RETROFITTING OF EXISTING VEHICLE TO ELECTRICAL VEHICLE

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Abstract:

This project enables existing vehicles to be retrofitted into a hybrid vehicle with minimal modification - achieved by placing electric motors in the hub with gear set up for wheel rotation. The present work describes different HEV configurations and identifies specific operating modes of the split-parallel architecture. Coupling of the two power sources - internal combustion engine (ICE) and electric motor - and control system. Proper distribution of power between the two sources determines effective operation of the hybrid vehicle. And efforts are being put to develop vehicle powered by solar energy, hydrogen, biodiesel and batteries. In this project we are replacing the motors and battery instead of engine of existing vehicle. This project makes use of a PIC micro controller, which is programmed, with the help of embedded C instructions. This PIC Microcontroller is capable of communicating with input and output modules. The user can select direction using joystick for controlling purpose. The controller is interfaced with two PMDC motors, which are fixed to the gears to control the Connection Rod of the vehicle.

Keywords:
Power supply, PIC micro controller, MOSFET, throttle, PMDC motors

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1. Introduction:

This project enables existing vehicles to be retrofitted into a hybrid vehicle with minimal modification - achieved by placing electric motors in the hub with gear set up for wheel rotation. Coupling of the two power sources - internal combustion engine (ICE) and electric motor - and control system. The target is to achieve minimum consumption of fuel, while ensuring the state-of-charge (SOC) of the battery bank remains at acceptable level. In metro cities like Delhi, Beijing, level of pollution from vehicles, during peak hour is dangerous. To minimize all these problems and to keep our earth free from pollution and human health and fitness, we introduced this project and efforts are being put to develop vehicle powered by solar energy, hydrogen, biodiesel and batteries. Battery powered vehicle are not so popular in India because they need frequent charging, small distance travelled in single charging, small range of speed in comparison to conventional automotives short battery life etc. In order to overcome above mentioned problems an attempt has been made to design and fabricate environment friendly, battery powered, single passenger electrical vehicle.

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There is growing demand for fossil fuel like diesel and petrol to power the automotive and cater other needs of human. Fossil fuels are being depleted because of their excessive use and limited stocks. Further the use of fossil fuels is polluting the environment. In metro cities like Delhi, Beijing, level of pollution from vehicles, during peak hour is dangerous. Because of this people are fragile to wear mask for filtering the polluted air for

respiration. Further, there are frequent traffic jams on the road due to this there is wastage of fuel and time. All these factors are responsible for various problems in human such as headache, stress, reduced performance etc. To minimize all these problems and to keep our earth free from pollution and human health and fitness, there is an urgent need to explore alternative in place of fossil fuel powered vehicles.

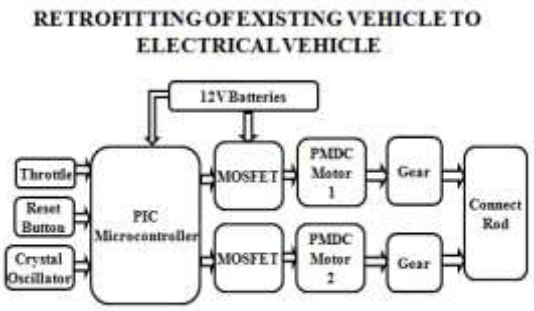
2. LITERATURE SURVEY:

D M Karthik and Arun C Giriyapur[01] Retrofitting of an Engine Powered Vehicle into an Electric Vehicle The paper describes the development of electric vehicle power-train and the comparison of the different parts of electric vehicles like a battery, motor, motor controller and transmission. Also, explains the design rules and calculations of the power-train subsystem. Electric vehicles are powered by traction motor or electric motor (AC or DC) which are powered by the battery through the electric converter or an inverter.

Fabian Hoeft[02] Internal combustion engine to electric vehicle retrofitting: Potential customer's needs, public perception and business model implications road transport is a major CO2 emission contributor globally. Driven by political incentives, the automotive industry is shifting from internal combustion engine (ICE) vehicles to electric vehicles (EVs).

Najmuddin Jamadar[03] Retrofitting of Existing Scooter into Hybrid Electric Scooter. The system proposes a solution by retrofitting existing scooters into hybrid electric which runs on Internal Combustion Engine. Here, by using scooter that has 80cc petrol combustion engine. The front wheel is replaced by an electric hub motor. It becomes a 2-wheel drive scooter with the hub motor driving the front wheel and conventional engine powering the rear wheel. Our main aim is to increase mobility and to improve the performance efficiency of existing vehicles.

