FINAL YEAR PROJECT REPORT

(Solar Based Hybrid Vehicle)

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Abstract

We live in a modern world of technology and science man has accomplished and devised efficient which include entertainment, networking comfort, travelling but all this is possible with one thing energy.

Energy is produced by power plants which are of several types including hydro, thermal, nuclear or conventional fuel based (petroleum). A huge consumption of fossil fuel is in locomotives area. To this time we are not very successful in achieving efficient and cheap ways of transportation. A large no of vehicles are gasoline based and we all know the problem is that world is running out of its oil reserves and prices are all the time high not to mention at how much it pollutes our environments, having that said our vehicles are also non efficient.

So, from above discussion we established that not only we have to squeeze every bit of energy when we are producing it but also save every drop of it when we are spending it hence devising efficient methods by which we can achieve the desired task using less amount of energy.
Our focus is mainly on locomotives; Word Hybrid is very popular these days, in simple word Hybrid means to join two of technologies into one. One covers the deficiencies of other and the result is more efficient operation in comparison to either one of them.

The purpose of the project is to implement the concept of hybrid and establish an algorithm which is the most efficient and adopt intelligent method for power consumption.

Dedication

This thesis is dedicated to my father, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my mother, who taught me that even the largest task can be accomplished if it is done one step at a time.

Acknowledgement

With the blessings of Allah and prayers of our parents we have achieved this project with our utmost devotion and hard work. The guidance of our teachers especially our project advisor really helped us in completing this project. Whenever we needed help the doors of our teachers were always open.

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1.0 Introduction

A hybrid vehicle is a vehicle that uses an on-board rechargeable energy storage system (RESS) and a fuel based power source for vehicle propulsion. These vehicles use less fuel than their counterparts and produce less emission. Hybrid vehicles recharge their batteries by capturing kinetic energy through regenerative braking. Some hybrids use the combustion engine to generate electricity by spinning a generator to either recharge the battery or directly feed power to an electric motor that drives the vehicle. This takes place when cruising or in other situations where just light thrust is needed. A block diagram briefly explains the different modes our project.

