Integration of Renewable Resources Such As Wind for Electric Vehicles and Implementation of Smart Electric Vehicles using Internet of Things

Mrigank Rishav, Rittika Maity, D. Sivakumar, S. Balaji

Abstract--- The excessive use of coal & petroleum have created many Global Problems such as Air Pollution. The effects of Air Pollution are very harsh for the environment. The climates are changing unevenly due to Global Warming, Therefore, The need of Renewable resources is very Important to resolve the factors caused by Global Warming.

In This paper, the concept of Renewable Grid Integration is Introduced in which two renewable resources grids such Wind & Bio-Gas are connected to form a micro-grid. The integration of two-Grid is utilized for the Electric vehicles. The Electric Vehicles are in heavy demand since the Conventional vehicles are not suitable for the environment & also due to the depletion of Fossil Fuels. In this paper we have also proposed a model in which the Electric vehicles are Connected to Internet of Things. IOT will provide security measures to passengers in vehicles. Since many People die every day due to accidents in the country. The introduction of IOT along with the integration of Artificial Intelligence will enable the car to take it's own decision depending on the circumstances present in the road. The system proposed gives us an alternative source of energy for the charging of electric vehicles and it also provides the Life security to passengers by introducing the smart E-Vehicles.

The motive of this paper is to show a new method and to develop a new system which is cleaner, greener and cheaper to use for the electric vehicles.

Keywords--- Electric Vehicles, Renewable Energy, Wind Energy, IOT, Smart E-vehicles.

I. INTRODUCTION

In the current industry the electric vehicle is charged with the help of the charging station which is fed by the generating station run by non-renewable source of energy. Such as by burning of coal and diesel in the thermal stations. There is a huge change in climatic conditions due to the use of such non-renewable source of energy in excess. The global warming and the greenhouse effect is one of the major reason for air pollution and decreased air quality. The amount of carbon di oxide emitted from the automobiles in the cities in India [1] (Delhi) accounts to about more that 53% of the total pollution**.** The goal of India is to achieve about 30% sales of two wheeler electric vehicles by 2030 which is now 1%.To overcome the losses caused by such system the renewable source of energy is taken in which the wind serves as the ultimate source for energy production and the thermal generating unit acts as the secondary system which is used when the renewable energy is unable to provide sufficient amount of energy to the Electric Vehicle utility grid. These goals can be achieved by proper installation of the charging stations which are fed by cleaner source instead of the polluted source.

Traffic accidents in India are a major source of death & injuries. According to [2] The National Crime Records Bureau (NCRB) 2016 reports states that there were 496,762 accidents in 2015 which is very huge. India is having rate of accidents about 0.8 per 1000 vehicles in 2015.Therefore to overcome these barriers, Smart Electric vehicle is introduced. The case of previous accidents in the country will analysed & then an algorithm is developed which will be fed to the controller in the vehicle. The controller will work on the set of instructions. The vehicle will be continuously monitored through IOT.The vehicle will be connected to each other through IOT with the help of vehicle-vehicle communication. Similarly, vehicle will be connected to Grid using Vehicle-Grid communication Technologies. This will make all the vehicles inter-connected to each other. The vehicles will be completely installed with sensors. The concept of image processing is also used to identify objects across the vehicle. The vehicle will be completely Automated as to reduce the human errors.

