Power Generation from Renewable Energy Sources for Mobile Vehicles

Mrs.A.Aruna Devi  
Assistant Professor  
Department of Electronics & Communication Engineering  
Christian College of Engineering & Technology  
Oddanchatram,

Arun Albert.V  
UG Scholar  
Department of Electronics & Communication Engineering  
Christian College of Engineering & Technology  
Oddanchatram,

Ranjith Kumar.N  
UG Scholar  
Department of Electronics & Communication Engineering  
Christian College of Engineering & Technology  
Oddanchatram,

Harish.S  
UG Scholar  
Department of Electronics & Communication Engineering  
Christian College of Engineering & Technology  
Oddanchatram,

Leo Paul  
UG Scholar  
Department of Electronics & Communication Engineering  
Christian College of Engineering & Technology, Oddanchatram

Abstract

In our day to day life power and fuel crisis is one of the major problems that we are facing now. In that case renewable resources could be the best solution. As the presence of renewable resources varies with climate a microcontroller based system is used to charge the vehicle battery. To gain the maximum energy we integrated both the solar and wind energy. In real time the vehicle needs diesel or petrol. On account of implementing our system it is less dependable on fuel. We developed a system which is purely eco-friendly. The Microcontroller is programmed by Embedded-c and developed in microprocessor lab. We use IR sensors to run our mini-module.

Keywords: Microcontroller, Renewable energy, Fuel crisis, IR sensor

I. INTRODUCTION

The number of vehicle users are increasing very rapidlyin the present years in all over the world. With the gradual increase and continuing threat of global warming to mankind and the depletion of existing fossil fuel reserves, many countries are looking forward to sustainable renewable energy solutions to preserve the resources for the future generations. Environmental pollution and oil price inflation are the most common issues in any geographical location of our planet.

Solar cars are often fitted with gauges as seen in conventional cars. Solar cars depend on PV cells to convert sunlight into electricity. Unlike solar thermal energy which converts solar energy to heat for either household purposes, industrial purposes or to be converted to electricity, PV cells directly convert sunlight into electricity. When sunlight (photons) strikes PV cells, they excite electrons and allow them to flow, creating an electrical current.

A. Basic function

Energy from Sun is captured by the solar panels and is converted to electrical energy. The electrical energy thus formed is being fed to the batteries that get charged and is used to run 24 V DC high torques DC series motor. The shaft of the motor is connected to the rear wheel of the vehicle through chain sprocket. The batteries are initially fully charged and thereafter they are charged by panels. This helps in completing the charging-discharging cycle of the batteries which is very important for proper working of batteries.

Even though electric vehicles have many advantages, driving range and recharge time (or charging system) needs an extra research.

Maximum charge and discharge rates are depends on the battery design even though it takes the same time. The battery capable of a high power discharge in 30 minutes is also capable of a high power charge in 30 minutes. And similarly, a traction battery best designed to deliver its total energy over a period of three or four hours will need three or four hours to achieve a full charge with additional to the charging cost. So, the aim of the paper/research is to analyse and realize the possibility and capacity of electric vehicle charging during motion using renewable energy and to reduce the time taken to charge the vehicle for long distance motion. And the result of the research helps to reduce or halt global warming and climate change and assures an option...
for non-renewable energy and charging system. PV cells are made of semiconductor materials such as silicon and alloys of indium, gallium and nitrogen. Silicon is the most common material used and has an efficiency rate of 15-20%. The PV cell photocurrent which depends on radiation and temperature.

To design the vehicle power need, it needs to know the electrical current and voltage that the panel generates. The current generated by a solar PV module can be Practically, only about 35% of the solar irradiance is potentially available for conversion to electrical power (John and Tony Weir, 2006). And the output power from the PV modules can be determined using the equation: OPV

II. RELATED WORKS

In order to achieve the required voltage, the Photo Voltaic (PV) Module may be connected either in parallel or series, but its costlier. Thus to make it cost effective, power converters and batteries are been used. The electrical charge is consolidated from the PV panel and directed to the output terminals to produce low voltage (Direct Current). The charge controllers direct this power acquired from the solar panel to the batteries. According to the state of the battery, the charging is done, so as to avoid overcharging and deep discharge. The voltage is then boosted up using the boost power converter, ultimately running the BLDC motor which is used as the drive motor for our vehicle application. In the course work, the characteristic features of the components: solar panel, charge controller, battery, power converter and BLDC motor required for the vehicle application were studied in real time and also were modelled individually and the complete hardware integration of the system is tested to meet up the application’s requirement.

