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Regenerative Power Storage and Supply System for 4-Wheeler Automobiles using Gear Coupled Generator

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Abstract: The world is a storehouse of energy, and energy cannot be produced or destroyed, but it can be converted from one type of energy to another, according to the Energy Conservation Law. However, we are squandering the resources available to us. We're running out of it. We are moving toward renewable fuels as a source of energy, but our primary focus should be on the resources we are squandering. We are using the rotational energy that is not used by automobiles. The energy is transformed into electricity and stored in the battery while the car is driving (wheel rotating). It's accomplished by combining a gear and a generator. We'll provide power from that battery while the car (engine) is switched off. We can save money on fuel by doing so, and we can take advantage of rotational motion. It can be used in traditional vehicles, hybrid cars, and electric cars. We may increase the distance (mileage) that an e-car travels. This project would be a watershed moment in the car industry if it succeeds. We must reuse the resources that are not being used in order to maintain our resources for future generations. We can break the use of the loads by using two batteries, so that when the engine is running, the load will run on one battery and when the engine is off, the load will run on the other battery, extending the battery's life and improving the car's performance.

Keywords: Energy Conservation Law, Regenerative Power System, Arduino, DC Motor, Car, 4-Wheeler

I. INTRODUCTION

The process of harvesting mechanical energy from vehicle and converting it to usable electrical energy is basic idea of the project. The input mechanical energy to be converted to electrical energy may be in the form of potential energy and/or kinetic energy. ... For example, in many cases, the interfacing mechanism is desired to maximize the rate or amount of mechanical energy transferred to the transducer. Mechanical energy is used in a number of ways for example, through linear or rotator vibration. By using this concept, we make a store house of energy and according to energy conservation law energy can neither be created nor destroyed but can be transformed from one form to another form. But we are wasting In this paper we bring a revolution in hybrid, E-vehicle by consuming and saving the energy for future use .E-vehicle has a disadvantage that the customer should always have eye on the battery level in some emergency situation it will lead to be held up somewhere the charging station is somewhat nearer. In that case, if we have to utilize the resources around us which we are wasting. We are making use of mechanical energy which is getting wasted while the car is running and is converted into electrical energy and which is stored in the battery for the future use. We are running out of the major fossil fuels to preserve for our future generation we need to work on certain things. We are wasting various forms of energy according to the law of conservation of energy, we can convert one form of energy into another form. Here we are converting the mechanical action of our car into electrical charge. If it gets into picture, we can reuse the energy which is wasted or dissipated from the travelling process.

II. LITERATURE REVIEW

[1]Hub dynamos for bicycles have a higher efficiency than other dynamos and does not have the noise. Therefore, the number of people turning on the hub dynamos that are installed to their bicycles at night is high. However hub dynamos are heavy and big in size, and as a result have not spread to bicycles whereby being light is of the upmost importance, such as racing bicycles. [2] The validity of the calculation method is verified by comparing the measured and calculated results in the case of a simple model that simulates the end part of the turbine generator. The method is also applied to the real machine to clarify the eddy current distribution. The proposed method is applied to the simple model that simulates the core-ends of the turbine generator. The calculated losses and flux distributions are compared with the measurement to verify the validity of the method.[3] Regenerative process and measurement of rotational speed in

