Improvement of Engine Efficiency of Vehicle Using Hybrid Power System

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Abstract—The objective of this paper is to develop a hybrid power delivery system for vehicles that is able to harness alternate sources like wind and solar energy and use it to effectively argue the capabilities and efficiency of the prime mover, or supply electrical energy to the accessory, and non-critical systems installed in the vehicle which would otherwise redact this power from the prime mover. This system will help increase the efficiency of the vehicle, reduce fuel consumption and increase the miles for gallon delivered by the vehicle.

Key Words: Index Terms— Hybrid Car, Photovoltaic cell, Wind mill.

1. INTRODUCTION

As conventional energy sources continue to diminish in availability and feasibility, the world has begun to give serious thought to un-conventional and renewable sources of power like wind, solar, fuel cells and tidal energy. The major disadvantage of each of these sources is that they provide intermittent power depending on generation technique. For example, solar power systems provide no output at night. This paper proposes to develop a hybrid power management unit to tie these dissimilar sources of power together and overcome the disadvantages of each of these sources by mutual interworking.

Hybrid power can also be used to prolong and extend the longevity and efficiency of conventional sources. Hybrid power describes the combination of a power producer and the means to store that power in an energy storage medium. This system will help increase the efficiency of the vehicle, reduce fuel consumption and increase the miles for gallon delivered by the vehicle.

This paper proposes to hybridize two sources: -Wind energy & solar energy. We shall use the storage medium, a DC battery. Wind power is the conversion of wind energy into a useful form of energy, such as using wind turbines to make electricity, windmills for mechanical power, wind pumps for water pumping or drainage, or sails to propel ships.

2. BLOCK DIAGRAM

The hybrid power management unit consists of a windmill (DC motor), a solar panel, Lead acid battery (6VAH), microcontroller ATmega 16, relay, RS232 Driver, simulation software (LabView).

2.1 Wind Mill & Solar panel: The solar panel in our demonstration model is a 12V, 10W unit of Photovoltaic (PV) type. From an operational point of view, a photovoltaic panel may experience large
fluctuations in output power due to varying weather conditions, which may result in control problems. Thus to overcome this we intend to integrate this with a complementary source, like wind power. The windmill is constructed by reverse engineering of a 12V, 300 RPM DC motor. At full wind velocity, it estimated that it will produce up to 13.2V, which can be easily regulated by a mechanical governor or a zenerized voltage regulator. This unit is capable of producing up to 10W, under fair wind conditions.

2.2 lead Acid Battery: The windmill and solar panel is connected to the series combination of 26V 4AH DC lead acid battery, through a switching relay. The battery will store the energy received from windmill & solar panel.

2.3 Microcontroller: The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed.

Fig 2. Block Diagram
Features:

- Two 8-bit Timer/Counters with Separate Prescalers and Compare Modes
- One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
- Real Time Counter with Separate Oscillator
- Four PWM Channels
- 8-channel, 10-bit ADC
- 8 Single-ended Channels
- 7 Differential Channels in TQFP Package Only
- 2 Differential Channels with Programmable Gain at 1x, 10x, or 200x
- Byte-oriented Two-wire Serial Interface
- Programmable Serial USART
- Master/Slave SPI Serial Interface
- Programmable Watchdog Timer with Separate On-chip Oscillator
- On-chip Analog Comparator

It performs the following task:

- Sending a control signal to the relay to switch between the windmill & solar panel. During the day time solar panel will be used as a source and during night windmill will used as a source to supply the power to the battery.
- Accept the data from lead acid battery so that it can monitor when the switching is required.
- The microcontroller is also connected to RS232 Serial port interface which is further connected to a computer.
- Sending control signals to relay driver & RS232 serial port interface &
- It also displays the readings on LCD.

2.4 Relay Driver (L293D): L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction.

2.5 RS232: RS 232 is a serial port interface that consists of 25 pins and the main function of each pin is discussed below. Pin3 is a receive data pin, which is used to receive the data. Pin7 is the common reference pin for all signals which includes timing, data and control signals.