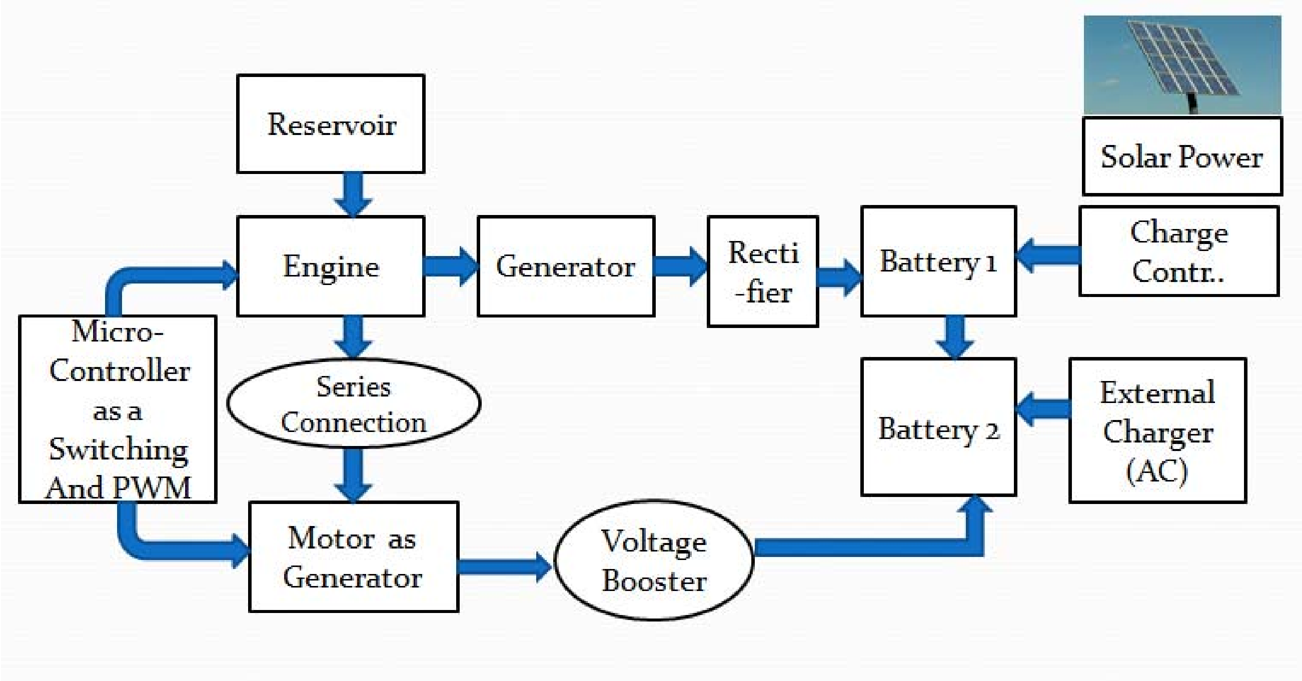

Figure 1.1 Block Diagram

1.1 History

1665-1825

Between 1665 and 1680, Flemish Jesuit priest and astronomer Ferdinand Verbiest created Plans for a miniature four-wheel unmanned steam “car” for Chinese Emperor Khang His. In 1769, Frenchman Nicholas Cugnot built a steam-powered motor carriage capable of six miles per hour.

In 1825, British inventor Goldsworthy Gurney built a steam car that successfully completed an 85 mile round-trip journey in ten hours time. Steamers dominated the automotive landscape until the late 19th century.

1839

Robert Anderson of Aberdeen, Scotland built the first electric vehicle.

1898

The German Dr. Ferdinand Porsche, at the age 23, built his first car. The Lohner Electric Chaise. It was the world's first front-wheel-drive. Porsche's second car was hybrid, using an internal combustion engine to spin a generator that provided power to electric motors located in the wheel hubs. On battery alone, the car could travel nearly 40 miles.

1970

With the Arab oil embargo of 1973, the price of gasoline soared, creating new interest in electric vehicles. The U.S. Department of Energy ran tests on many electric and hybrid vehicles produced by various manufacturers, including a hybrid known as the "VW Taxi" produced by Volkswagen in Wolfsburg, West Germany. The Taxi, which used a parallel hybrid configuration allowing flexible switching between the gasoline engine and electric motor, logged over 8,000 miles on the road, and was shown at auto shows throughout Europe and the United States.

1979

Dave Arthurs of Springdale, Arkansas, spent $1,500 turning a standard Opel GT into a hybrid car that could get 75 miles per gallon, using a six-horsepower lawnmower engine, a four-hundred-amp electric motor, and an array of six-volt batteries. Mother Earth News used the Arthurs plan to build their own hybrid, which averaged 75 miles per gallon. Sixty thousands Mother Earth News readers wrote in for the plans, when the magazine published their results.

1997

Audi became the first manufacturer in Europe to take a hybrid vehicle into volume production: the Audi duo based on the A4 Avant. The vehicle was powered by a 90 horsepower 1.9-litre TDI in conjunction with a 29 horsepower electric motor. Both power sources drove the front wheels. A lead-gel battery at the rear stored the electrical energy. The Duo was not commercial success and therefore discontinued, prompting European carmakers to focus their R&D investment on diesels.

2000

Toyota released the Toyota Prius, the first hybrid four-door sedan available in the United States.

2002

Honda introduced the Honda Civic Hybrid, its second commercially available hybrid gasoline-electric car. The appearances and drivability of the Civic Hybrid was (and still is) identical to the conventional Civic.

2004

The Toyota Prius II won the 2004 Car of the Year Awards from Motor Trend Magazine and the North American Auto Show. Toyota was surprised by the demand and pumped up its production from 36,000 to 47,000 for the U.S market. Interested waited up to six months to purchase the 2004 Prius. Toyota Motor Sales U.S.A. President Jim Press called it "the hottest car we've ever had".

