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A Compact Multifunctional Power Electronic Interface for Plug-In Hybrid Electric Vehicles Using IoT

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Abstract: ***The main objective of this endeavor is to construct a hybrid electric vehicle that recharges its battery using a range of electrical energy sources, such as solar, wind, and dynamo power using multifunctional power electronic sources. These are the forms of renewable energy that regenerate more quickly than they exhaust. Voltage sensors are attached to the PIC microcontroller, battery, solar panel, wind turbine, and dynamo in order to measure voltages. This measured voltage will be displayed on an LCD, and embedded C language will be used to upload the values, along with the date and time using ESP8266 WIFI-Module, to the THINGSPEAK cloud. This project's primary goals are to use rechargeable batteries to store source energy from solar, wind and dynamo power in an electric vehicle (EV) while using THINGSPEAK to monitor and record data, and update the LCD display with measured voltages.***

Keywords: Electric vehicle, energy sources, voltage sensor, power electronic interface, thingspeak, LCD display.

I. INTRODUCTION

At the Göteborg conference on June 15 and 16, 2001, the European Council acknowledged greenhouse gas emissions and pollution from transportation as two of the main obstacles to sustainable development [1]. The 2020 targets for energy efficiency, usage of renewable energy, and reduction of greenhouse gas emissions are intended to be implemented. Creating and promoting safer, smarter, greener, and more energy-efficient products is one way to accomplish these kinds of objectives. Developing an urban transportation system that is sustainable requires the use of EVs. Since roads emit less CO2 than internal combustion engines, they should reduce noise pollution and enhance the quality of the air in the surrounding area. They should also use renewable energy sources for transportation [1].

An environmentally friendly and clever option is an electric vehicle charging station. We need more charging stations to operate electric cars. Increased use of EV charging stations in India could lead to a rise in EVs driven by residents and employees of residences, workplaces, schools, and hospitals. [2] Electric machinery, power electronics, and an internal combustion engine are all included in HEVs. The need to create alternative energy sources for vehicles because of the limitations of fuel-based energy, global warming, and exhaust emission limits in the previous century has drawn a lot of attention to studies on hybrid electrical vehicles (HEVs) [3].

Smart Grid is a network for the transmission and distribution of electricity, enjoying complete integrated control and new capabilities in information technology and telecommunications. It provides bidirectional energy flow and information in real time between all actors in the network.[4]. An embedded system is a combination of hardware to perform a dedicated task. Microcontrollers and IoT can perform real-time operations. The thesis explains the implementation of “compact multifunctional power. Electronic Interface for Plug-in Hybrid Electric Vehicles Using IoT” using a 16F72 microcontroller.

An intelligent and ecologically conscious choice is an electric car charging station. Electric cars need additional charging stations to be driven. India is expected to have a growing number of electric vehicle owners as more EV charging stations are added to homes, offices, schools, and hospitals, among other areas. Internal combustion engines, power electronic components, and electric motors are all installed in [2] HEVs. The need to find alternative energy sources for vehicles due to finite fuel-based energy, global warming, and exhaust emission regulations in the past century has drawn much interest to studies on hybrid electrical vehicles, or HEVs. [3]

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A smart grid is a system for distributing and transmitting power that has full integrated control and new telecommunications and information technology capabilities. It allows for real-time information sharing and bidirectional energy transfer among all network participants.[4]

A collection of hardware components working together to serve a certain purpose is called an Embedded system. Real-time operations can be carried out by means of microcontrollers and the Internet of Things. The thesis explains the implementation of "a Compact Multifunctional Power Electronic Interface for Plug-in Hybrid Electric Vehicles using IoT" using 16F72 microcontroller.

II. LITERATURE REVIEW

C. Vlad, M. A. Băncilă, T. Munteanu and G. Murariu ,"Using renewable energy sources for electric vehicles charging [1]", Several options for electric power supply from renewable sources for electric vehicle charging stations are especially covered in this study. The outcomes of the Homer simulation analysis demonstrated that, in order to determine the system's technical and financial viability, the selection of a suitable power charging station should take into account both the available local resources and the laws that support the use of renewable energy.

