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ANALYSIS OF HYBRID ELECTRIC VEHICLE OPERATED BY WIND AND SOLAR ENERGY

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Abstract:

The energy problem and the pollution caused by vehicle emissions are two of the most urgent issues of our day. This study assesses a wind-solar hybrid system created specifically to provide electricity for HEVs, or hybrid electric vehicles. The main goal is to optimize the hybrid system by making efficient use of solar and wind energy. Furthermore, the significance of integrating renewable energy into transportation networks is emphasized and a basis for further research is laid. To charge HEV batteries, a Battery Management System (BMS) makes use of converters, solar panels, wind turbines, and electrical outlets. The simulation and analytical findings show that the system is capable of harnessing solar and wind energy to successfully produce electricity, offering hybrid electric cars a reliable source of power.

Keywords **—**: Maximum Power Point Tracking

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I. INTRODUCTION

As seen by the ongoing demand for fuel, automobiles are now considered essential components of daily life for both personal transportation and the movement of commodities. In tandem with this desire, concerns have been voiced about escalating fuel costs and environmental issues related to air pollution and climate change. Automakers have been under pressure from multiple governments to provide low-emission and ecologically responsible transportation options as a result.

II.LITERATURE SURVEY

Because of the increased use of electric vehicles (EVs) and decreased reliance on fossil fuels, there has been a decrease in the emissions of greenhouse gases and other pollutants. [1] Innovative appraisement of smart grid operation considering large-scale integration of electric vehicles enabling V2G and G2V systems. Apart from the negative consequences of pollution, fossil fuels are running out. As a result, developing cutting-edge technology is essential to maximize the use of petroleum-based products[2]. Researchers are attempting to create state-of-the-art, eco-friendly energy solutions for transportation. Petroleum products, in contrast to unconventional energy sources, provide numerous advantages despite the apparent disadvantages of scarcity and pollution[3]. In addition, filling up the gas tank is faster than charging a battery, which could take several hours[4]. Unlike chemical batteries, fuel cells generate electricity instead of storing it, and their capacity to do so is dependent on the availability of fuel[5]. While EV deployment is rapidly growing globally, Pakistan cannot claim the same, and there are a number of reasons why EV adoption in Pakistan has stagnated[6]. First, Pakistan's energy conditions are not ideal for broadly gauged EV substructure support[7]. A persistent mismatch between system power production and demand has resulted in one of Pakistan's worst energy crises in the past ten years[8]. The energy crisis caused power shortages that negatively impacted the nation's annual output, employment, and exports. Pakistan has recently worked hard to create large-scale power-producing facilities, and to some extent, these have been successful in meeting the country's increasing energy need[9]. Although the installed generation capacity of the nation was claimed to have reached 37,402 MW in 2020, the combined demand from industrial and residential sectors was never greater than 25,000 MW[10].

III.PROPOSED SYSTEM

Maximum Power Point (MPP) Calculation for Solar Panel International Journal of Advanced Natural Sciences and Engineering Researches 23 The maximum power point of a solar panel can be calculated using the equation:

$$P_{MPP} = V_{MPP} * I_{MPPP}$$

where PMPP is the maximum power output, VMPP is the voltage at the maximum power point, and IMPP is the current at the maximum power point. Power Output Calculation for Wind Turbine The power output of a wind turbine can be determined using the equation:

$$P_{output} = 1/2 \times \rho \times A \times V\ 3 \times Cp$$

where P_{output} is the power output, ρ is the air density, A is the swept area of the rotor, v is the wind speed, and Cp is the power coefficient. The car operates on the principle of on-board battery charging and draining. The motor draws energy from the battery while the car is moving, and after a set number of miles, the battery needs to be recharged. In this vehicle, the solar panels are used to charge the battery while wind turbines produce the energy. The car does not need to be in standby mode to recharge the battery because it is recharged on board. A car that runs on a battery and is recharged by free energy sources is designed to preserve energy and make the greatest use of it. Then the solar panel and wind generator motors are linked in accordance with the needs. Driver IC L293D is used to drive the vehicle's motors. It receives a signal from the controller and, depending on the signal, provides 12V or 0V to the motor terminals. And the motor rotates either forward, reverse, or not at all depending on the voltage at the motor terminals. The driver IC provides 12 and 0V to both motors, causing them to operate in the same direction, which is forward, in order to move the car ahead. Driver IC L293D provides the motors with 12 and 0V in reverse for forward motion, causing both motors to revolve in the opposite direction When traveling left, the left motor will remain stopped and the right motor will move forward, however when moving right, the right motor will forward. In this manner, the car is operated wirelessly and by remote while using the battery as a power source.

