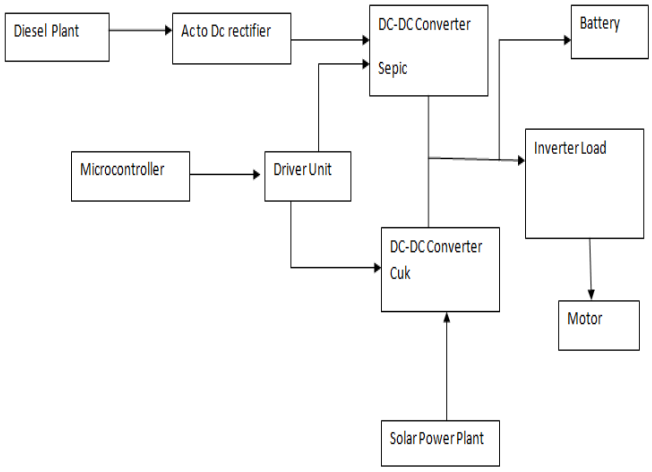

Fig.1: Block Diagram of Basic model for renewable resources with Electric Vehicle

II. CONCEPT OF INTEGERATION OF RENEWABLE RESOURCES

As of now there is no smooth electric vehicle grid present to supply the power to the charging station.

In this paper the Integeration of diesel and solar power plant is taken into account. The solar plant is the ultimate source of energy whereas the diesel plant is the standby unit which will be used as a backup In case of any break down or insufficient supply of solar energy in the system.

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The power is generated by the photovoltaic system and it is supplied to the dc - dc converter to step up the voltage and following that it is fed to battery storage. [6] The batteries which are used to store the charge are of lithium ion or lead acid batteries because they have better life cycles and efficiency.

After the storage of charge in batteries the power is converted to ac current with the help of an inverter and then it is fed to the electrical grid for transmission. In the receiving station the power is again converted to DC current and then it is used to charge the batteries of the Electric vehicles.

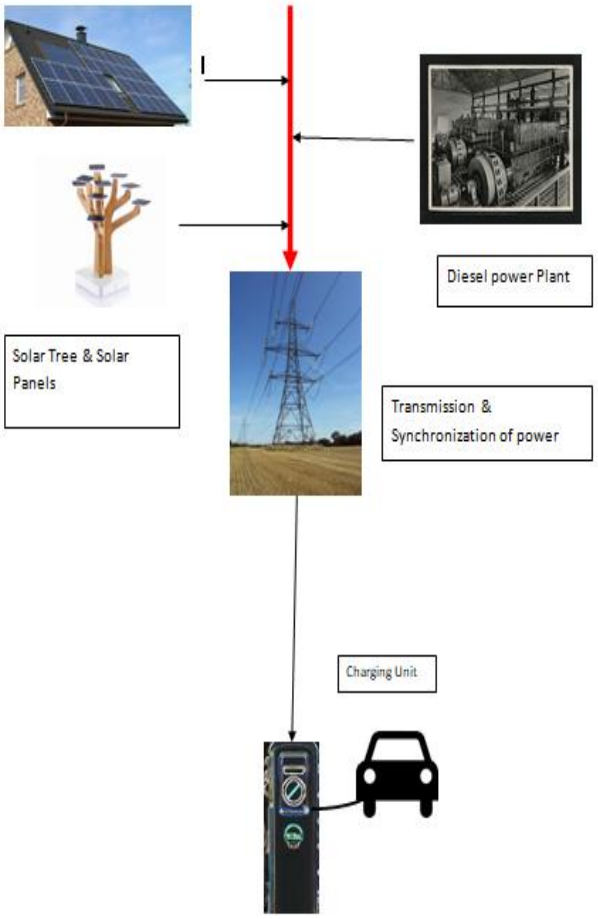

Fig.2: Solar Power &Diesel power plant Synchronisation

Given figure2, the solar power plant is shown in synchronisation with the diesel power plant with a substation and EV charging station.

III. MAIN CHARACTERISTIC OF THE SYSTEM ARE

- **Non-polluting – the grid is absolutely no polluting.**
- **Free power- it provides a good amount of free power from the solar photovoltaic system.**
- **Maintenance free- the system is more efficient and maintenance free compared to other**

IV. SOLAR ENERGY

The solar energy is one of the greatest forms of free and renewable source of energy. It is available almost everywhere and is a constant source in India as the country experience about 300 days of clear sunny days. It is the fastest growing technology in India as well as in the world with better future and scope. The cost of solar panel today is around (5- 6) $ per watt. [7]

The photovoltaic modules currently used in india have an efficiency of about (13 – 19) % depending upon the area and intensity of the irradiance.

In the above given figure there is a vehicle whether hybrid, plug-in or pure electric vehicle which is getting charged with the help of the developed charging station fed from renewable sources of energy.

V. DIESEL POWER PLANT

The diesel power plant is a form of conventional source[8] of energy which generates AC current with the help of an alternator.