P. K, K. T, G. A and R. V, "Design of EV Charging Station Using Renewable Energy Sources [2]" , This research reports that the consumption of fossil fuels results in the byproduct of CO2, which adds to greenhouse gas emissions, global warming, and other adverse effects. These days, there are more electric vehicles on the road as a solution to these issues. This electric car doesn't require any gasoline or lubricants because it runs only on energy. An environmentally friendly and clever option is an EV charging station. We need more charging stations in order to operate electric cars. A greater number of EVs may be driven by installing EV charging stations in diverse locations. In order to meet the endless demand for electric car charging, solar PV and fuel cell-based EV charging stations were presented in this study.

H. S. Matharu, V. Girase, D. B. Pardeshi and P. William, "Design and Deployment of Hybrid Electric Vehicle [3]", The primary focus of the explanation is regenerative braking, which is a one-stop shop for boosting the production, application, and advancement of hybrid electric vehicles that will either partially or fully power the vehicle. Regenerative braking involves part of the electricity being returned to the battery while the vehicle is braking; this process charges the battery.

S. Krishnakumar *et al.*, "IoT-based Battery Management System for E-Vehicles[7]", This paper discusses plug-in electric vehicles (HEVs) and hybrid vehicles (HEVs), which use the power grid to charge their energy storage devices. The suggested methodology covered the bill payment procedure as well as a specific interface for predicting and estimating the amount of battery energy used at various places. The information regarding the energy storage device charging times for electric vehicles is covered in this chapter. Additionally, the technological aspects of DC fast chargers and traditional AC chargers are examined.

III. EXISTING SYSTEM

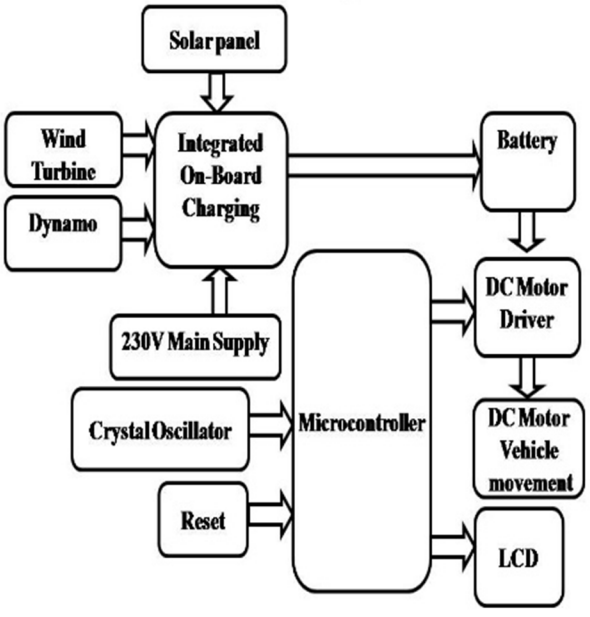


Figure 1:-Block diagram of the existing system

To reduce the greenhouse gases, the sources used must be renewable and causes less pollution. Petrol and diesel vehicles causes noise and pollution which is very hazardous to environment. Hence Electric vehicles are introduced in the mobile industry for saving the fuel and also causes less pollution .The Existing system project has plug-in hybrid electric vehicle using renewable energy sources. These nonconventional energy sources are used to create a vehicle. The three primary renewable energy sources are hydro, wind, and solar. The generated energy is kept in reserve in a battery. DC motors are supplied with power from the battery. The microcontroller and motor are further connected. The obtained voltage will be shown on the LCD panel.

