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Implementation of Regenerative Power Storage for Automobiles

Tamilarasan.T[1], Ravikiran.B[2], Surraj NS [3], Kavin KV[4], Krishna kumar.R[5]

Assistant Professor, Department of Instrumentation and Control Engineering, Saranathan College of Engineering, Trichy, Tamil Nadu, India[1]

UG Student, Department of Instrumentation and Control Engineering, Saranathan College of Engineering, Trichy, Tamil Nadu, India[2-5]

ABSTRACT:According to the Energy Conservation Law, the world is a storehouse of energy, which cannot be generated or destroyed but can be converted from one type of energy to another. We, on the other hand, are squandering the resources at our disposal. We're about to run out of it. As a source of energy, we are moving toward renewable fuels, but our main focus should be on the resources we are wasting.We're using rotational energy that cars don't use. While the car is driving, the energy is converted to electricity and stored in the battery (wheel rotating). It's done by blending a generator and a gear. We'll use that battery to provide power while the car (engine) is turned off.We can save money on fuel and take advantage of rotational motion by doing so. It can be used in traditional automobiles, hybrid automobiles, and electric automobiles. We may be able to extend the range (mileage) of an electric vehicle. If this project succeeds, it will mark a turning point in the automobile industry.To ensure that our resources are preserved for future generations, we must repurpose those that are no longer in use. We can break the use of the loads by using two batteries, so that the load runs on one battery when the engine is running and on the other battery when the engine is off, extending the battery's life and increasing the car's performance.

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

I.INTRODUCTION

The project's basic concept is to harvest mechanical energy from a vehicle and convert it to useful electrical energy. Potential energy and/or kinetic energy are two types of mechanical energy that can be converted to electrical energy.In many situations, the goal of the interfacing mechanism is to optimise the rate or amount of mechanical energy transferred to the transducer. Mechanical energy can be used in a variety of ways, such as linear or rotator vibration.We create a storehouse of energy using this principle, and according to the energy conservation law, energy cannot be generated or destroyed but can be converted from one form to another. However, we are squandering our time. In this paper, we propose a hybrid, E-vehicle revolution by consuming and storing energy for future use.The drawback of an e-car is that the customer must keep an eye on the battery level at all times. If the battery runs out in an emergency, the vehicle will be stranded somewhere where a charging station is closer. In that case, we must make use of the resources that we are currently wasting.We are converting mechanical energy that would otherwise be wasted when the car is running into electrical energy, which is then stored in the battery for future use. We are running out of the big fossil fuels, so we must work to conserve them for future generations.We are wasting different forms of energy, and we can turn one form of energy into another, according to the law of conservation of energy. We're turning our car's mechanical action into an electrical charge here. If it comes into play, we will be able to repurpose the energy that is wasted or dissipated during the travel process.

II.LITERATURE REVIEW

[1]Hub dynamos for bicycles have a greater efficiency and produce less noise than other dynamos. As a result, a large number of people turn on the hub dynamos installed on their bicycles at night. Hub dynamos, on the other hand, are heavy and large in size, and as a result, they have not spread to bicycles where weight is critical, such as racing bicycles.[2] In the case of a simple model that simulates the end portion of the turbine generator, the validity of the calculation procedure is proved by comparing the measured and calculated results. The technique is also used to explain the eddy current distribution on a real machine.The proposed technique is used to simulate the core-ends of a

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turbine generator using a simple model. To ensure that the method is valid, the calculated losses and flux distributions are compared to the measurement.[3] In electric vehicles, the regenerative process and rotational speed measurement are particularly useful. In all cases, to achieve precise and real-time motor drive control. The measurement of rotational speed will aid in maintaining a healthy control over the applied breaking force. In a regenerative electric vehicle, this simultaneous method of measuring rotational speed information.This work was also extremely useful in distinguishing between the ideal and actual positions of the Hall Effect sensor.[4] For EVs with HESS and Brushless DC (BLDC) motors, a new Regenerative Braking System (RBS) is proposed. The BLDC acts as a generator during regenerative braking. The DC-link voltage is increased as a result of the appropriate switching algorithm, and the energy is transferred to the super-capacitor or battery through the inverter.The harvested energy can be used to increase vehicle acceleration and/or prevent deep discharge of the battery pack while driving uphill. Braking force distribution is achieved through an Artificial Neural Network in order to provide a reliable and smooth brake (ANN).[5] The dc machine satisfies these criteria, but it necessitates ongoing maintenance. Brushes are not used in brushless permanent magnet motors, so they require less maintenance. Because of their low inertia, quick response, high reliability, and low maintenance, brushless dc motors are commonly used in applications that require a wide range of speed and torque control.This three-phase current controlled approach is based on the generation of quasi-square wave currents with only one controller. For the power transistors, the current control strategy uses a triangular carrier, which is simpler and more precise than any other alternative.[6] By installing an energy storage system and discharging the energy based on the load situation, greater energy efficiency can be achieved.Flywheels, nickel-metal hydride batteries, lithium-ion batteries, electric double layer capacitors (EDLC), and other energy storage systems are commonly used. At the Haijima and Okegawa substations, the East Japan Railway Company also installed two energy storage units using lithium-ion batteries. The installed results of these energy storage systems are documented in this paper.