The power generated in this plant will serve as a backup[9] to the electric vehicle (EV) grid in case the solar power plant fails to give sufficient power or there is any maintenance work[10] which is to be carried out.

The thermal power[11] plant in India produces power of about 65% of the total power. It is one of the good and reliable sources of energy.

Diesel power plant consists of components such as Turbine, Alternator, Turbocharger & cylinders. Diesel Power Plant is mainly used for backup. This plant will be operated when the irradiance of solar is low due to climate conditions.

This Plant can be operated on Heavy oil Fuel (HFO) instead of diesel.

Since Heavy oil Fuel (HFO) is crude product of petroleum & it does not cause much pollution as compared to diesel.

VI. SYNCHRONISATION OF POWER

Synchronisation of power[12] is a process of matching the frequency of the AC current waveforms. Both the plants solar and diesel cannot transmit power to a single bus until and unless both have a similar frequency, So to synchronise the power, first the dc current is changed to ac current waveforms with the help of an inverter and then with the help of cyclo converters[13] the frequency of the systems are kept same and constant and then it is fed to the transmission bus.

VII. ON GRID SYSTEM

In an on-grid system of solar system[14] the power which is generated is used by the house and if there is any excess of power generated by the system it transmits the power to the main grid of the government and in return certain tariffs are made for the customers.

It should be taken note that there is no battery used in this system.

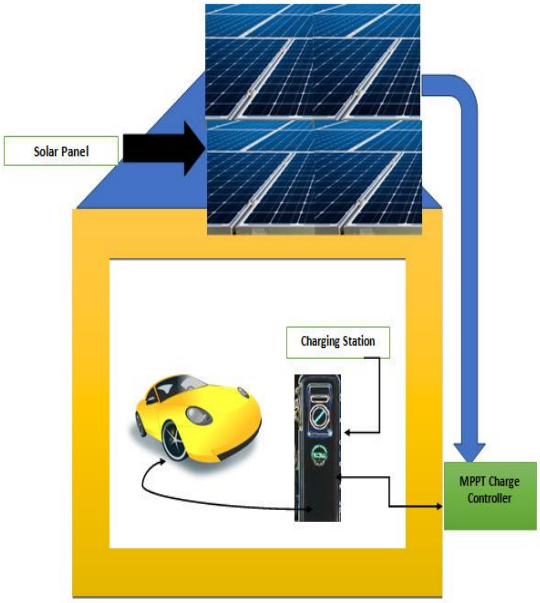

Fig.3: Solar Power Feeding to charging Station

In the below given figure3, the solar panel is supplying the power to the charging station through an Maximum Power Point Tracking (mppt controller)[15].

VIII. OFF GRID SYSTEM

An off-grid system is a system[16] in which the system is not connected to the electrical grid but has its own storage in the form of batteries. The batteries act as a source of energy after getting charged.

Generally, the off-grid system is more expensive due to the involvement of converters and costly batteries and are mostly used in rural areas such as villages and small towns where supply of power is insufficient.

IX. CHARGING STATIONS

The charging stations consist of charging booth which consists of a Lithium-ion battery[17] which will be charged by the renewable resources. These renewable resources are not available during day & night so energy of these resources needs to be stored in the battery. The battery on the charge station is unidirectional. This can charge the battery of vehicle up to 2 times a day. The charging times varies with battery brand & their made. The charging will vary upon the demand made by the consumer. These charging stations can get the supply from piezoelectric[18]. solar, Wind, Biogas etc. If these charging stations are charged form non-renewable resources then it can cause much pollution as compared to renewable resources.

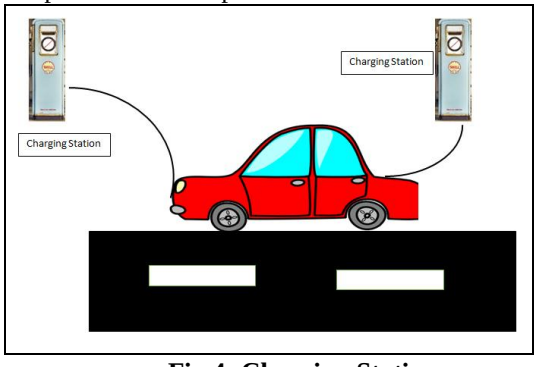

Fig.4: Charging Station

X. MACHINE TO MACHINE COMMUNICATION

In machine-machine communication[19], the data will be stored in the cloud. The data can be extracted from the cloud through internet protocols such as zigbee, Bluetooth etc. In machine-machine communication, the vehicle will be notified about the state of charging, condition of the battery, winding temperature of the motor can be notified on the screen. This vehicle can be monitored through Global Positioning System (GPS) & it can detect the obstacle through obstacle sensor. In M2M communication[20], the sensors are fully installed in the vehicle. These sensors are used for the collection of data & monitoring of the electric vehicle. The sensors such as speed sensor, voltage sensor, current sensor are connected in the the vehicles. They can be monitored through internet of things (IOT) Platforms. The data can be sent to mobile phones/laptops. This is bi-directional communication.