3. HARDWARE IMPLEMENTATION:



3.1 Block diagram of RETROFITTING OF EXISTING VEHICLE TO ELECTRICAL VEHICLE

The main blocks of this project are: Regulated power supply, PIC Microcontroller, Reset, MOSFET, PMDC motor, Gear, Throttle (POT). This project makes use of a PIC micro controller, which is programmed, with the help of embedded C instructions. This PIC Microcontroller is capable of communicating with input and output modules. The user can select direction using joystick for controlling purpose. The controller is interfaced with two PMDC motors, which are fixed to the gears to control the Connection Rod of the vehicle. Here we can see PIC micro controller is mother piece and the joystick is placed for controlling from user end and two Permanent Magnet DC (PMDC) motor are used and the gears are connected to the following PMDC motors and the selected gears are connected to the rod and the action development will be taking place**.**

4. Related Work:

The brief introduction of different modules used in this project is discussed below:

4.1. Transformer:

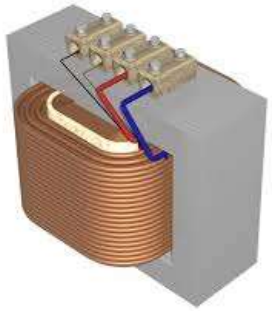


Fig: **Transformer**

Transformer Transformer is a electromagnetic device which induces the voltage due to magnetic field present between primary and secondary windings. It has two windings called as primary winding and secondary winding. We are giving

input 230v input voltage at primary side. The output of transformer is 12v(ac only).We have two types of transformers which are step up transformer and step down transformer.

FEATURES:

- The frequency of input and output power is the same
- All transformers make use of electromagnetic induction laws
- The primary and secondary coils are devoid of electrical connection (except for auto transformers). The transfer of power is through magnetic flux.
- No moving parts are required to transfer energy, so there are no friction or wind age losses as with other electrical devices.

4.2. Rectifier:

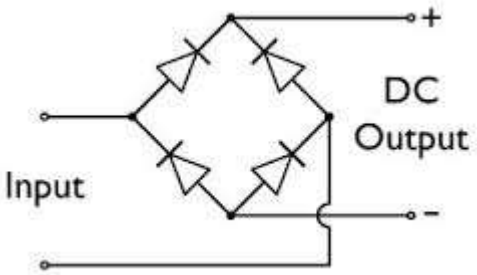


Fig: **rectifier**

An alternating current has the property to change its state continuously. This is understood by observing the sine wave by which an alternating current is indicated. It raises in its positive direction goes to a peak positive value, reduces from there to normal and again goes to negative portion and reaches the negative peak and again gets back to normal and goes on. Actually it alters completely and hence the name alternating current. But during the process of rectification, this alternating current is changed into direct current DC. The wave which flows in both positive and negative direction till then, will get its direction restricted only to positive direction, when converted to DC. Hence the current is allowed to flow only in positive direction and resisted in negative direction The circuit which does rectification is called as a Rectifier circuit. A diode is used as a rectifier, to construct a rectifier circuit.

Specifications:-

- 3-phase supply voltage main by customer up to 36000
- 3-phase supply voltage on the secondary is 590/1150/2262(on-demand)
- maximum power 7000
- frequency 50/60 Hz
- rectifier connection bridge ,bridge with IPT
- DC current Adc 5000 and more
- DC voltage Vdc750/1500/3000

4.3. Regulator:

Fig: Regulator

The LM78XX series of three terminal positive regulators are available in the TO-220 package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents

Specifications:-

- 5V Positive Voltage Regulator.
- Minimum Input Voltage is 7V.
- Maximum Input Voltage is 25V.
- Operating current(I_Q) is 5mA.
- Internal Thermal Overload and Short circuit current limiting protection is available.
- Junction Temperature maximum 125 degree Celsius.
- Available in TO-220 and KTE package.

4.4. PIC micro controller:

Fig: PIC micro controller

The PIC microcontroller features 5 channels of 8-bit Analog-to-Digital (A/D) converter with 2 additional timers, capture/compare/PWM function and the synchronous serial port can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I²C™) bus.PIC devices are popular with both industrial developers and hobbyists due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, serial programming, and re-programmable flash-memory capability. The Proteus Design Suite is able to simulate many of the popular 8 and 16-bit PIC devices along with other circuitry that is connected to the PIC on the schematic. The program to be simulated can be developed within Proteus itself, MPLAB or any other development tool.

Peripheral Features:-

- High Sink/Source Current: 25 mA
- Timer0: 8-bit timer/counter with 8-bit pre-scaler
- Timer1: 16-bit timer/counter with pre-scaler, can be incremented during SLEEP via external crystal/clock
- Timer2: 8-bit timer/counter with 8-bit period register, pre-scaler and post-scaler
- Capture, Compare, PWM (CCP) module- Capture is 16-bit, max. resolution is 12.5 ns- Compare is 16-bit, max. resolution is 200 ns- PWM max. resolution is 10-bit
- 8-bit, 5-channel analog-to-digital converter
- Synchronous Serial Port (SSP) with SPI™ (Master/Slave) and I2C™ (Slave)
- Brown-out detection circuitry for Brown-out Reset (BOR)

4.5. Potentiometer:

Fig: Potentiometer

We have a resistive track whose complete resistance will be equal to the rated resistance value of the POT. Potentiometers also known as POT, are nothing but variable resistors. They can provide a variable resistance by simply varying the knob on top of its head. It can be classified based on two main parameters. One is their Resistance (R-ohms) itself and the other is its Power (P-Watts) rating. As the symbol suggests a potentiometer is nothing but a resistor with one variable end. Let us assume a 10k potentiometer, here if we measure the resistance between terminal 1 and terminal 3 we will get a value of 10k because both the terminals are fixed ends of the potentiometer. Now, let us place the wiper exactly at 25% from terminal 1 as shown above and if we measure the resistance between 1 and 2 we will get 25% of 10k which is 2.5K and measuring across terminal 2 and 3 will give a resistance of 7.5K.