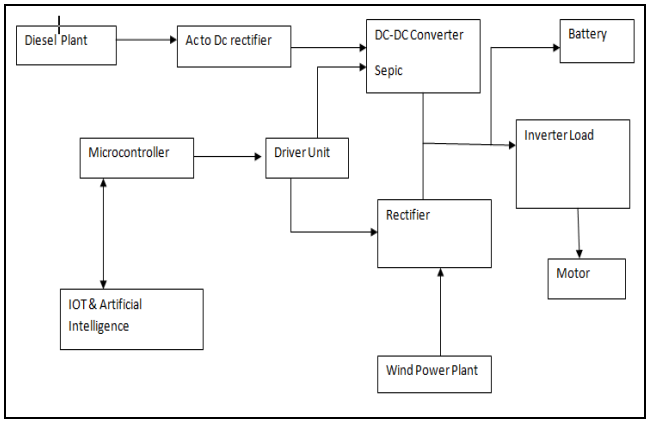

Fig.1: Block diagram of proposed system

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II. WIND ENERGY

Wind energy is one of the purest and cleanest form of energy readily available throughout the earth . [2] India has installed a total capacity of about 34.293 GW .[3] According to betz's law the maximum total achievable efficiency of a wind kinetic energy is about 59.3%. A wind turbine turns energy in the wind into electricity using the aerodynamic force created by the rotor blades. When the Pressure is Developed across the blade, The air pressure across the two sides of blade creates both lift and drag. The force of the lift is stronger than the Drag which causes the rotor to spin. The rotor is directly coupled to a Generator or through a shaft. It also consists of a series of Gears(Gearbox) which changes the speed of the rotation of blades.In vertical axis turbine the axis of the rotor is perpendicular to the wind and vertical to the ground. Where as in the horizontal wind axis turbine the axis of rotor rotation is in parallel with wind stream.The wind energy can be captured with the help of highway wind turbines. In this system the turbines are placed either on the top of the middle road with the help of erected poles or it can be put along the edges of the road. The fast moving vehicle creates a difference in the air pressure thereby moving the blades of the system and as a result energy is generated. [1]The installed capacity of overall wind power has grown up drastically from 6270 Mw in 2005 to 34046 Mw in 2017.

III. INTEGERATION OF RENEWABLE RESOURCES

Currently there is no proper grid for the electric vehicles in India to supply power to the vehicles.

The Integration of diesel and wind power plant is taken into consideration. The wind 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 or interrupted supply of wind energy in the system.

The power is generated by the alternator and it is supplied to the grid to a converter and following that it is fed to battery storage. [6]

The batteries which are used to store the charge are of lead acid or lithium ion batteries because they have better efficiency and life cycles. After the storage of charge in batteries the power is boosted by DC-DC converter & then it is fed to Charging Station.

The charging Station across the city gets the supply from the utility Grid formed by the renewable resources such as Wind, Bio-Gas or Solar.

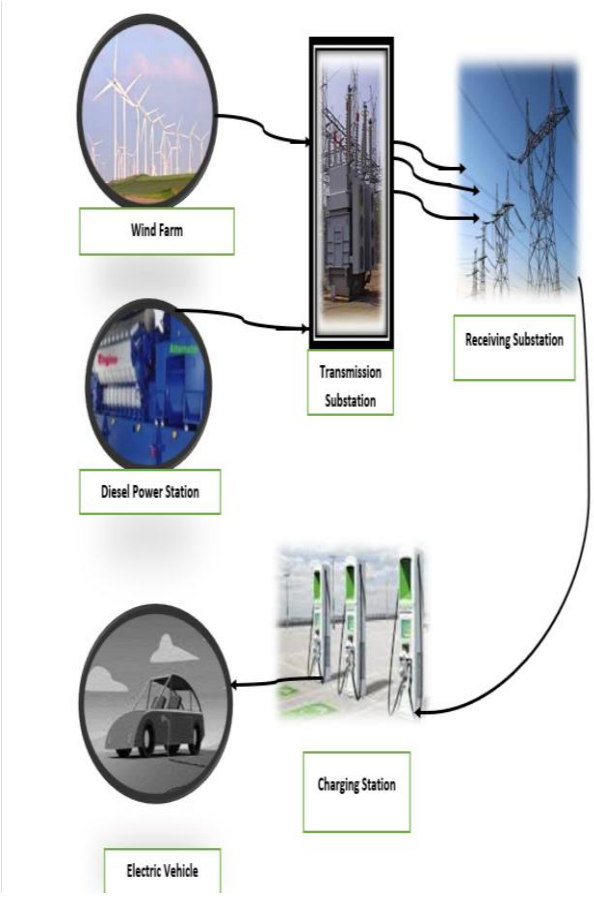

Fig. 2: Design of Power Flow for Charging Station

IV. DIESEL POWER PLANT

The diesel power plant is a form of conventional source of energy which generates AC current with the help of an alternator. The power generated in this plant will serve as a backup to the ev grid in case the solar power plant fails to give sufficient power or there is any maintenance work which is to be carried out.

The thermal power power plant in india produces power of about 65% of the total power. It is one of the good and reliable source of energy.