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electric vehicles are specially used. In all cases for realization of accurate and real-time control of motor drives. Acquisition of rotational speed values will help for a healthy control over applied breaking force. This simultaneous method of measuring rotational speed information in regenerative electric vehicle. This presented work also made a remarkable benefaction in distinguishing the ideal and actual positions of the Hall Effect sensor.[4] A new Regenerative Braking System (RBS) is proposed for EVs with HESS and driven by Brushless DC (BLDC) motor. During regenerative braking, the BLDC acts as a generator. Hence, using appropriate switching algorithm, the DC-link voltage is boosted and the energy is transferred to the super-capacitor or the battery through the inverter. The harvested energy can be utilized to improve the vehicle acceleration and/or keep the battery pack from deep discharging during driving uphill. In order to provide a reliable and smooth brake, braking force distribution is realized through an Artificial Neural Network (ANN).[5] The dc machine fulfils these requirements, but it requires constant maintenance. In the brushless permanent magnet motors, they do not have brushes and so there will be lesser maintenance. Brushless dc motors are widely used in applications which require wide range of speed and torque control because of its low inertia, fast response, high reliability and less maintenance. This current controlled technique is based on the generation of quasi-square wave currents using only one controller for the three phases. The current control strategy uses a triangular carrier for the power transistors which is simpler and more accurate than any other options [6] Greater efficiency in energy use is achieved through the installation of the energy storage system by discharging the energy depending on the load situation. The energy storage systems are usually used flywheel, nickel-metal hydride batteries, lithium-ion batteries, electric double layer capacitor (EDLC), etc. East Japan Railway Company also installed two energy storage devices using lithium-ion batteries at Haijima and Okegawa substations. This paper describes the installed results of these energy storage systems.

III. EXPERIMENTAL SETUP

This experimental setup consists of various hardware components which acts as a major role in this regenerative process, the basic components used in this setup are,

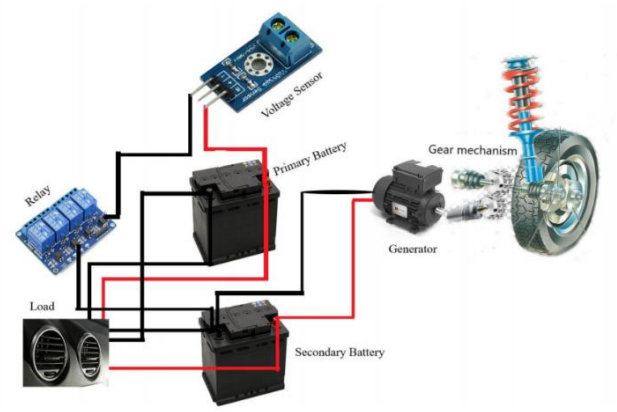

Fig. 1 Circuit diagram of the system

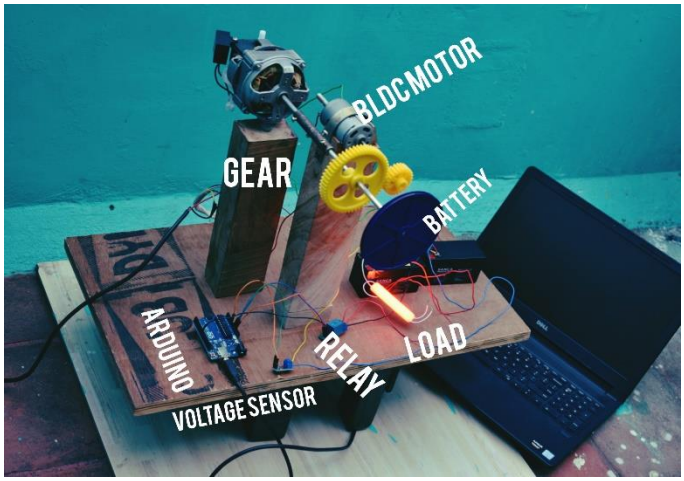

Fig.2 Overall Experimental setup of the project

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A. Gear system:

When the vehicle's engine is started, the gear system kicks in and the vehicle begins to move forward, the shaft connected with wheel rotates a wheel in a counter clockwise direction in a counter clockwise direction An installation of gear in the wheel's axle is connected to the wheel's rotation a wheel The gear shifts as the car goes forward. Generates a rotation in the clockwise direction electric power When the car is reversing, the gear rotates in the opposite direction of the clock.