III.EXPERIMENTAL SETUP

This experimental setup is made up of a variety of hardware components that play a key role in the regenerative process. The most important components in this setup are:

A. Gear system:

When the vehicle's engine is turned on, the gear system engages, and the vehicle begins to move forward. The shaft connected to the wheel rotates a wheel in a counterclockwise direction.A wheel's rotation is connected to a gear installation in the wheel's axle. As the car moves forward, the gear shifts. Electric power is generated in a clockwise direction. The gear rotates in the opposite direction of the clock when the car is reversing.

B. Motor:

A current of electricity is generated by the gear motion, which is coupled with a 12V BLDC motor with a range of 0-24 VDC. When the object is moving backwards, the gear engages and the wheel rotates counterclockwise. The motor spins in a counterclockwise direction.By spinning it in the opposite direction, you can turn it into a generator. A truck is said to be in reverse motion when it moves backwards and forwards. The bypass removes the engine from the generation process.

C. Voltage:

A resistive voltage sensor is used to determine the amount of voltage induced. Depending on the speed, the amount of voltage produced varies. The motor provides 1400 rotations per minute during the rotation.A fraction of a second the mileage of a vehicle is proportional to its size and the voltage produced. The amount of voltage produced is proportional to the amount of energy used when power usage is based on mileage.

D. Battery:

In a battery, electrons flow from the anode to the cathode, according to the electron flow principle. The energy is stored in the car's lead acid battery. Electricity is used in the chemical reaction. Aside from the main battery, the energy generated is stored in a 12 V DC secondary battery.

E. Relay:

The message relay is connected to both batteries and acts as a switching device between the battery and the circuit, allowing the vehicle's battery to be used as a backup source of energy. As soon as the charge in the main battery is depleted.The secondary battery is switched on by a relay based on a threshold value, and the vehicle's electric charge is given.

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F. Arduino:

The Arduino Uno is an open-source microcontroller board designed by Arduino and based on the Microchip ATmega328P microcontroller. The board has a number of digital and analogue input/output (I/O) pins that can be used to connect to different expansion boards (shields) and other circuits.The board has 14 digital I/O pins (six of which are capable of PWM output), 6 analogue I/O pins, and is programmable via a type B USB cable using the Arduino IDE (Integrated Development Environment). It can be powered by a USB cable or an external 9-volt battery, with voltages ranging from 7 to 20 volts.

