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Regenerative Braking System with Power Monitor

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ABSTRACT: We are slowly reaching the age of electric vehicles. The major issue behind the mass use of electric vehicles is the battery charging time and lack of charging stations. So we propose a regenerative braking system. This system allows a vehicle to generate energy each time brakes are applied. The stronger the brakes, the more power is generated. We use friction lining arrangement in a brake drum. As soon as brakes are applied, the friction lining touches the drum from inside and moves the motors connected to lining in same direction, thus generating electricity using motors as dynamo. Thus this system allows for charging car battery each time brakes are applied, thus providing a regenerative braking system. It moves us another step ahead towards a pollution free transportation system.

KEYWORDS: Electric vehicle, Motor-generator integration, friction lining arrangement.

I.INTRODUCTION

In today's world where fossil fuel is limited and we are aware that it is going to end early, it enthrals researchers to find a solution for urban transport. EVs have become a best solution as it does not use any fossil fuel and it can charge from standard power outlet. The environmental concern is big and forcing IC engine low emissivity standard day by day it is coming zero. However, uses of IC engine will not be possible to achieve zero emissivity, so for urban transportation everyone must choose EVs. The battery weight and prices are lowering down day by day which another advantage of using EVs. The commercially developed batteries in today's world are have more power storing capacity is limited space and proven effective for use in EVs. To achieve more effective performance from battery and prolonged distance of EVs regenerative braking can be embedded in the EVs. For accomplishing the task of embedding regenerative braking with EVs smart and effective management techniques can be used in EVs. Many techniques for smart charging of the batteries are explained in literature. In the literature it is also suggested that for production of electricity solar energy can be use in day time and wind in night time to ensure maximum utilization of the renewable energy, and it can be use for charging the batteries of EVs. Using the renewable energy sources for battery charging will also lower down electricity production cost, as uses of solar and wind energy are associated with capital cost so lowering of tariff cost is also possible. Regenerative braking is most suitable solution for further extension of distance covered by EVs. Regenerative braking is technique which is used to recycle brake energy which is wasted otherwise. The implementation of regenerative braking is not possible in traditional IC engine vehicles. In regenerative braking technique energy. wasted in braking process is fed back to battery. In this process vehicle inertia causes electric motor to acts as a generator to produce electrical energy. Battery acts as a load directly connected to generator, and it enables the charging of the battery. It is been observed that usage of regenerative braking system can cause 15% - 20% range extension of EVs. However few constraints like no charging of the battery is possible if batteries are fully charged. In this case the produced electrical energy is wasted as a heat in resistance to waste as a heat. Hence, mechanical brakes must be installed in addition to regenerative braking system in EVs. Mechanical brakes are very essential as per the international laws for any automobile considering emergency and safety of vehicle and passenger. Although researchers have proven that mechanical as well as regenerative braking can be achieved by using single pedal in EVs. In the first step regenerative braking will be applied and if driver still pushes a brake pedal mechanical brakes will be applied. This seamless transition from regenerative braking to mechanical will not be notice by driver and same braking results as IC engine vehicles can be obtained in EVs. In this paper, as a system to be developed is ATmega328p. The Atmel ATmega328P is a 32K 8-bit microcontroller based on the AVR architecture. Many instructions are executed in a single clock cycle providing a throughput of almost 20 MIPS at20MHz. The ATMEGA328-PU comes in an PDIP 28 pin package and is suitable for use on our 28pin AVR Development Board. It has four inputs including the driver's braking requirements, vehicle speed, batteries SOC and batteries temperature and one output which is the braking force. What's more, the original force distribution regulation between mechanical and electrical forces is modified to realize more

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energy can be recycled in the braking process. Through the simulation results, we can verify the effectiveness of the control strategy in ensuring braking safety and stability and improving energy efficiency

II.SYSTEM MODEL AND ASSUMPTIONS

The block diagram is shown in fig 2.1 consisting of solar panel, GTI, manual relays, house hold supply and electricgrid.