B. Motor:

The gear motion, which is coupled with a 12V BLDC motor with a range of 0-24 VDC, is used to generate a current of electricity When the motion of the object is the gear is in reverse and the wheel is turning counter clockwise. The motor is rotated in a clockwise direction. Making it a generator by spinning it in the opposite direction. When a vehicle is moving backwards and forwards, it is said to be in reverse motion. With the bypass, the motor is removed from the generation process. Diode is an abbreviation for "diode.

C. Voltage:

The amount of voltage induced is calculated using a resistive voltage sensor. The amount of voltage produced varies depending on the speed. During the rotation 1400 rotations per minute are provided by the motor. A split-second Vehicle mileage is proportional to its size to the voltage that is generated Power usage based on mileage the amount of voltage generated is proportional to the amount of energy used.

D. Battery & Relay:

According to the electron flow principle, electrons in a battery flow from the anode to the cathode. The car's lead acid battery is used to store the energy. The chemical reaction uses electric energy. Other than the main battery, a 12 V DC secondary battery the energy produced is stored in a battery. Relay the message is connected to both batteries and serves as a switching device between the battery and the circuit the amount of energy contained in the vehicle's battery can be used as a backup. as soon as the primary battery's charge has been depleted. Relay switches secondary battery based on threshold value and the vehicle's electric charge is given for the automobile.

E. Arduino:

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

IV. WORKING

A gear mechanism couples the car wheel's shaft to the 12V BLDC generator. The ratio of the two gears that will be paired is 1:3 (shaft:motor). The gear on the dc motor, for example, should be three times less than the gear on the wheel. The charge is then stored by feeding the output voltage to the secondary battery. A voltage sensor is connected to the primary battery in parallel, keeping track of the voltage level. When the voltage falls below the threshold, the relay is activated. The main battery is connected to the NO (Normally Open) terminal, while the secondary battery is connected to the NC (Normally Close) terminal, latching the secondary battery's line. As a result, the load's supply will begin to flow from the secondary battery. The relay switching is done with Arduino code, and the transmission of the power supply to the load is diverse.

A. Gear system:

When the gear with three times the dimension of the other is rotated clockwise, the other gear rotates counter clockwise. As a result, the generator is rotated by the gear that is connected to it.

B. Voltage sensor:

The voltage sensor's operating range is 3V to 12V. If the battery level falls below 3V, the load supply should be shifted to a secondary battery or the main battery should be used to power the load.

C. Relay:

The main battery is connected in NO (normally open), and the secondary battery is connected in NC (normally close). The relay switches the battery based on the voltage sensor input.

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D. Arduino:

Arduino program to switch the batteries,

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```
#include "LiquidCrystal.h"

const int voltageSensor = A0;
int rel_pin=8;
float vOUT = 0.0;
float vIN = 0.0;
float R1 = 30000.0;
float R2 = 7500.0;
int value = 0;

LiquidCrystal lcd(7, 6, 5, 4, 3, 2); // RS, E, D4, D5, D6, D7

void setup()
{
Serial.begin(9600);
lcd.begin(16,2);
lcd.print(" Measure > 25V  ");
delay(2000);
pinMode(rel_pin,OUTPUT);
}

void loop()
{
  value = analogRead(voltageSensor);
  vOUT = (value * 5.0) / 1024.0;
  vIN = vOUT / (R2/(R1+R2));
  Serial.print("Input = ");
  Serial.println(vIN);
  lcd.setCursor(0,0);
  lcd.print("Input =          ");
  lcd.setCursor(9,0);
  lcd.print(vIN);
  delay(500);
  if(vIN <= 1)
  {
```

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```
int value = 0;

LiquidCrystal lcd(7, 6, 5, 4, 3, 2); // RS, E, D4, D5, D6, D7

void setup()
{
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  value = analogRead(voltageSensor);
  vOUT = (value * 5.0) / 1024.0;
  vIN = vOUT / (R2/(R1+R2));
  Serial.print("Input = ");
  Serial.println(vIN);
  lcd.setCursor(0,0);
  lcd.print("Input =          ");
  lcd.setCursor(9,0);
  lcd.print(vIN);
  delay(500);
  if(vIN <= 1)
  {
    digitalWrite(rel_pin,HIGH);
  }
  else if(vIN > 1)
  {
    digitalWrite(rel_pin,LOW);

  }
}
```