IV. PROPOSED SYSTEM

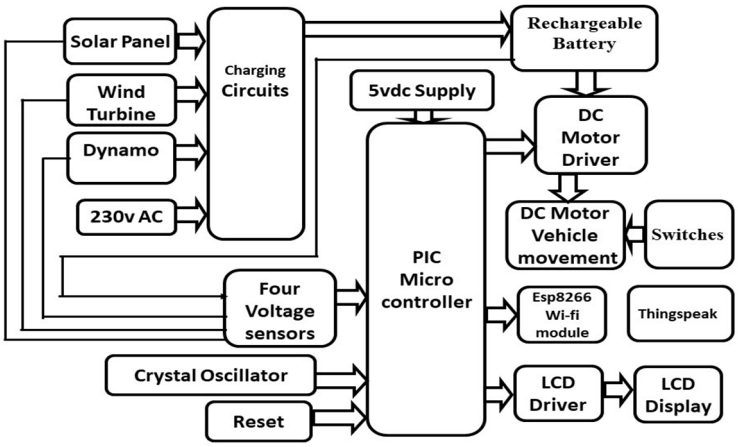


Figure 2:-Block diagram of the proposed system

The main aim of the project is to design a hybrid electric vehicle using multifunctional power electronic sources to charge EV battery. This system consists of solar, wind, dynamo, mains sources is uses to charge the EV battery. Natural resources like the sun and wind provide renewable energy since they replenish more quickly than they deplete. The combined energy obtained from non-renewable resources is stored to a battery through charging circuit. The battery supply is fed to DC motors for vehicle movement controlled by the user through switches. Solar, wind, dynamo and battery are connected to the microcontroller through voltage sensors to measure the voltages. This measured voltage will be display on LCD as well as these values upload into the thingspeak cloud along with date and time using ESP8266 WI-FI module. To achieve this task microcontroller loaded program written in embedded C language. The Proposed system does not cause any environmental pollution like the fossil fuels and nuclear power and utilizes free available source of energy from sun and wind. By using this project, we can save more power.

V. METHODOLOGY

The main blocks of this project are: 1. Wind turbine. 2. Solar panel. 3. Dynamo. 4. Charging circuits. 5. Voltage sensors. 6. Buttons. 7. PIC Microcontroller. 8. DC Motors. 9. ESP8266 WI-FI module. 10. LCD display. 11. Crystal oscillator. 12. Reset button. 13. LED indicator. 14. Robot chassis. By connecting to an external power source and applying regenerative braking, a plug-in hybrid electric car can refill its battery. Under usual circumstances, the electric power can be conserved in a battery, which may significantly reduce the vehicle's oil consumption. [9] This project consists of total four renewable/non-conventional energy sources which are solar, wind, dynamo and batteries. It also consists of battery storage system where 12v batteries are places together. The model of the project comes with a remote access by which you an run the vehicle. As you can see in the above image of this project, the four energy sources are connected to the charging circuits. The charging circuits are connected to the batteries for storage of power generated. The Voltage sensors are connected to the PIC Micro Controller. The Micro Controller is further connected to ESP8266 Wi-fi module and LCD display. With its inbuilt TCP/IP protocol stack, the ESP8266 Wi-Fi Module is a self-contained SOC that enables any microcontroller to access your Wi-Fi network. This module's strong on-board processing and storage capabilities allow it to be connected with sensors and other application-specific devices through its GPIOs with little to no impact. Development up-front and minimal loading during runtime. The volage generated by the energy sources are displayed on the LCD display individually for each source. The primary objective in this project is thingspeak application which is connected to the wifi module. The thingspeak application has to be connected to the mobile and pre-installed Wi-fi password and details of the costumer has its access of the energy usage data log of the plug -in Hybrid Electric

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VI. APPROACHES

The Electric vehicles are divided further which are hybrid electric vehicles (HEV's) and all-electric vehicle. The all-electric vehicle has only a motor and this can be controlled using power supply. In this project we used plug-in hybrid electric vehicle(PHEV)[10]. The main advantage is that the PHEV will also run by a grid. The EV's with large battery is widely used in vehicle industry than small batteries so that the vehicles can run for a longer distances. Many researches are done on the electric vehicles and it was revealed that EV's can be used in the power system widely which is also economical[10]. The future scope of our project is that the plug-in hybrid electric vehicle already has a thingspeak installed and this can be further extended by using raspberry pi processor. With more innovations in technology in the Electric vehicles, the usage of EV's in the automobile industry increases, which helps in hugely reducing the carbon emissions.