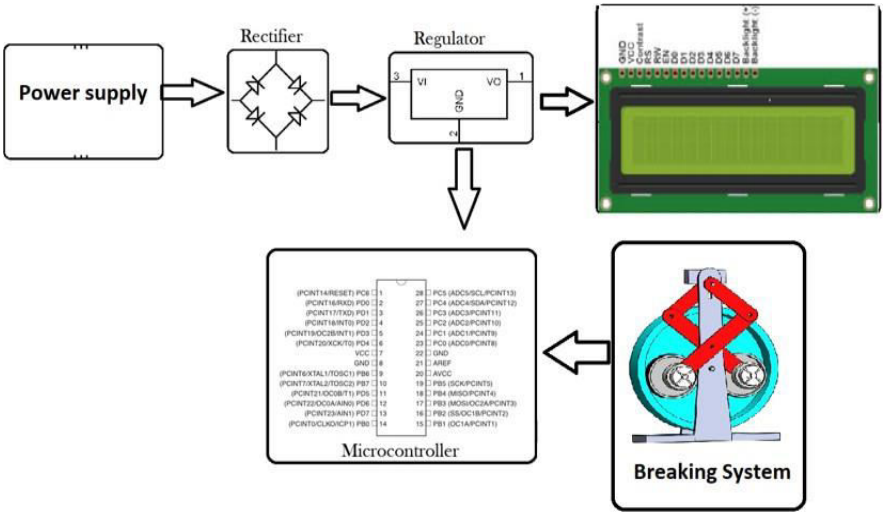

Figure 2.1: Block Diagram of Regenerative braking system

The operation and design of regenerative braking system are here. fig 2.1 shows the block diagram of regenerative braking system. The power supply to rectifier that converts alternating current, which periodically reverses direction, to direct current, which flows in only one direction. The reverse operation is performed by an inverter. The voltage regulator is designed to automatically maintain a constant voltage. A voltage regulator may use a simple feed-forward design or may include negative feedback. And the power monitor used to display the voltage during the breaking time..

III. SYSTEM DESCRIPTION

Operating Principle

Regenerative brakes work by reversing electric motors that propel an electric vehicle. It works like a generator and feeds energy back into the hybrid or electric system to help replenish a little bit of range. These small boosts in battery range can accumulate and improve efficiency over time when used regularly. Drivers can activate regenerative brakes in a few different ways. Some hybrid and electric cars have a paddle by the steering wheel that activates the regenerative brakes. How- ever, activation is seamless in most cars with regenerative braking. Applying the regular brake pedal with your foot makes the regenerative and friction brakes work together to slow down the vehicle. Cars with an especially aggressive system can use regenerative brakes when the car is coasting. Sometimes called one-pedal driving, drivers may use the feature while in a specific drive mode that emphasizes efficiency on longer trips.

IV. CIRCUIT DIAGRAM

Regenerative braking takes the energy generated by the motor and feeds it back to the AC power source or to a common bus, where it can be used again. Feeding the energy back to a common bus gives an additional benefit in terms of efficiency, because the power is converted from AC to DC only one time. Although regenerative drives have relatively higher up-front costs than simple dynamic braking systems, regeneration can often be justified when a large amount of energy can fbe recovered or when the cost of the recovered energy is high. Fig 4.1 shows the circuit diagram of regerative breaking system.

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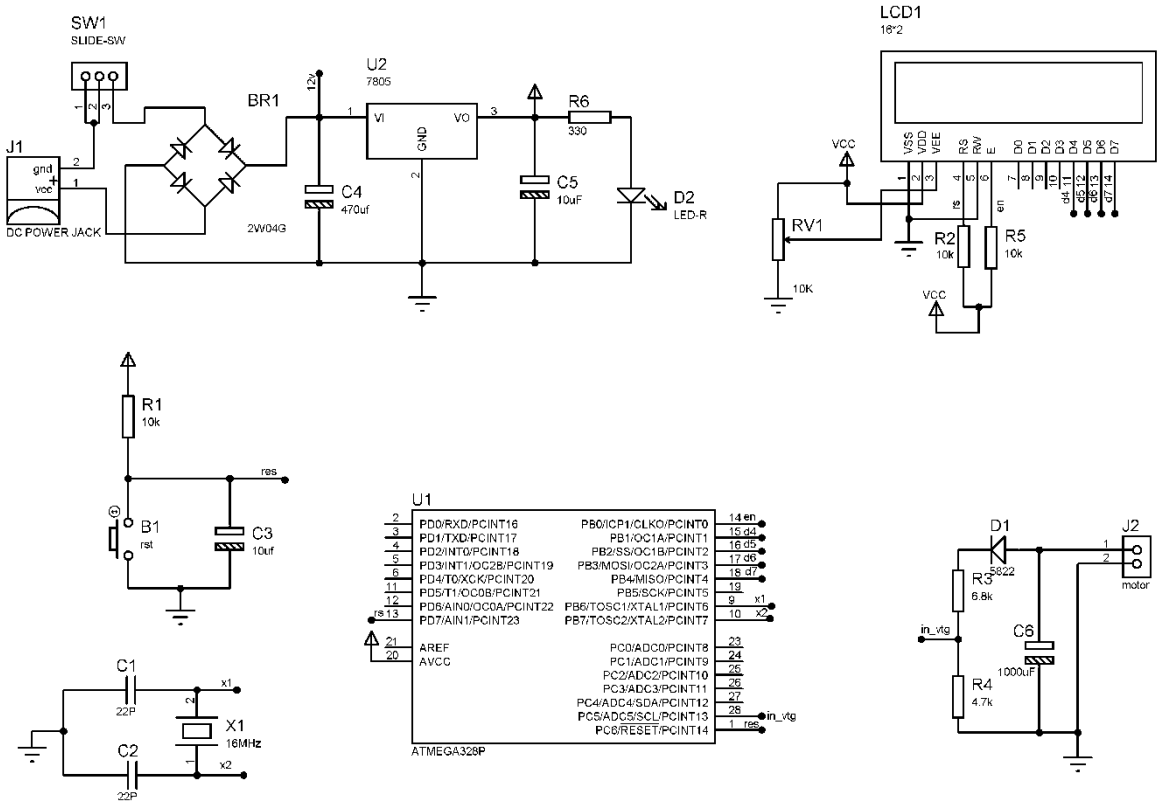