Fig.3,3A Arduino program for battery switching

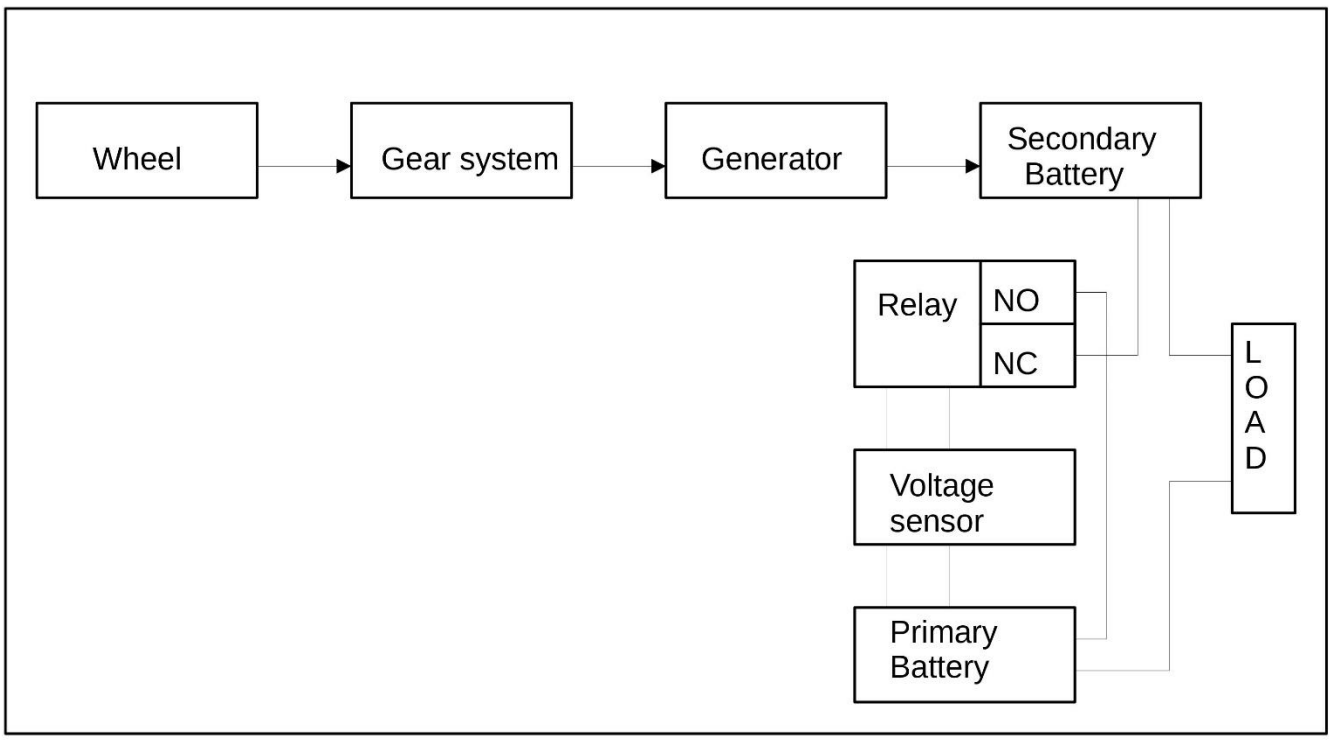

Fig.4 Block diagram of the process

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V. RESULT AND DISCUSSION

The model is fixed with the car (four- wheeler), as the car driven in various speeds the voltage generated is also varied. The relation between speed of the car and the voltage generated is directly proportional to each other. The rpm produced for the speed of the car is tabulated below and plotted as graph.