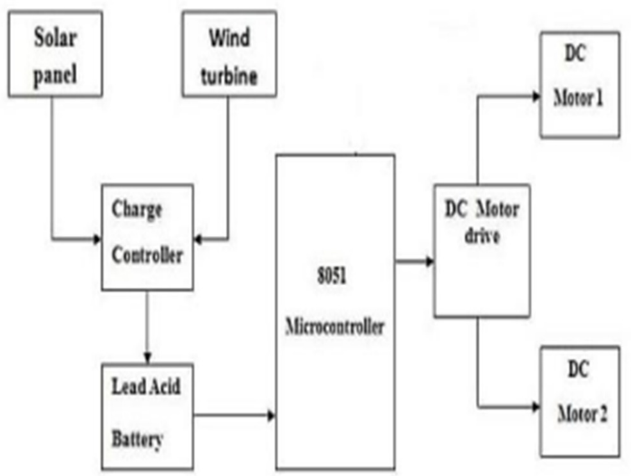


Fig 1: Block diagram of proposed system

III. RESULTS AND DISSCUSSION

The output of the code that was supplied shows that a hybrid wind-solar system is in place for producing electricity. 10500 Wh (watt-hours) of energy were produced in total. The total energy production of the wind-solar hybrid system for the given range of wind speeds and solar irradiance levels is represented by this value. It provides an overall assessment of the electrical generation capacity of the system. The average vigour generation is 350 Wh. This figure shows the average power used by the hybrid scheme each hour, taking into account solar irradiation and wind speeds. The predicted energy generation of the system is displayed. A 1.05 Wh/Wh energy density.These results shed light on the hybrid wind-solar approach. The system's capacity to generate electricity is based on its average and maximum energy output. The efficiency of the system's energy conversion and storage is indicated by its energy density. These interpretations could compare installations, assess if the system is suitable for a given application, or make recommendations for future development.

SOLAR PANEL ON THE ROOF OF HEV

The maximum power output of the HEV roof solar panel is 1000 W. The maximum power point (MPP) of the solar panel produces the most electricity under optimal circumstances. These details are essential for assessing the solar panel on the HEV roof. The hybrid electric vehicle system may optimize the performance and power production of the solar panel by positioning and utilizing

• Aggressive loop optimization typically compromises debug data.

WIND TURBINE ON THE ROOF OF CAR

These figures imply that the vehicle's wind turbine produces up to 300 W at a speed of 8 m/s. The maximum control point (MPP), which produces the most power given the current wind conditions, is the wind turbine's ideal operating position. The performance of the wind turbine in the car is dependent on these outcomes. To optimize power production to the vehicle's power system, the wind turbine can be positioned and operated using MPP data.

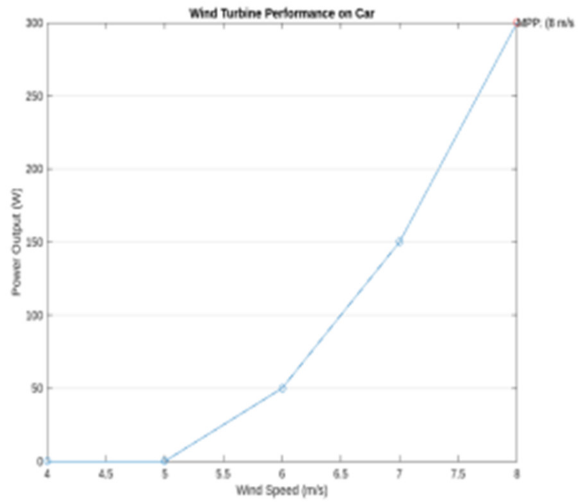
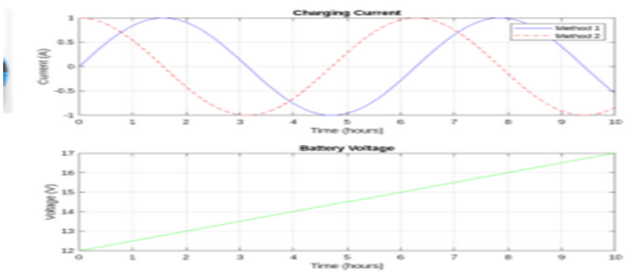


Fig 2: Wind Turbine Performance On The Car



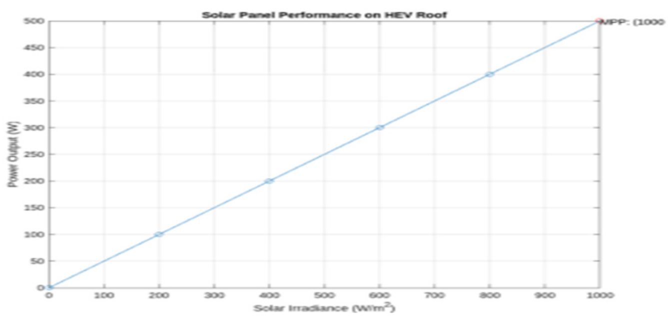


Fig 3: Solar Panel Performance HEV Proof

IV. CONCLUSION

There is exciting potential for increasing vehicle economy and sustainability with the construction and evaluation of a wind-solar hybrid power system. Modeling and visualizations suggest that HEVs could be powered by the wind-solar hybrid approach. Under 1000 W of solar irradiation, the vehicle's roof solar panel's maximum power point.

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