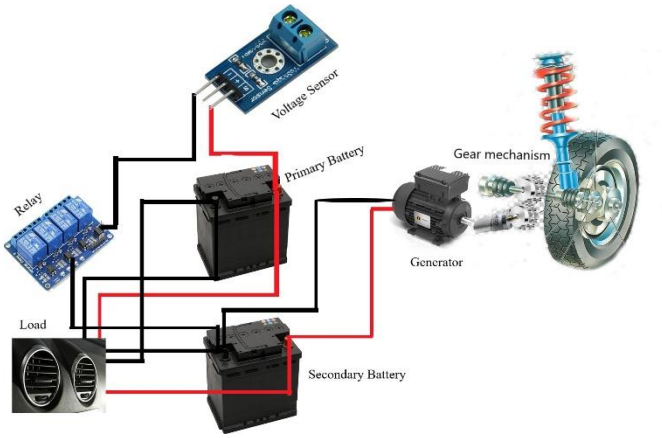

Fig.1 Circuit diagram of the system

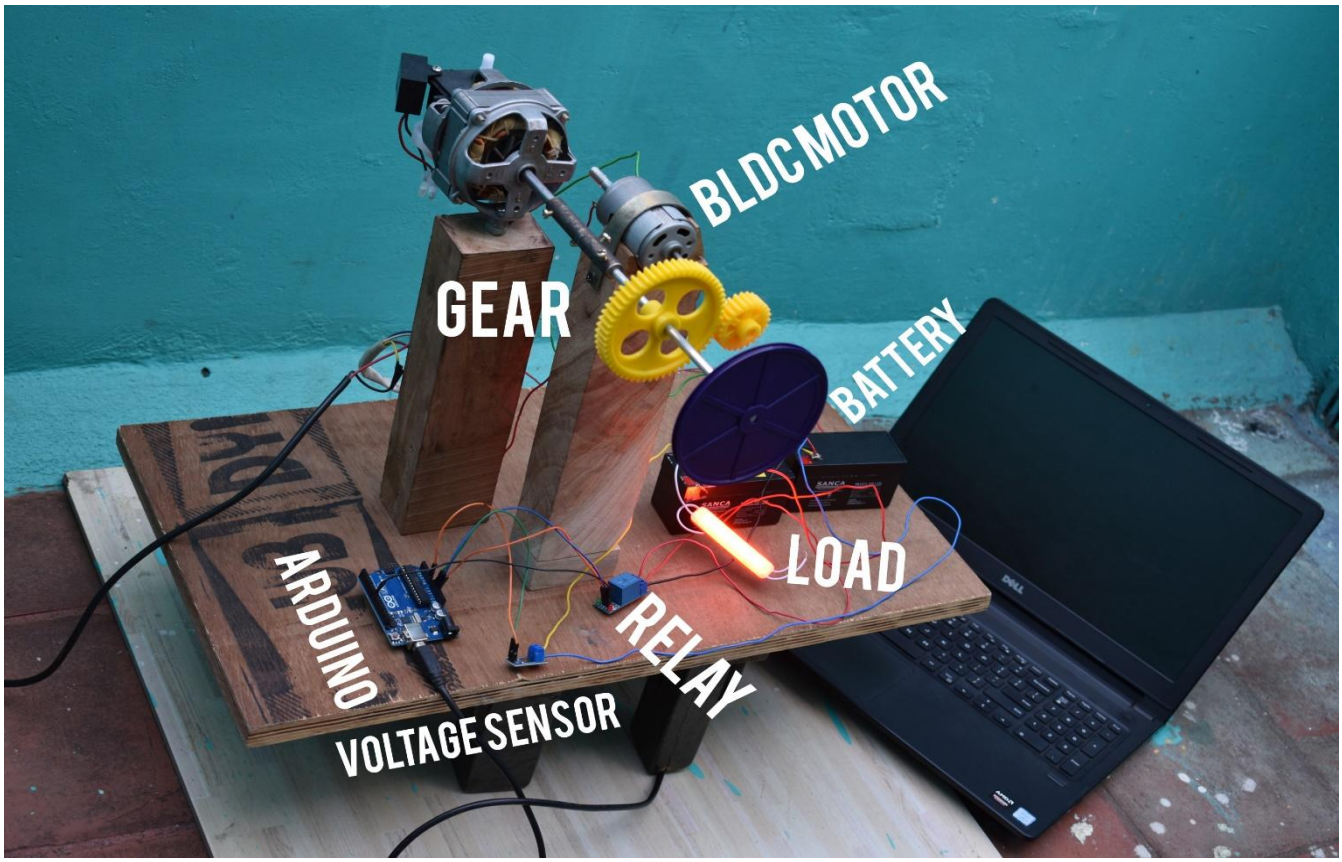

Fig.2 Overall Experimental Setup of the Project

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IV. WORKING

The car wheel shaft is connected to the 12V BLDC generator through a gear mechanism. The two gears that will be paired have a 1:3 ratio (shaft: motor). The dc motor's gear, for example, should be three times less than the wheel's gear. The charge is then stored in the secondary battery by feeding the output voltage to it.A voltage sensor is connected in parallel to the primary battery to monitor the voltage level. The relay is triggered when the voltage falls below the threshold. The NO (Normally Open) terminal of the primary battery is connected to the NC (Normally Close) terminal of the secondary battery, latching the secondary battery's line.As a result, power will begin to flow from the secondary battery to the load. The relays are switched using Arduino code, and the power supply to the load is distributed in a variety of ways.

A. Gear system:

When one gear rotates clockwise, the other rotates counterclockwise. As a result, the gear that is connected to the generator rotates.

B. Voltage sensor:

The operating range of the voltage sensor is 3V to 12V. If the battery voltage drops below 3 volts, the load should be switched to a secondary battery or the main battery should be used to power the load.