4.6. PMDC motor:

Fig: PMDC motor

Permanent Magnet DC motor (PMDC motor) is a type of DC motor that uses a permanent magnet to create the magnetic field required for the operation of a DC motor. As the magnetic field strength of a permanent magnet is fixed it cannot be controlled externally, field control of this type of DC motor cannot be possible. Thus permanent magnet DC motor is used where there is no need to control the speed of the motor (which is usually done by controlling the magnetic field). Small fractional and sub-fractional KW motors are often constructed using a permanent magnet. The working principle of PMDC motor is just similar to the general working principle of DC motor. That is when a carrying conductor comes inside a magnetic field, a mechanical force will be experienced by the conductor and the direction of this force is governed by Fleming's left hand rule. As in a permanent magnet DC motor, the armature is placed inside the magnetic field of a permanent magnet; the armature rotates in the direction of the generated force.

Features:-

- Motor permanent magnet, Bi-directional electric motor
- watts 12 to 370W
- volts 6 to 180V DC
- torque 0.5Kg-cm to 6Kg-cm
- RPM 1500 to 10,000
- duty cycle Continuous/Intermittent

4.7 MOSFET

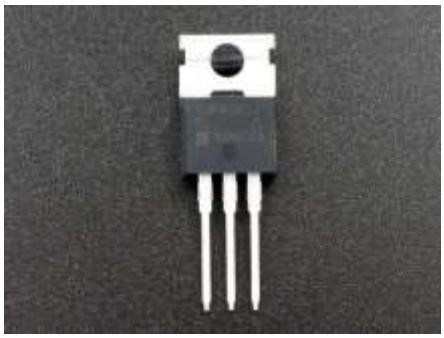


Fig: MOSFET

The metal–oxide–semiconductor field-effect transistor (MOSFET, MOS-FET, or MOS FET), also known as the metal–oxide–silicon transistor (MOS transistor, or MOS), is a type of insulated-gate field-effect transistor that is fabricated by the controlled oxidation of a semiconductor, typically silicon. The voltage of the covered gate determines the electrical conductivity of the device; this ability to change conductivity with the amount of applied voltage can be used for amplifying or switching electronic signals. The MOSFET was invented by Mohamed M. Atalla and Dawon Kahng at Bell Labs in 1959, and first presented in 1960. It is the basic building block of modern electronics, and the most frequently manufactured device in history, with an estimated total of 13 sextillion (1.3×10^{22}) MOSFETs manufactured between 1960 and 2018. It is the dominant semiconductor device in digital and analog integrated circuits (ICs), and the most common power device. It is a compact transistor that has been miniaturized and mass-produced for a wide range of applications, revolutionizing the electronics industry and the world economy, and being central to the digital revolution, silicon age and information age. MOSFET scaling and miniaturization has been driving the rapid exponential growth of electronic semiconductor technology since the 1960s, and enables high-density ICs such as memory chips and microprocessors. The MOSFET is considered the "workhorse" of the electronics industry.

A key advantage of a MOSFET is that it requires almost no input current to control the load current, when compared with bipolar junction transistors (BJTs). In an enhancement mode MOSFET, voltage applied to the gate terminal can increase the conductivity from the "normally off" state. In a depletion mode MOSFET, voltage applied at the gate can reduce the conductivity from the "normally on" state.[5] MOSFETs are also capable of high scalability, with increasing miniaturization, and can be easily scaled down to smaller dimensions. They also have faster switching speed (ideal for digital signals), much smaller size, consume significantly less power, and allow much higher density (ideal for large-scale integration), compared to BJTs. MOSFETs are also cheaper and have relatively simple processing steps, resulting in high manufacturing yield.

5. CONCLUSION:

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested. The project "RETROFITTING OF EXISTING VEHICLE TO ELECTRICAL VEHICLE" was designed retrofitted hybrid vehicle with minimal modification achieved by placing electric motors in the hub with gear set up for wheel rotation.

6. ACKNOWLEDGEMENT

We would like to thank all the authors of different research papers referred during writing this paper. It was very knowledge gaining and helpful for the further research to be done in future.

7. RESULTS:

The paper presents the design of "**RETROFITTING OF EXISTING VEHICLE TO ELECTRICAL VEHICLE**" and retrofitted hybrid vehicle with minimal modification - achieved by placing electric motors in the hub with gear set up for wheel rotation. The main objective of this design to fabricate environment friendly, battery powered, single passenger electrical vehicle. We are taking old fuel vehicle and its conversion into electric vehicle through retrofitting .The target is to achieve minimum consumption of fuel, while ensuring the state-of-charge (SOC) of the battery bank remains at acceptable level and also by using this method we can reduce the scrab.

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