Figure 4.1: Circuit Diagram of Regenerative braking system

Components

1. **Atmega 328p** - The ATmega328P is a 32K 8-bit microcontroller based on the AVR architecture. Many instructions are executed in a single clock cycle providing a throughout of almost 20 MIPS at 20MHz.The computer on one hand is designed to perform all the general purpose tasks on a single machine like you can use a computer to run a software to perform calculations or you can use a computer to store some multimedia file or to access internet through the browser, whereas the microcontrollers are meant to perform only the spe- cific tasks, for e.g., switching the AC off automatically when room temperature drops to a certain defined limit and again turning it ON when temperature rises above the defined limit. There are number of popular families of micro- controllers which are used in different applications as per their capability and feasibility to perform the desired task, most common of these are 8051, AVR and PIC microcontrollers. In this we will introduce you with AVR family of microcontrollers.

a. High Performance, Low Power Design

b. 8-Bit Microcontroller Atmel AVR advanced RISC architecture

131 Instructions most of which are executed in a single clock cycle

Up to 20 MIPS throughput at 20 MHz

32 x 8 working registers

2 cycle multiplier

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c. Memory Includes

32KB of of programmable FLASH 1KB of EEPROM 2KB SRAM 10,000 Write and Erase Cycles for Flash and 100,000 for EEPROM Data retention for 20 years at 85 C and 100 years at 25 C Optional boot loader with lock bit

In System Programming (ISP) by via boot loader

- True Read-While-Write operation

Programming lock available for software security

d. Features Include

2 x 8-bit Timers/Counters each with independent prescaler and com- pare modes

A single 16-bit Timer/Counter with an idependent prescaler, com- pare and capture modes

Real time counter with independent oscillator

10 bit, 6 channel analog to digital Converter

6 pulse width modulation channels

Internal temperature sensor

Serial USART (Programmable)

Master/Slave SPI Serial Interface - (Philips I2C compatible)

Programmable watchdog timer with independent internal oscillator

Internal analog comparator

Interrupt and wake up on pin change

e. Additional Features Features

Internal calibrated oscillator

Power on reset and programmable brown out detection

External and internal interrupts

6 sleep modes including idle, ADC noise reduction, power save, power down, standby, and extended standby

f. I/O and Package

23 programmable I/O lines

28 pin PDIP package

g. Operating voltage: Operating voltage:

h. Operating temperature range: 40 C to 85 C

i. Speed Grades:

0-4 MHz at 1.8-5.5V

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0-10 MHz at 2.7-5.5V

0-20 MHz at 4.5-5.5V

j. Low power consumption mode at 1.8V, 1 MHz and 25 C:

Active Mode: 0.3 mA

Power-down Mode: $0.1\mu A$

Power-save Mode: $0.8\mu A$ (Including 32 kHz RTC)

2. **voltage regulator 7805** - The LM78XX/LM78XXA series of three-terminal positive regulators are available in the TO-220/D-PAK package and with sev- eral fixed output voltages, making them useful in a Wide range of applica- tions.Each type employs internal current limiting, thermal shutdown 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.

3. **DC motor** -A DC motor is any of a class of rotary electrical motors that converts direct current (DC) electrical energy into mechanical energy. The most common types rely on the forces produced by induced magnetic fields due to flowing current in the coil. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.