1.2 Types by drive-train structure

- Parallel hybrid
- Series hybrid
- Combined hybrid

1.2.1 Parallel hybrid

Structure of a parallel hybrid electric vehicle Parallel hybrid systems, which are most commonly produced at present, have both an internal combustion engine (ICE) and an electric motor connected to a mechanical transmission. Most designs combine a large electrical generator and a motor into one unit, often located between the combustion engine and the transmission, replacing both the conventional starter motor and the alternator. To store power, a hybrid uses a large battery pack with a higher voltage than the normal automotive 12 volts. Accessories such as power steering and air conditioning are powered by electric motors instead of being attached to the combustion engine. This allows efficiency gains as the accessories can run at a constant speed, regardless of how fast the combustion engine is running.

Parallel hybrids can be categorized by the way the two sources of power are mechanically coupled. If they are joined at some axis truly in parallel, the speeds at this axis must be identical the supplied torques add together. Most electric bicycles are in effect of this type. When only one of the two sources is being used, the other must either also rotate in an idling manner or be connected by a one-way clutch or freewheel. With cars it is more usual to join the two sources through a differential gear. Thus the torques supplied must be the same and the speeds add up, the exact ratio depending on the differential characteristics. When only one of the two sources is being used, the other must still supply a large part of the torque or be fitted with a reverse one-way clutch or automatic clamp.

Parallel hybrids can be further categorized depending upon how balanced the different portions are at providing motive power. In some cases, the combustion engine is the dominant portion; the electric motor turns on only when a boost is needed. Others can run with just the electric system operating.

1.2.2 Series Hybrid

In a series hybrid system, the combustion engine drives an electric generator instead of directly driving the wheels. The generator both charges a battery and powers an electric motor that moves the vehicle. When large amounts of power are required, the motor draws electricity from both the batteries and the generator. A complex transmission is not needed, as electric motors are efficient over a wide speed range. Some vehicles designs have separate electric motors for each wheel. Series hybrids can be also fitted with a super capacitor or a flywheel, which can improve efficiency by minimizing the losses in the battery.

The advantage of a series hybrid is the lack of a mechanical link between the combustion engine and the wheels. The combustion engine runs at a constant and efficient rate, even as the car changes speed. During stop-and-go city driving, series hybrids are relatively the most efficient.

A weakness is that the power from the combustion engine has to run through both the generator and electric motor. During long-distance highway driving, the electrical transmission can be less efficient than a conventional transmission.

The use of one motor per wheel eliminates the conventional mechanical transmission elements (gearbox, transmission shafts, differential). If the motors are integrated into the wheels, the unspring mass increases, decreasing ride performances. If the motors are attached to the vehicle body, flexible couplings are required. Advantages of individual wheel motors include simplified traction control , all wheels drive and allowing lower floors, which is useful for buses. Some 8x8 all-wheel drive military vehicles use individual wheel motors.

1.2.3 Combined hybrid

Combined hybrid systems have features of both series and parallel hybrids. They incorporate power-split devices allowing for power paths from the engine to the wheels that can be either mechanical or electrical. The main principle behind this system is the decoupling of the power supplied by the engine (or other primary source) from the power demanded by the driver.

In a conventional vehicle, a larger engine is used to provide acceleration from standstill than one needed for steady speed cruising. This is because a combustion engine’s torque is minimal at lower RPMs, as the engine is its own air pumps. On the other hand, an electric motor exhibits maximum torque at stall and is well suited to complement the engine’s torque deficiency at low RPMs. In a combined hybrid, a smaller, less flexible, and highly efficient engine can be used. It is often a variation of the conventional Otto cycle, such as the Miller or Atkinson cycle. This contributes significantly to the higher overall efficiency of the vehicle, with regenerative braking playing a much smaller role.

Interesting variations of that simple theme, as very well known (implemented in the Toyota Prius) are the addition of a fixed gear second planetary gear-set as used in the Lexus RX400h and Toyota Highlander Hybrid. This allows for a motor with less torque but higher power (and higher maximum rotary speed), i.e. higher power density.

Addition of a ravigneux-type planetary gear (planetary gear with 4 shafts instead of 3) and two clutches as used in the Lexus GS450h. By switching the clutches, the gear ratio from MG2 (the "drive" motor) to the wheel shaft is switched, either for higher torque or higher speed (up to 250 km/h/155 mph) while sustaining better transmission efficiency.