C. Relay:

The primary battery is in NO (normally open), while the secondary battery is in NC (normally closed) (normally close). The voltage sensor input causes the relay to switch the battery.

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()
{
Serial.begin(9600);
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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)
  {
    digitalWrite(rel_pin,HIGH);
  }
  else if(vIN > 1)
  {
    digitalWrite(rel_pin,LOW);

  }
}
```

Fig.3,3A Arduino program for battery switching

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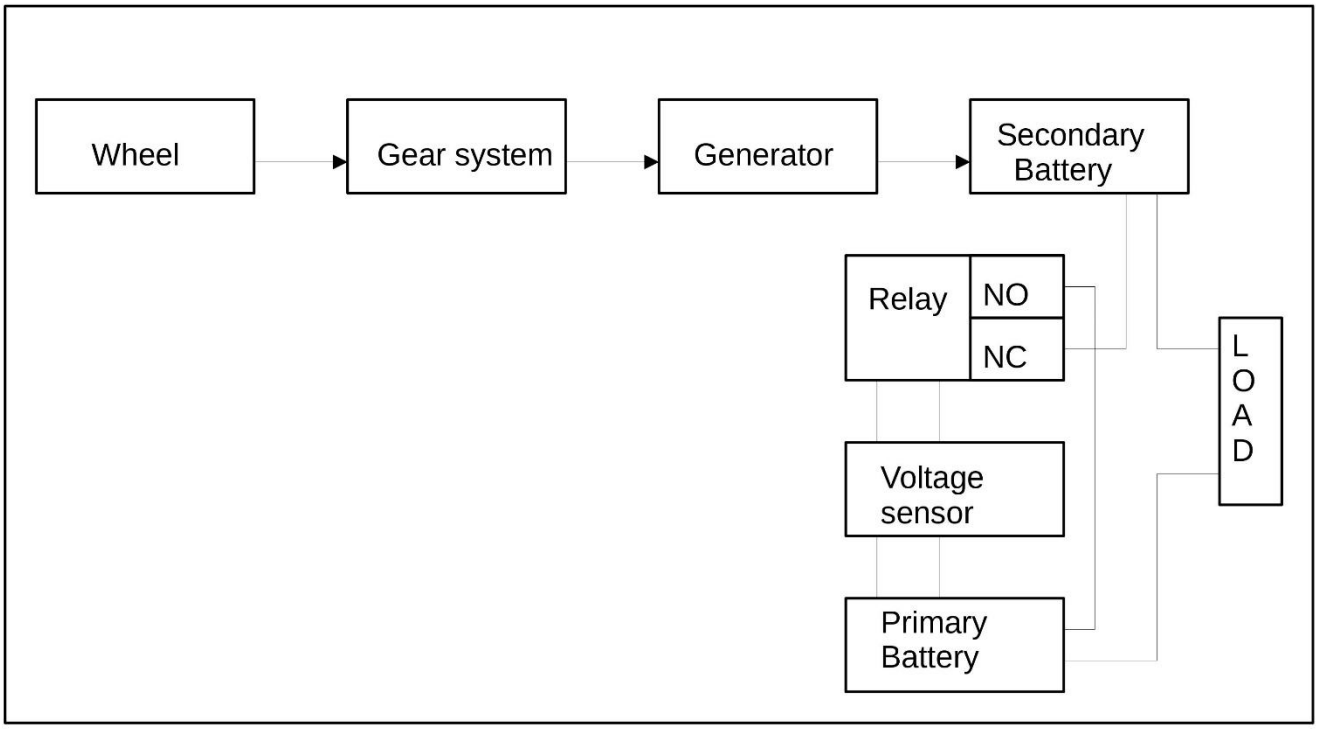

Fig.4 Block diagram of the process

V. RESULT AND DISCUSSION

The model is fixed to the car (four-wheeler), and the voltage produced varies as the car is driven at different speeds. The relationship between the car's speed and the voltage produced is directly proportional. The rpm generated for the car's speed is tabulated and plotted as a graph below.

Speed of the car(Km/hr)	RPM of the wheel
10	156
20	312
30	468
40	624
50	780
60	935
70	1092
80	1248
90	1402
100	1560

Table 1 Speed of the car vs rpm of the wheel