B. Future Discussion

This study describes the usage of renewable energy by integrating solar and wind energy, for continuous electric vehicles battery charging capacity in mobile vehicles. Both solar and wind energy is integrated and given to the battery.

III. ARCHITECTURE OF THE SYSTEM

![Architecture Diagram]
In our project we use both solar energy and wind energy.

The solar panel is placed in the top of the module. The wind turbine is placed in front of the vehicle. Both the sources are integrated and given to the regulator. The regulator is a device which can remove the unwanted flow of the voltage gained from the solar and wind energy. Both the regulators are given to the charging circuit meant for charging the battery.

Pic (Peripheral Interface Controller) microcontroller is connected with the battery. The battery acts as a power supply for the whole circuit and motor. Here we did not need to use transformer because we are using DC voltage. A display is given to the top of the battery which is used to show that how much of voltage is saved in the battery. The driver circuit is used to drive the vehicle.

A. Hardware Description

1) PIC Microcontroller -16F877A

Peripheral Interface Controllers (PIC) is one of the advanced microcontrollers developed by microchip technologies. These microcontrollers are widely used in modern electronics applications. A PIC controller integrates all type of advanced interfacing ports and memory modules. These controllers are more advanced than normal microcontroller like INTEL 8051. The first PIC chip was announced in 1975 (PIC1650). As like normal microcontroller, the PIC chip also combines a Microprocessor unit called CPU and is integrated with various types of memory modules like RAM and ROM.

IV. BLOCK DIAGRAM

All PIC microcontroller family uses Harvard architecture. This architecture has the program and data accessed from separate memories so the device has a program memory bus and a data memory bus (more than 8 lines in a normal bus). This improves the bandwidth (data throughput) over traditional von Neumann architecture where program and data are fetched from the same memory (accesses over the same bus). Separating program and data memory further allows instructions to be sized differently than the 8-bit wide data word.

V. PIN DESCRIPTION

It consists of both 40 and 44 pin packages
Consist of five sectors “A-E”
A and E are analog pins
B, C and D are digital pins

We can give analog input and obtain digital input similarly can give digital input and gain Analog output.
A. H-BRIDGE LM293D

The L293D is a popular motor driver IC that is usable from 6 to 12V, at up to 1A total output current. By itself, the IC is somewhat difficult to wire and use, but the Compact L293D Motor Driver makes it much more convenient to use.

Board Special Features
- Four motor direction indicator LEDs.
- Schottky EMF-protection diodes.
- Socket pin connectors for easy logic interfacing.
- Enable pins are user accessible.

L293 FEATURES:

REGULATOR:
This series of fixed-voltage integrated-circuit voltage regulators is designed for a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single-point regulation. Each of these regulators can deliver up to 1.5 A of output current. The internal current-limiting and thermal-shutdown features of these regulators essentially make them immune to overload. In addition to use as fixed-voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents, and also can be used as the power-pass element in precision regulators.

VI. FEATURES OF REGULATORS

3-Terminal Regulators
- Output Current up to 1.5 A
- Internal Thermal-Overload Protection
- High Power-Dissipation Capability
- Internal Short-Circuit Current Limiting
- Output Transistor Safe-Area Compensation

Here we are using positive regulators, negative regulators are available.

POWER SUPPLY

The transformer contains two huge copper coils, one between the two terminals of the input power supply and other between the two terminals of the output. Here we use a step-down transformer which means it will convert high voltage to low voltage. The number of turns of the coil inside will determine the voltage supported at input and output both.

\[ \text{Vin}/\text{Vout} = \text{Nin}/\text{Nout} \]

Vin = Input AC voltage
Vout = Output AC voltage
Nin = Number of turns at the input terminal of transformer
Nout = Number of turns at the output terminal of transformer

VII. SOLAR PANEL

There are two major types of renewable technologies that utilize solar energy: solar thermal plants and photovoltaic cells. Solar thermal plants utilize the sun’s energy to heat a fluid that drives a turbine to produce electricity. Photovoltaic cells, also known as solar cells, which convert light energy directly into electricity, are the primary focus of this project.