VII. OUTPUT



Figure.3: Thingspeak channel status

VIII. CONCLUSION

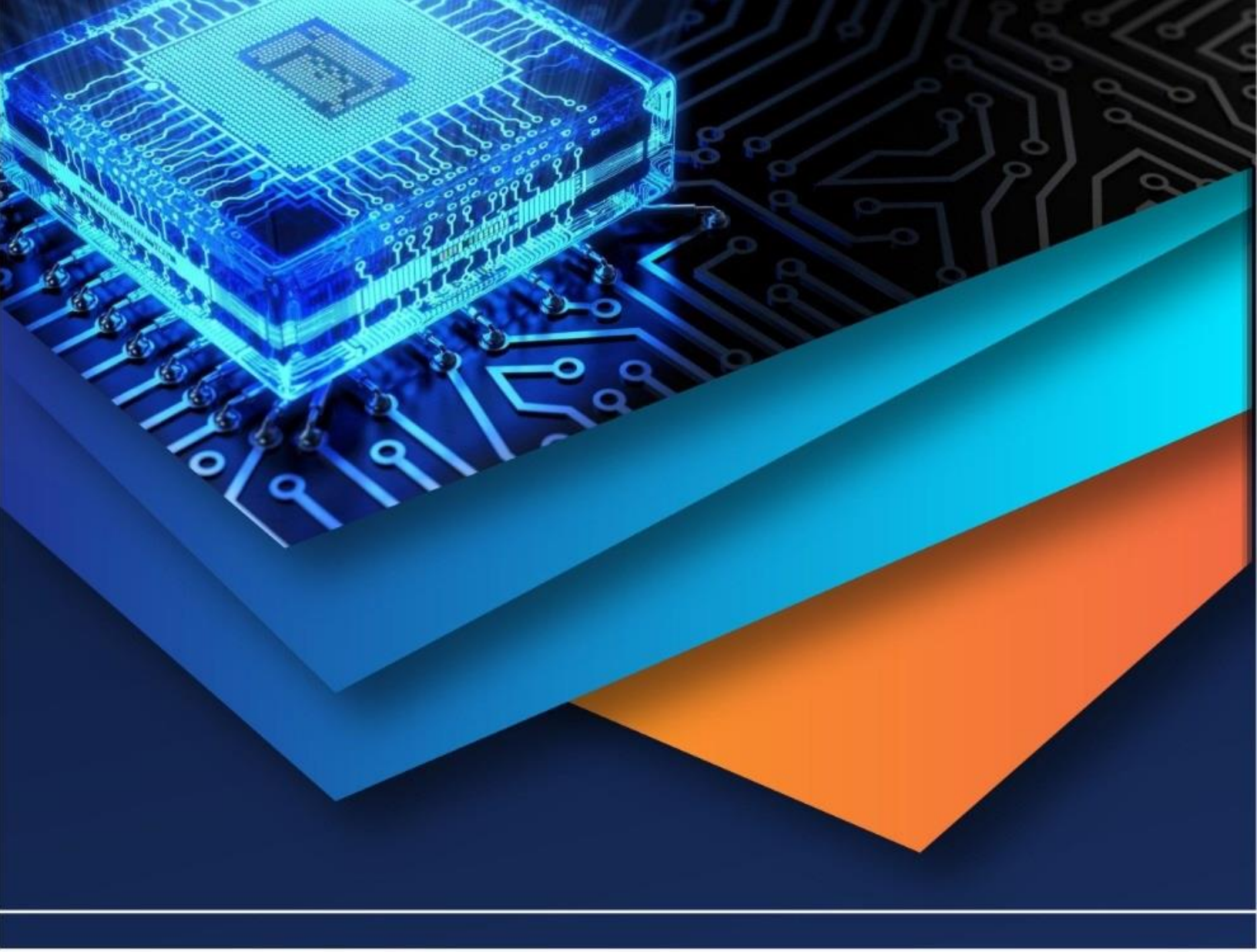
With the help of the project "A Compact Multifunctional Power Electronic Interface for Plug-in Hybrid Electric Vehicles using IOT," a hybrid car with several battery-charging options was created. The project kit prototype and the output graph of the energy sources used separately, which is displayed on the Thingspeak application, are shown in the images above. The data log is kept within the programme and contains a reset option in case it has to be utilised for reference. It has been built with features that integrate all of the hardware components that are used. Each module's presence has been thoughtfully considered and arranged to enhance the unit's overall performance. Second, with the aid of developing technology and extremely sophisticated integrated circuits,

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