There are numerous actions and motions all around us that can provide us with power generation resources. Because four-wheelers are so common, the proposed system is the best choice in this case. The setup can be installed inside the car without interfering with the car's normal setup because it takes up very little space.This model can be improved by incorporating advanced controllers such as fuzzy and adaptive fuzzy to increase its effectiveness.

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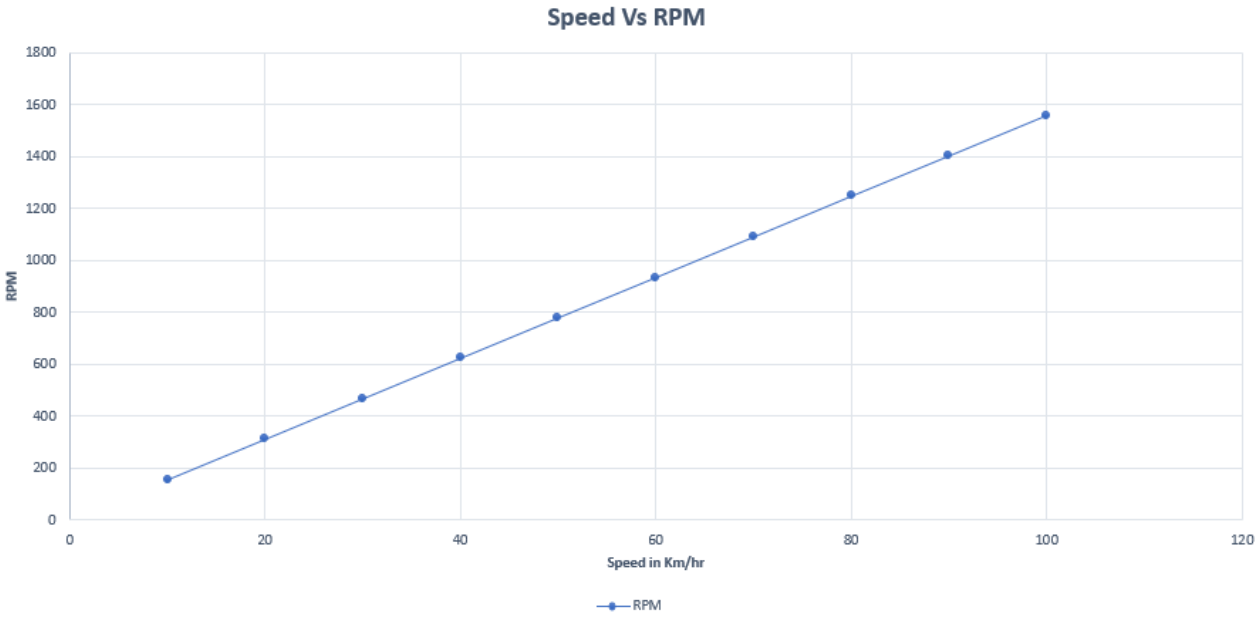


Fig.5 Speed of the car vs rpm of the wheel graph

VI.CONCLUSION

This paper focuses on the output, which consists of various parameters. It depends on the gear coupling system and the processes that take place on the road. It spins at 1400 rpm without gear in its normal state. It spins at 1360 rpm with gear, which is 97.6%. This equates to a 2.4 percent decrease in value.The speed of this system determines how long it takes to charge. Consider how much the battery will be charged after 5 hours and 8 minutes of driving at top speed. The battery determines the charging speed.Fuel efficiency could be increased by 12% as a result. After accounting for the 2.4 percent loss, we have an overall efficiency of 9.6% in the previous model.

REFERENCES

[1] Hajime Ukaji, Katsuhiro Hirata, Noboru Niguchi (2014).” Claw Pole Magnetic-Geared Generator for Hub Dynamos”, Proc. Int. Conf. Electr. Mach.