Sunlight carries energy which normally is partly turned into heat when it hits an object. Solar cells are constructed of materials that turn solar energy into electrical current which can be collected for power generation. To increase the voltage of the electricity generated, solar cells can be wired together in series to create larger arrays, known as solar panels. Solar cells accomplish this energy conversion by the use of semiconductor materials. Silicon solar cells are a popular solar cell category because of availability and cost and will be the technology investigated. These semiconductors are broken down into two types, n-type and p-type. In order to improve its electrical conductivity characteristics, silicon is “doped.” This means that another element is added into the silicon structure to change the nature and number of electrons in the valence shell. Silicon atoms normally have four electrons in their valence shell. N-type silicon typically has phosphorous added to it, which has five electrons.
in its valence shell. When the phosphorous and silicon combine, one electron is in excess. This last electron is weakly bound and has the ability to move, which improves the electrical conductivity. Alternately, the same methodology applies when creating p-type silicon. In this case, an atom with three electrons in its valence shell is added to silicon. Boron is commonly used for this purpose. The boron-silicon combination creates a “hole” because there are only three electrons versus the normal number of four valence electrons in silicon.

B. Motor:
Motor meant for the driving of the vehicle
Gear motor is used in this project
It has minute gears
It can drive heavy load
VIII. WIND TURBINE

A wind turbine is a device that converts kinetic energy from the wind into the electric power. A wind turbine used for charging batteries may be referred to as a wind charger. The result of over a millennium of windmill development and modern engineering, today's wind turbine is manufactured in a wide range of vertical and horizontal axis types.

The smallest turbines are used for applications such as battery charging for auxiliary power for boats or caravans to power traffic warning signs slightly larger turbines can be used for making small contribution to a domestic power supply while selling unused power back to the utility supplier via the electrical grid. Areas of large turbines known as wind farms, are becoming an increasingly important source of renewable energy and are used by many countries as part of a strategy to reduce their reliance on fossil fuels.

A wind turbine is a rotary engine that extracts energy from the flow of wind. The simplest turbine have one moving part, a rotor assembly which is a shaft with blades attached. Wind energy acts on the blades and the blades react to wind, so that they rotate impart energy to the rotor. Early wind turbines examples are windmills.

IR sensors

This infrared transmitter and receiver is called as IR TX-RX pair. Color of IR transmitter and receiver is different. However you may come across pairs which appear exactly same or even has opposite colors and it is not possible to distinguish between TX and RX visually. In case you will have to take help of multimeter to distinguish between them. Pair of Infrared LED and Photo diode tuned to same IR wave length. You can use this sensors for your Robotics, Pulse oximeter and other applications. This sensor can be used to detect reflecting silver/white strip, obstacle detection, flame detection.

C. IR Sensors Advantages:

1) Low power requirements: therefore ideal for laptops, telephones, PDAs
2) Low coding/decoding, simple circuitry.
3) Beam directionality ensures data leakage during transmission.
4) Few international regulatory constraints.
5) Relatively high noise immunity

Infrared transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. Similarly IR Receiver is used to receive the IR rays transmitted by the IR transmitter. One important point is both IR transmitter and receiver should be placed straight line to each other.

The transmitted signal is given to IR transmitter whenever the signal is high, the IR transmitter LED is conducting it passes the IR rays to the receiver. The IR receiver is connected with comparator. The comparator is constructed with LM 358 operational amplifier. In the comparator circuit the reference voltage is given to inverting input terminal. The no inverting input terminal is connected IR receiver. When interrupt the IR rays between the IR transmitter and receiver, the IR receiver is not conducting. So the comparator non inverting input terminal voltage is higher than inverting input. Now the comparator output is in the range of +5V. This voltage is given to microcontroller or PC and led so led will glow.

When IR transmitter passes the rays to receiver, the IR receiver is conducting due to that non inverting input voltage is lower than inverting input. Now the comparator output is GND so the output is given to microcontroller or PC. This circuit is mainly used to for counting application, intruder detector etc.
IX. OVER VIEW

A. RESULT

The following tabulation shows the output voltage gained from the 20 watts solar panel:

<table>
<thead>
<tr>
<th>Sunlight availability in %</th>
<th>Charging duration</th>
<th>Output gained in volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>2 hours</td>
<td>17.1</td>
</tr>
<tr>
<td>30</td>
<td>3 hours</td>
<td>16</td>
</tr>
<tr>
<td>20</td>
<td>5 hours</td>
<td>13</td>
</tr>
<tr>
<td>10</td>
<td>8 hours</td>
<td>12</td>
</tr>
</tbody>
</table>

X. CONCLUSION

We have presented a novel technique to solve the power and fuel crisis. We use both solar and wind energy so it will be more efficient. We can change the environment pollution free.

REFERENCES

[1] Efficiently Operating Wireless Nodes Powered by Renewable Energy Sources