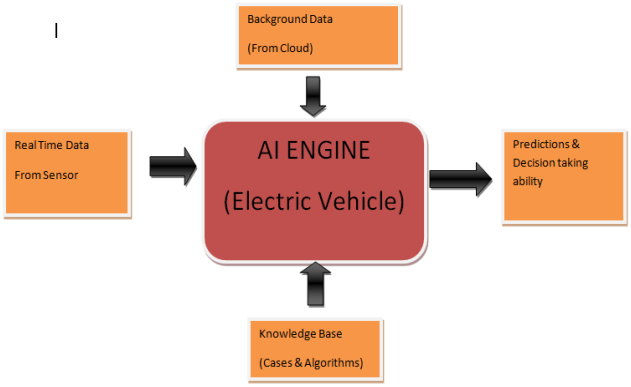

Fig. 3: Vehicle to Vehicle Communication

The diesel plant in india is in a state of decommission. [8] For example the GMR vasavi power plant because of its high running cost and more pollution the plant was dismantled.

V. SYNCHRONISATION OF POWER

Synchronisation of power is a process of matching the frequency of the AC current waveforms.

Both the plants wind and diesel cannot transmit power to a single bus until and unless both have a similar frequency. At the time of Synchronization, various Power Quality Issues occurs such as Harmonics, Instability, impact to the power Factor. The power quality issues can be overcome by using phase locked loop. In Phase Lock Loop (PLL) an output signal is generated whose phase is related to the phase of an input signal. It consists of a variable Frequency Oscillator, a phase detector in a feedback loop. The oscillator generates a periodic signal and the phase detector compares the phase of that signal with the phase of the input periodic signal, adjusting the oscillator to keep the phases matched. In Wind power plant, the output is ac which is rectified from AC to DC. The obtained DC is passed through the BUCK-BOOST Converter which regulates the voltage level & provides a constant DC voltage for a grid-synchronized inverter.

VI. SMART ELECTRIC VEHICLE

In Smart Electric Vehicle, the vehicle is pure Electric vehicle composed of Ultracapacitors & Tesla Power Wall Battery. The vehicle will be connected to the internet. The vehicle will be interfaced with a controller such as raspberry pi. The controller will have a pre-programmed Instructions. The instructions will execute on the basis of conditions present in Algorithm. The controller will be interfaced with camera. Due to camera Installed in the vehicles, the image Processing can be done. The advantage of Image Processing is, it will determine the objects across the car in the conditions of Foggy weather & during the mid-night. The vehicle is installed with motion sensor, Proximity sensor, Light sensor, Speed Sensor & Temperature Sensor.

It also consists of Global Positioning System (GPS), Accelerometer, & Gyroscope. The vehicle is having a current senor & voltage sensor to measure the parameters such as state of charging of the vehicle. The vehicles will be connected through IOT & Wi-Fi module. The vehicles will transmit data to the cloud & then the transmitted data can be accessed by different vehicles. In order to avoid the collision, The Vehicles driver Bio-Medical signals can be transmitted through wearable sensors over IOT to the other Drivers. For e.g. If the Driver is Drunk or not able to drive. This will help in pre-determination of the condition of the driver. The communication
technologies used are Zigbee & Bluetooth Low Energy.

In vehicle-vehicle communication different communication Technologies & standards which allow devices to communicate with each other

1. Zigbee: - It is a wireless communication Technology. It works on IEEE 802.15.4 standard in 2.4 GHZ or 915/868 MHZ bands. ZigBee can handle mesh networking & has lower power consumption.
2. Bluetooth low Energy: - Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ism band from 2.4 to 2.485 GHZ). BLE usage fast, low energy usage while maintaining the communication range.
3. Wi-Fi-Wifi is wireless local area network (WLAN) that utilizes the IEEE 802.11 standard.it has 2.4 GHz UHF and 5GHz ISM Frequencies. It provides internet access to the devices which are within the range (approx. 66 feet from access point).

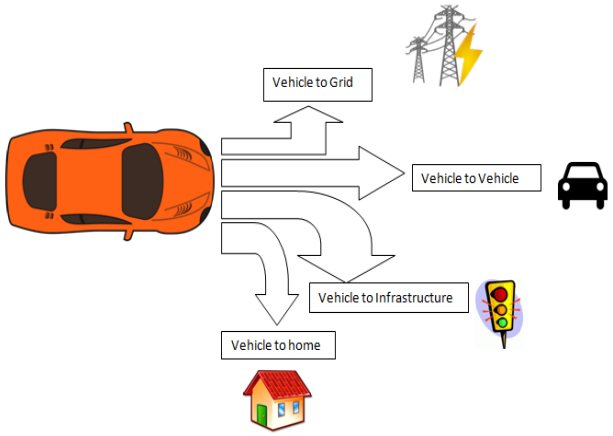

Fig.4: Different types of communication

4. RFID

Radio Frequency Identification (RFID) uses electromagnetic Fields to identify objects. The short range of RFID is about 10cm, but long range can go up to 200 cm. The RFID usually identifies tags which contains the stored information mostly authentication replies.