XI. RESULTS

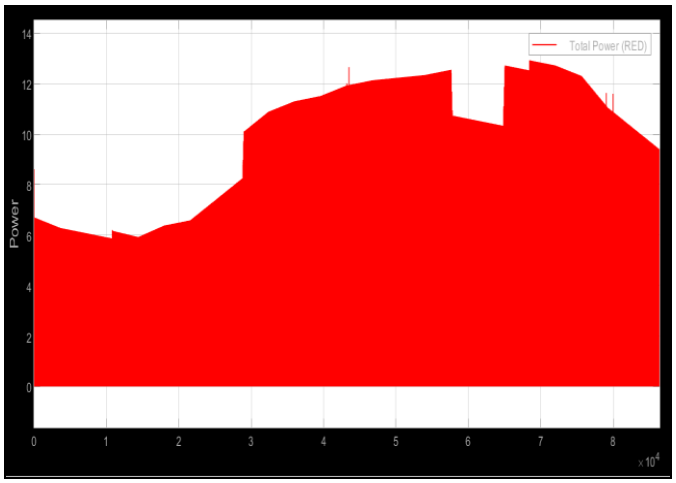

Fig.5: Simulation Shows total power of the Charging Station.

In the above provided figure it clearly shows us about change in power with respect to time in a charging station.

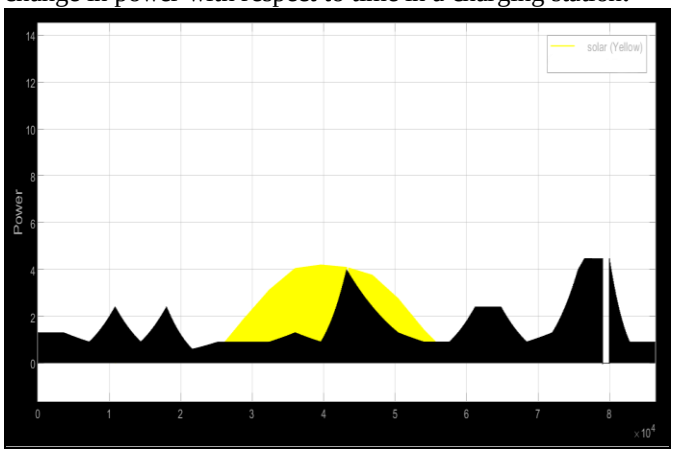

Fig.6: Simulation shows power production from solar plant

The above graph gives us detail about the power generated by the solar power plant with respect to time.

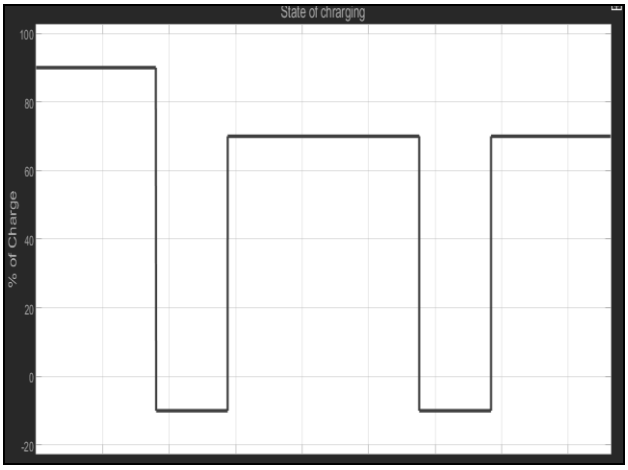

Fig.7: Simulation Shows percentage of charge of electric

Vehicle with respect to the state of charging of the electric vehicle. It has a form of square waves with more than one peak value.

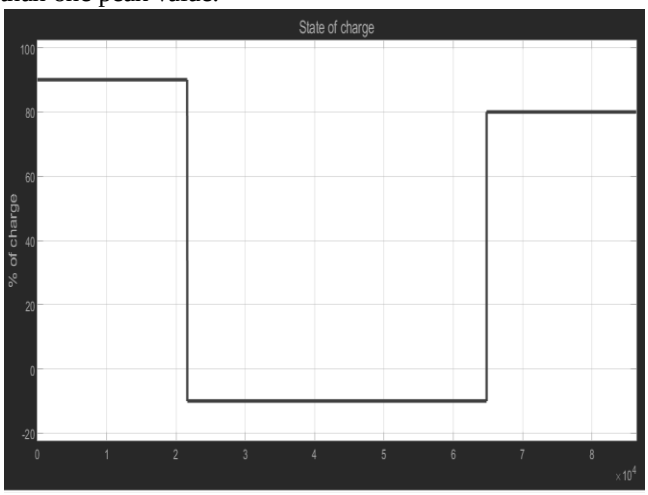

Fig.8: Simulation Shows the percentage of charge with respect to the state of charge. It has a form of square waveform.

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