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Solar Wind Powered Smart Electric Car

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ABSTRACT: Transportation is the act of moving things from one place to another. It is one of the basic prerequisite of human beings that allows the economic development to occur. As the population increases the need and advancement in the field of transportation also increases. In order to overcome the never ending fuel demand of conventional vehicles, an electric vehicle (EV) is launched. The focus on electric vehicle have gained considerable attraction because of the necessity for developing alternative methods to drive the vehicle with limited global warming and exhaust emission. This paper proposes a completely new methodology for transportation, which is an electric car.

KEYWORDS: Solar panel, Wind blade, Piezoelectric crystal, RFID technology, Ultrasonic sensor, MPPT

I.INTRODUCTION

Electric vehicle was first appeared in the mid- 19th century. An electric vehicle held the vehicular land speed record until around 1900. The high cost, low top speed and short range of battery compared to normal IC engine vehicle led to a worldwide decline in their use. But by the beginning of 21st century, interest in EV and other alternative fuel based vehicles has increased due to growing concern over problems associated with hydrocarbon fuelled vehicle [1]. The key factor behind the introduction of electric car is the future perspective of zero emission derived by solar and wind energy. Besides this the vehicle has been greatly contributed to the conservation of energy [2].

This paper introduces a prototype of an electric car with the ability to overcome most of the drawbacks of conventional vehicles. With renewed interest in renewable and sustainable energy, solar wind powered smart electric cars have come to the forefront. Moreover renewable sources can be considered as an infinite source and can be renewed from natural sources found on earth. The model accepts only renewable energy resources as input to drive the vehicle. Also, it employs some smart functions with the help of sensors.

II. VEHICLE STRUCTURE AND OPERATION

a. Structure

As the name indicates it is an electric car customary drives with the help of renewable energy sources such as solar and wind. Fig 1 shows the model structure. It habitually consists of a DC motor along with a solar panel, wind blade and piezoelectric crystal. The solar panel routinely works with the help of maximum power point tracking. Besides these, radio frequency identification technology is employed to make the car ignition smart. An ultrasonic sensor is also fitted with it for the detection of obstacle with in a fixed range.

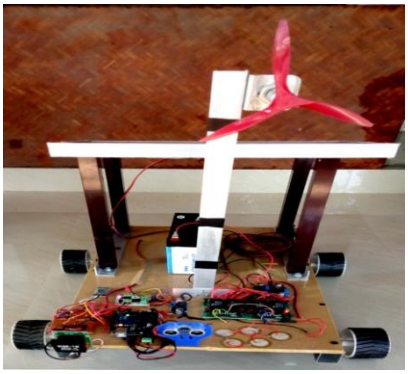

Fig 1: Structure of the car

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b. Inner assembly

The inner assembly of the car is composed of Arduino Uno, MPPT charge controller, relay, DC motor, battery, and Bluetooth module. The Arduino is a microcontroller board based on ATmega 328p.It is the base with which the modelling starts. MPPT charge controller is a DC-DC converter embedded with MPPT algorithm to maximize the amount of current to the battery from PV module. The charge selector is a voltage sensing relay which can automatically manage charge function between the source and battery. DC motor is the central part and accepts electrical energy to produce mechanical movement. It is driven by a motor driver L293D. A rechargeable battery of 12V, 7Ah is used for storing the energy. The serial communication is provided by Bluetooth module HC-05.

c. Operation

Fig 2 represents the system diagram. The entire operation of the electric car is controlled by user developed android application. It provides the user with information such as battery percentage, on which source the motor runs, whether authorized or not.