5. LoRa

Lora WAN is a long Range, low power wide area Network intended for wireless operated battery things in a regional, national, global network. It has secure bi-directional communication, mobility & localization services.

VII. VEHICLE TO GRID COMMUNICATION

In Vehicle-to-grid (V2G) communication, The vehicles communicates with Grid to sell the demand response services by returning electricity to the grid or by controlling their charging rate. In this system, The Electric vehicles cannot be charged more than 2-3 times per day. If the battery is charged more than its normal cycle then the life of battery decreases. According to Potential earning report [5], It is found that with proper regulatory support, vehicle owners could earn $454, $394 etc per year depending on whether their average daily drive was 32,64 or 97 km respectively. In this system we have introduced a smart Tariff system for Electric vehicles. The fare for the electricity will be low during mid-night since the load demand during is less so the battery can be charged & consumed later. Similarly, during the time of High winds, the energy can be stored in Telsa battery which is highly efficient & can be used during high peak loads. The battery charged in the parking will have less cost as compared to battery charged in Normal charging station.

Therefore, it will encourage the consumers to switch for renewable resources & build smart buildings.

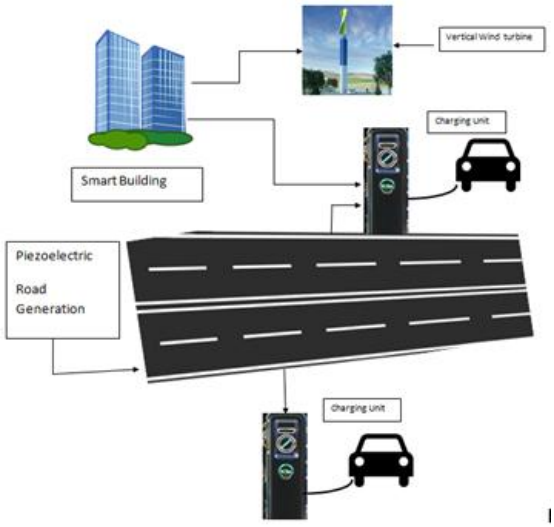

Fig.5: Different types of power sources

VIII. RESULTS

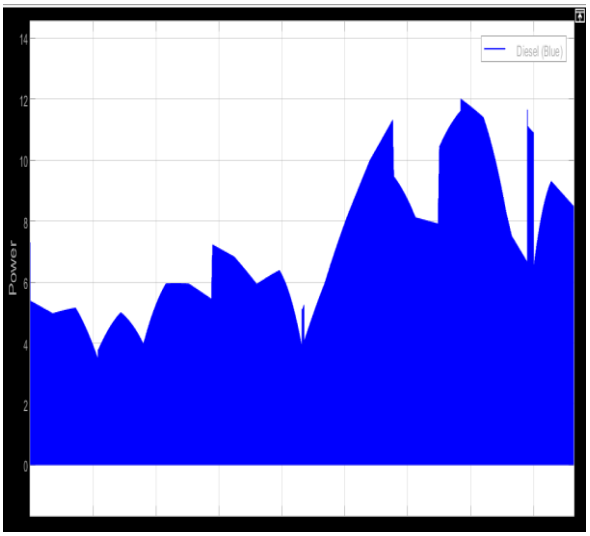

Fig.6: The figure shows us the power generated by the diesel power plant with respect to time.

Fig.7: In this figure it gives us details about the total power generated which is fed to the charging station.