2.6 Simulation software (LabView): LabView offers a graphical programming approach that helps you visualize every aspect of your application, including hardware configuration, measurement data, and debugging. This visualization makes it simple to integrate measurement hardware from any vendor, represent complex logic on the diagram, develop data analysis algorithms, and design custom engineering user interfaces. All the methods and functional block diagram given in this paper were implemented using LABVIEW on the window 7 operating system. The experiments were performed on an Intel (R) Core (TM) i3 CPU @ 2.20 GHz.
3. CIRCUIT DIAGRAM

![Circuit Diagram]

Fig 3. Circuit Diagram

4. RESULT

We have developed a hybrid power system which amalgamates power from two sources, wind and solar energy, and stores the resultant collected energy in a lead acid battery capable of supplying the power on demand to the target application. The solar energy source dominates during the day when the sun is the primary source of generation and the windmill dominates at night when the solar power is low. The target

<table>
<thead>
<tr>
<th>RPM (Continuous)</th>
<th>Voltage (with fluctuations)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 (full rotation)</td>
<td>11-12V</td>
</tr>
<tr>
<td>200</td>
<td>7-8V</td>
</tr>
<tr>
<td>150 (half rotation)</td>
<td>5-6V</td>
</tr>
</tbody>
</table>

Table 1. Readings of Wind turbine
application envisioned is the argumentation of the efficiency of an internal combustion engine powered automobile. We have developed a real time monitoring system to supervise and administer the flow of power and optimize delivery to target systems. The screenshot of the developed software is shown below.

It is capable of displaying both real time voltages and a histogram of developed voltage.

![Fig 4. Histogram and real time voltages of developed software](image)

![Fig 5. Histogram result at ideal condition](image)

![Fig 6. Fluctuations due to environmental change](image)
As shown in figure 4 the voltage readings with respect to time of solar panel, windmill and battery is displayed at ideal condition. The reading has taken using Labview software which is real time software i.e, it gives reading of renewable sources of every seconds. In figure 6 the reading of renewable sources and a battery is shown at variable weather condition. As we can observe that, at variable weather condition the voltages of renewable sources and a battery is less than the ideal condition. 

This system has the ability of augmenting the efficiency of an automobile by 1-3%. Sample calculations for a Maruti Zen are as follows: The Zen has a 1000cc engine (approx) capable of developing 65HP. Assuming our system to be a 1:10 scale model; we shall discuss an equivalent developing 6.5HP. Our system delivers power from a 12V and 4.5AH source, thus capable of supplying 54W per hour or 0.075HP.

**Calculation:** 1HP = 745.699 Watt Therefore, 54watt per hour will give 0.075HP.

The Engine efficiency will be calculated as 

\[ \text{H.P obtained (0.075) \over \text{total H.P (6.5)}} \times 100 = 1.15\% \]

This power will totally be devoted to driving the air condition and other electrical systems which would otherwise have drawn power from the prime mover. Thus the efficiency improvement is 1.15% over an unsupported engine. The possible mounting points for the windmill are in-front of the radiator with a vertical architecture, on rear boot on the wind spoiler. The solar panels can be spread over roof, bonnet and side door area, thus maximizing energy generated.

5. CONCLUSION

Thus we have developed and described a hybrid power delivery system for vehicles that is able to harness alternate sources like wind and solar energy and use it to effectively argue the capabilities and efficiency of the prime mover, or supply electrical energy to the accessory, and non-critical systems installed in the vehicle which would otherwise redact this power from the prime mover.

This system will help increase the efficiency of the vehicle, reduce fuel consumption and increase the miles for gallon delivered by the vehicle.

The applications of this system range from improvement of efficiency of commercial vehicles to extension of efficiency and lowering of running costs of long haul freighters and trucks.

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