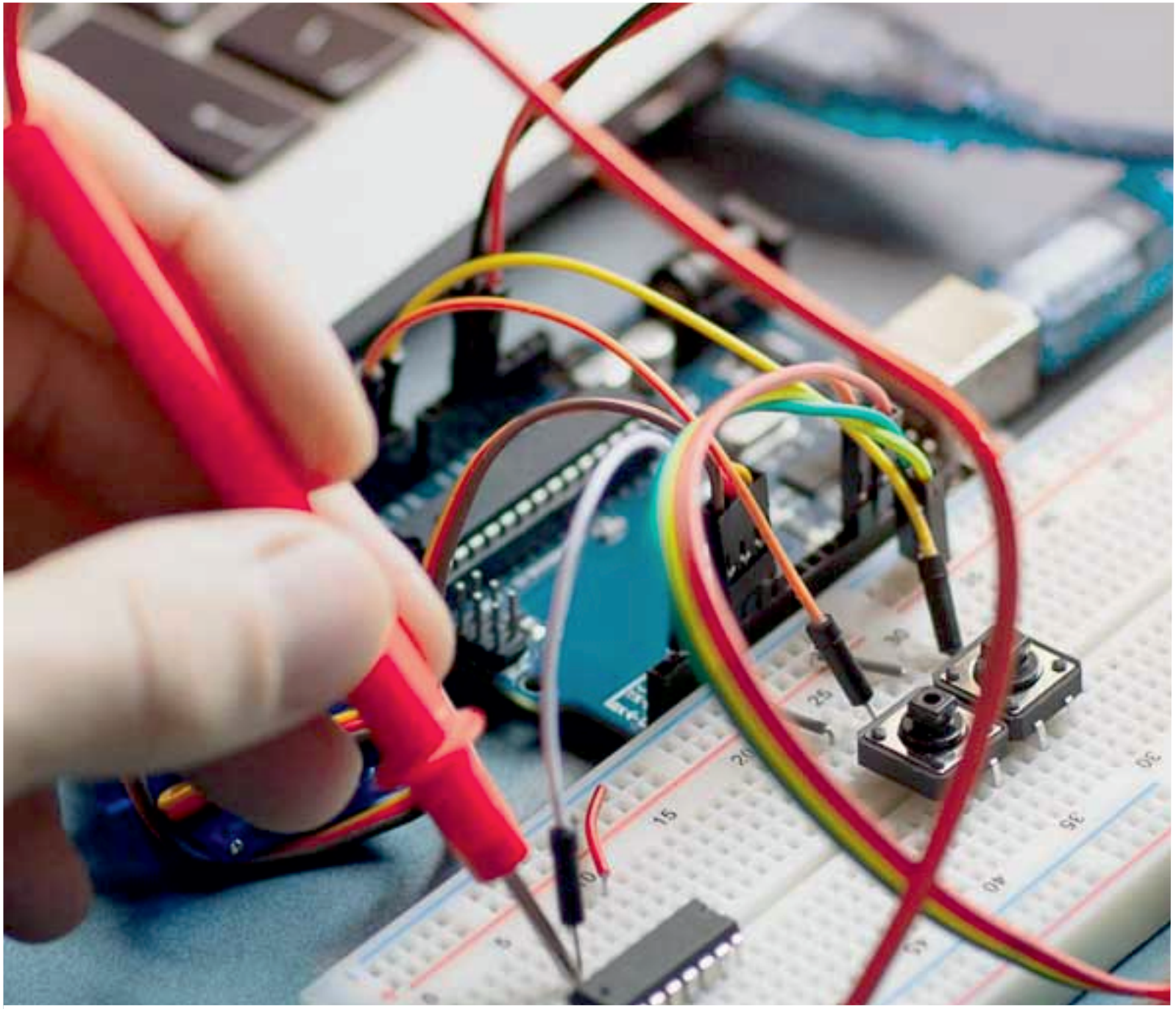
[2] Katsumi Yamazaki, Shin Tada, Hisashi Mogi, Yoichi Mishima, Chikara Kaido, Shinichi Kanao, Kazuhiko Takahashi, Kazumasa Ide, Ken’ichi Hattori, and Akihito Nakaha (2008),” Eddy Current Analysis Considering Lamination for Stator Core Ends of Turbine Generators”, IEEE Transactions on Magnetics.

[3] N.Pothirasan, Dr.M.PallikondaRajasekaran (2016),” Regenerative e-vehicle using BLDC Motor”, International Conference on Emerging Technological Trends [ICETT].

[4] FarshidNaseri (2016),” An Efficient Regenerative Braking System Based on Battery/Supercapacitor for Electric, Hybrid and Plug-In Hybrid Electric Vehicles with BLDC Motor”, IEEE Transactions on Vehicular Technology.

[5] J. Karthikeyan, R. Dhana Sekaran (2011),” Current control of brushless dc motor based on a common dc signal for space operated vehicles”, Electrical Power and Energy Systems.

[6] Yuuki Iino, Hitoshi Hayashiya, Masami Hino, Shotaro Abe, Katsutoshi Nakao, Kishin Kudo (2016),” Evaluation of installation effect of the energy storage system in d.c. traction power supply system”, IEEE International power Electronic and Motion Control conference.



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