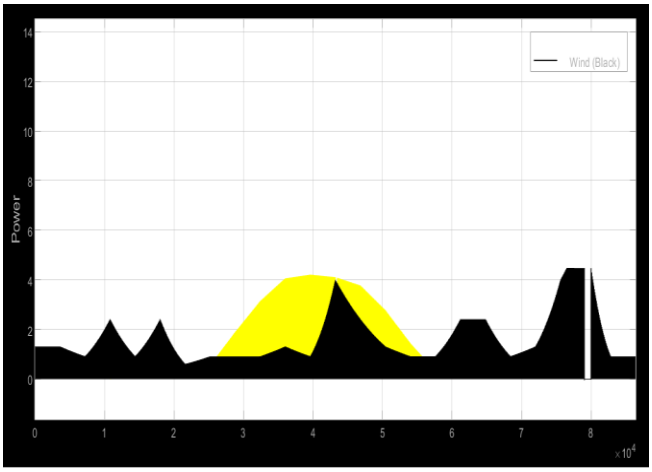

Fig.8: The above graph clearly shows us details about the power generated by wind power source with respect to time. It is a non constant graph with more shift in power

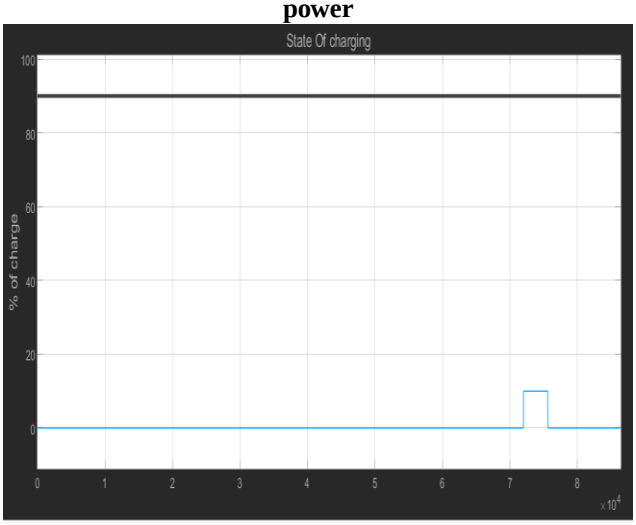

Fig.9: Shows us state of charging of the electric vehicles. It also shows the percentage of charge and state of charge

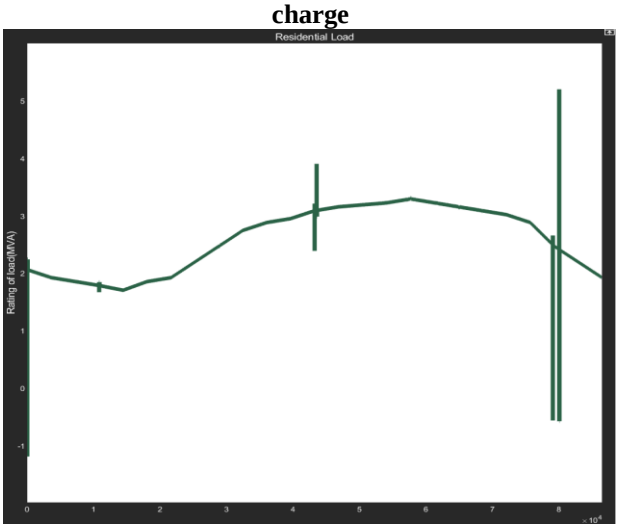

Fig.10: The figure shows us the values of Residential load with respect to its rating & time.

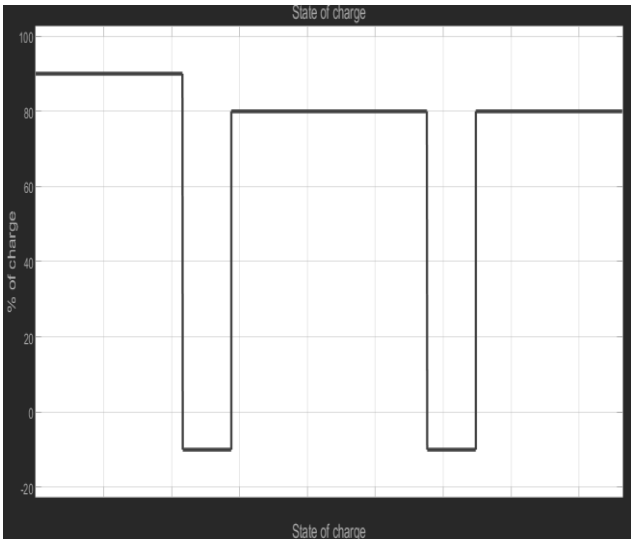

Fig.11: The graph above gives us details about percentage of state of charge vs time

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