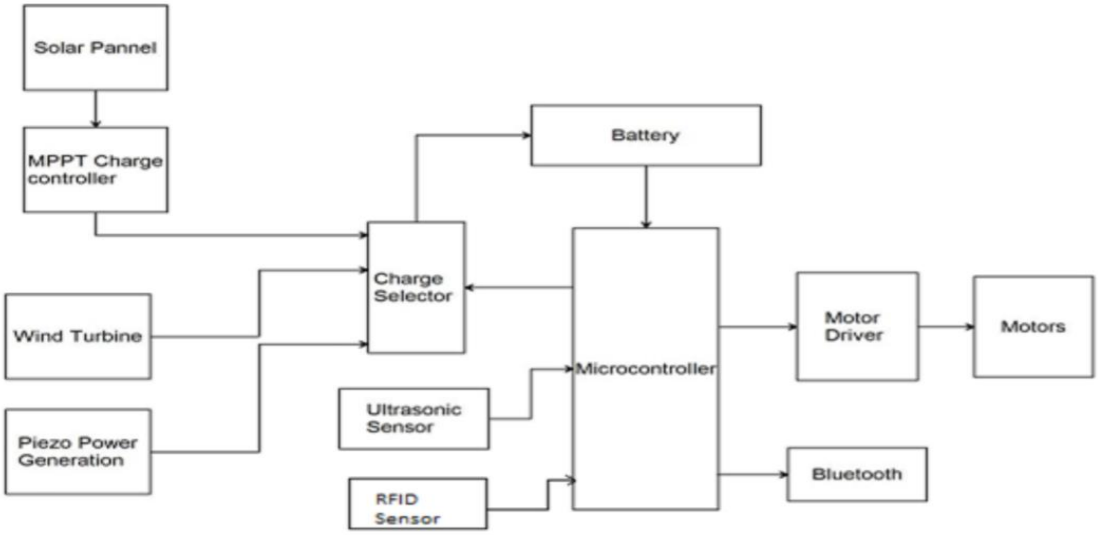

Fig 2: System diagram

Unlike conventional vehicle, the smart car is ignited by a RFID card. Along with two cards, of which one for accessing and other for denying the ignition, an EM-18 RFID reader module operating at 125 kHz is employed. After being authorized the car starts to move by accepting renewable energy resources as input. The energy source is selected based on the density of available radiations.

A solar panel is placed in parallel with the horizontal axis. Similarly a wind blade is placed vertically at the top of the car and a piezoelectric crystal is attached on brake, clutch and accelerator in order to provide regenerative braking. The solar panel which is an assembly of photovoltaic cell collect solar radiation and the panel output is fed into MPPT charge controller as its input. Mainly the charge controller has two functions;

i. If the amount of available solar radiation is higher than that required for the motor to run, then the controller controls the output by lowering it. This function of charge controller is called buck.

ii. If the amount of available solar radiation is lower than that required for the motor to run, then the controller controls the output by increasing it. This function of charge controller is called boost.

From the charge controller the constant output is fed in to the charge selector. The charge selector also receives input from the wind fan as well as from piezoelectric sensor. As the name indicates, charge selector decides which source is to be selected for charging the battery. It also provides the function of automatic switching. It selects a source having higher density to run the motor. ie, the vehicle runs by giving priority to the energy which has higher density. After

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selecting the source, its output is given as input to charge the battery. Also a series of four relays are employed in between the sources and battery. Each of the relays has its own function. Their functions are as follows,

i. Relay 1: used to provide solar energy to charge the battery.
ii. Relay 2: used to provide either wind energy or energy from sensor to charge the battery.
iii. Relay 3: used as a charge selector.
iv. Relay 4: act as a cut-off to prevent reverse charging.

Another astonishing feature that makes the car smart is the presence of ultrasonic sensor (HC-SR04). It enable to virtually see and recognize object, avoid obstacles, measure the distance. Whenever an obstacle comes across the sensor, it detects the obstacle and automatically stops the motor. It helps in reducing accidents and has an inevitable role in parking lots during parking. The detecting range can be limited as 10-30 cm for precise operation.

III. RESULT

The prototype model works efficiently at all climatic condition. The design is successfully simulated using proteus software. Fig 3 shows the snapshot of model simulation. Availability of solar radiation at a particular region is dependent up on several factors such as altitude, terrain, seasons, humidity and pressure.

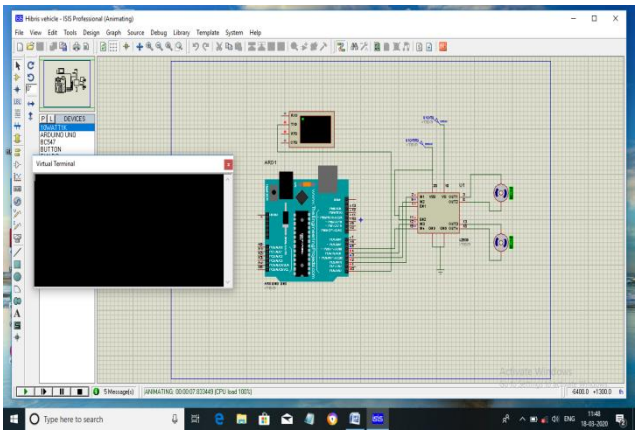

Fig 3: Snapshot of model simulation

Wind energy extracted by wind blade is given by [3],

Wind power $=\frac{1}{2}\rho AV^3Cp$

A = area swept by blade

ρ = air density

V = wind speed

Cp = Betz coefficient (0.59 for ideal blade)

IV. CONCLUSION

In this paper we discover a new technology to develop an eco-friendly vehicle. The study and fabrication of the proposed model contributes to the promotion of green technology as well as energy security. Additional maximum power point tracking helps the car to operate at maximum efficiency under all conditions. The automatic braking helps to avoid accidents whereas smart ignition helps to prevent robbery.

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