Speed of the car (Km/hr)	RPM of the wheel
10	157
20	313
30	469
40	625
50	780
60	936
70	1093
80	1249
90	1404
100	1561

Table 1 speed of the car vs rpm of the wheel

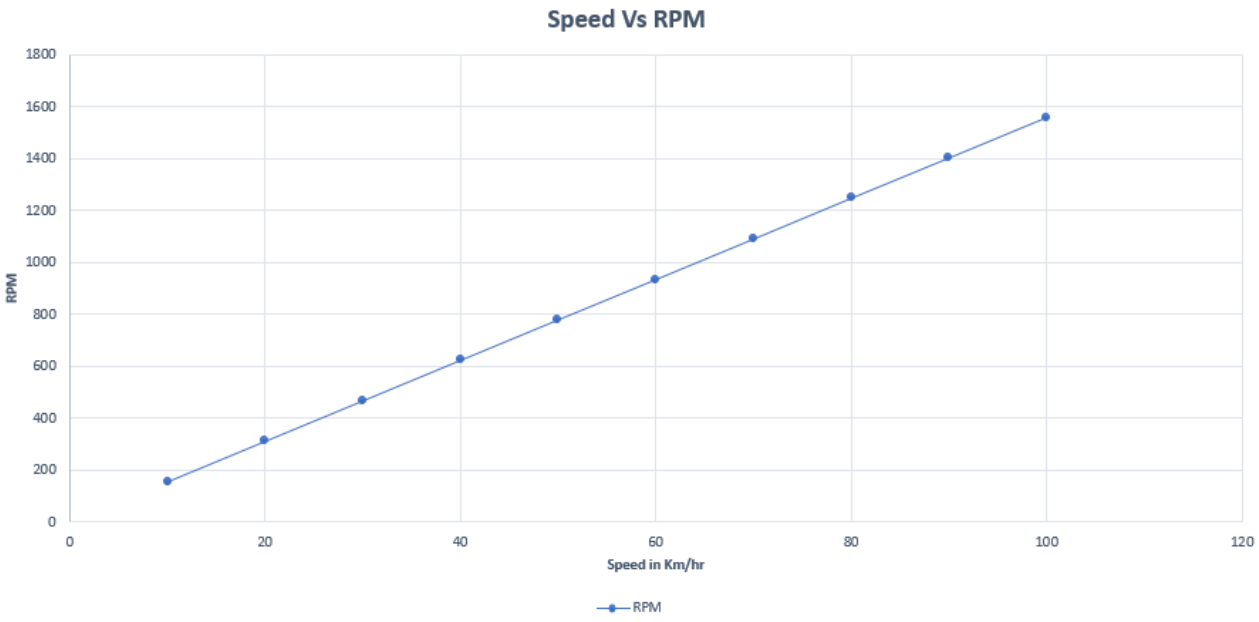

Fig.5 Speed of the car vs rpm of the wheel graph

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There are a plethora of actions and motions all around us that can provide us with resources for power generation. In this case, the proposed system is the best option since four-wheelers are ubiquitous. Because the setup takes up very little space, it can be installed inside the car without interfering with the car's usual setup. To improve its effectiveness, this model can be enhanced by integrating advanced controllers such as fuzzy and adaptive fuzzy.

VI. CONCLUSION

The output, which consists of different parameters, is the focus of this paper. It varies depending on the gear coupling system and the processes that occur on the road. It spins at 1400 rpm in its normal state without gear. It has a rpm of 1360 with gear, which is 97.6%. This represents a loss of approximately 2.4 percent. This system's charging time is determined by its speed. Consider how much the battery will be charged if the car is driven at maximum speed for 5 hours and 8 minutes. The charging speed is dependent on the battery. As a result, fuel efficiency can be improved by 12%. In the pre-existing model, we have an overall productivity of 9.6% after compensating for the 2.4 percent loss.

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