1.3 Types by degree of hybridization

- Full hybrid
- Mild hybrid
- Plug-in hybrid
- Power assist hybrid

1.3.1 Full Hybrid

A full hybrid, sometimes also called a strong hybrid, is a vehicle that can run on just the engine, just the batteries, or combustion of both. A large, high-capacity battery pack is needed for battery-only operation. These vehicles have a spilt power path that allows more flexibility in the drive-train by inter-converting mechanical and electrical power, at some cost in complexity. To balance the forces from each portion, the vehicles use a differential-style linkage between the engine and motor connected to the head end of the transmission.

1.3.2 Mild Hybrid

Mild hybrid are essentially conventional vehicles with oversized starter motors, allowing the engine to be turned off whenever the car is coasting, braking, or stopped, yet restart quickly and cleanly. Accessories can continue to run on electrical power while the engine is off, and as in other hybrid designs, the motor is used for regenerative braking to recapture energy. The larger motor is used to spin up the engine to operating rpm speeds before injecting fuel.

1.3.3 Power Assist hybrid

Power assist hybrid use the engine for primary power, with a torque-boosting electric motor also connected to a largely conventional power-train. The electric motor, mounted between motor, engine and transmission, is essentially a very large starter motor, which operates not only when the engine needs to be turned over, but also when the driver "steps on the gas" and requires extra power. The electric motor may also be used to re-start the combustion engine, driving the same benefits from shutting down the main engine at idle, while the enhanced battery system is used to power accessories.

1.3.4 Plug-in Hybrid

A plug-in hybrid electric vehicle (PHEV) is a full hybrid, able to run in electric-only mode, with larger batteries and the ability to recharge from the electric power grid. They are also called gas-optional, or griddable hybrid. The main benefit is that they can be gasoline-independent for daily commuting, but also have the extended range of a hybrid for long trips. They can also multi-fuel, with the electric power supplemented by diesel, biodiesel, or hydrogen.

1.4 Types by nature of the power source

- Electric-internal combustion engine Hybrid
- Fuel cell hybrid
- Hydraulic hybrid
- Pneumatic hybrid
- Human power and environmental power hybrids

1.4.1 Electric-internal combustion engine hybrid

There are many ways to create an electric-internal combustion hybrid. The variety of electric-ICE designs can be differentiated by how the electric and combustion portions of the power train connect, at what times each portion is in operation, and what percent of the power is provided by each hybrid component. Two major categories are series hybrid and parallel hybrid, though parallel designs are most common today.

Most hybrids, no matter the specific type, use regenerative braking to recover energy when slowing down the vehicle. The simply involves driving a motor so it acts as a generator. Many designs also shut off the internal combustion engine when is not needed in order to save the energy.

1.4.2 Fuel Cell Hybrid

Fuel cell vehicles are often fitted with a battery or super capacitor to deliver peak acceleration power and to deduce the size and power constraints on the fuel cell (and thus its cost); this is effectively also a series hybrid configuration.

1.4.3 Hydraulic Hybrid

A hydraulic hybrid vehicle uses hydraulic and mechanical components instead of electrical ones. A variable displacement pump replaces the motor generator, and a hydraulic accumulator (which store energy as highly compressed nitrogen gas) replaces the batteries. The hydraulic accumulator, which is essentially a pressure tank, is potentially cheaper and more durable than batteries. Hydraulic hybrid technology was originally developed by Volvo Flygmotor and was used experimentally is buses from the early 1980s and is still an active area.

1.4.4 Pneumatic Hybrid

Compressed air can also power a hybrid car with a gasoline compressor to provide the power. Moteur Development International in France produces such air cars. A team led by Tsu-Chin Tsao, a UCLA mechanical and aerospace engineering professor, is collaborating with engineers from Ford to get Pneumatic hybrid technology up and running. The system is similar to that of a hybrid- electric vehicle in that braking energy is harnessed and stored to assist the engine as needed during acceleration.

1.4.5 Human power and environmental power hybrids

Many land and water vehicles use human power combined with a further power source. Common are parallel hybrids, e.g. a boat being rowed and also having a sail set, or motorized bicycles. Also some series hybrids exists, see in hybrids vehicle. Such vehicle can be tribrid vehicles, combining at the same time three power sources e.g. from on-board solar cells, from grid-charged batteries, and from pedals.