4. **LED** - LEDs are semiconductor devices. Like transistors, and other diodes, LEDs are made out of silicon. What makes an LED give off light are the small amounts of chemical impurities that are added to the silicon, such as gallium, arsenide, indium, and nitride.

5. **Resistor** -A resistor is a two-terminal electronic component designed to op- pose an electric current by producing a voltage drop between its terminals in proportion to the current, that is, in accordance with Ohm's law.

6. **Capacitor** - A capacitor or condenser is a passive electronic component consist- ing of a pair of conductors separated by a dielectric. When a voltage potential difference exists between the conductors, an electric field is present in the di- electric. This field stores energy and produces a mechanical force between the plates. The effect is greatest between wide, flat, parallel, narrowly separated conductors.

7. **LCD** - This is the example for the Parallel Port. This example doesn't use the Bi- directional feature found on newer ports, thus it should work with most, if not all Parallel Port.

V. SOFTWARE INTEGRATION

Coding of LCD display

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(7, 8, 9, 10, 11, 12);
const int led = 3;
long x = 0, y = 0;
const int led1 = 2;
const int sensor = A5;
float input_voltage = 0.0;
float last_input = 0.0;
float temp = 0.0;
float r1 = 6800.0;
float r2 = 4700.0;
int a = 0;
void setup() {
lcd.begin(16, 2);
```

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```
lcd.print(" Regenerative");
lcd.setCursor(0, 1);
lcd.print(" Braking System");
delay(3000);
}
```

VI. RESULT AND DISCUSSION

Hardware circuit for our Regenerative braking system with power monitor is developed using the specified components. The real hardware system is developed ,and verified the outputs from regenerative braking system using friction breakers.

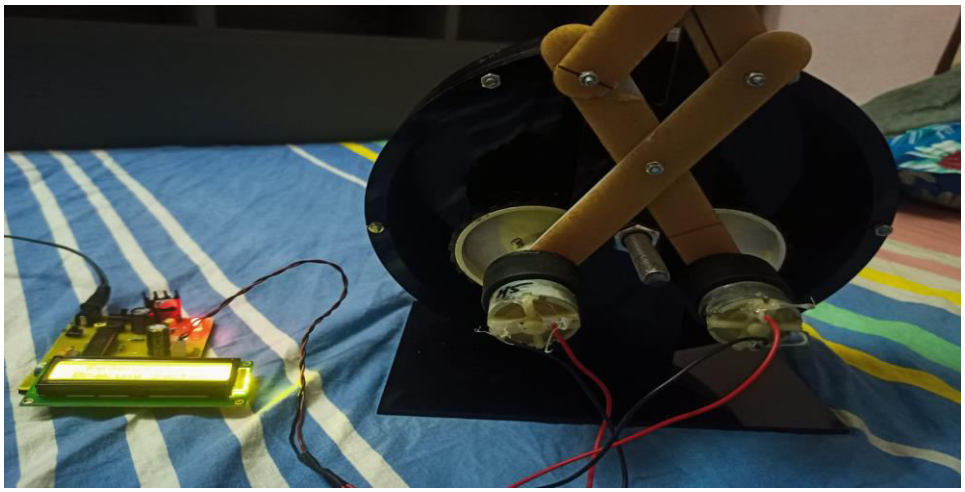

Fig 6.1 Regenerative braking system with power monitor

VII.CONCLUSION

This paper aimed at energy recovery system of electricvehicle and regenerative braking system,we still need friction brakers because regenerative braking system cannot stop the vehicle effectively in case of emergency thus there is further scope of new innovation in this field. But the use of present model can also be useful.Study has showed that regenerative braking system can increase the efficiency of engine by reduce the fuel consumption thus improving fuel economy and we are able to capture the energy which was going to waste by the use of our model. Additionally, we builtup a specific model for Hardware, results had testified oursuppositionscientific regenerative braking integrationsystemcould be used in electric vehicle and energy recovery systemintegratedwith friction brakers wasmoreeffective.

REFERENCES

[1] Y. Luo, D. Huang and X. Gao, "Research on energy recovery for electric vehicle based on motor-generator integration system," 2013 IEEE International Conference on Mechatronics and Automation, Takamatsu, 2013, pp. 93-97doi: 10.1109/ICMA.2013.6617899.

[2] Nian, X., Peng, F., & Zhang, H. (2014). Regenerative braking system of electric vehicle driven by brushless DC motor. IEEE Transactions on Industrial Electronics, 61(10), 5798-5808.

[3] Bobba, P. B., & Rajagopal, K. R. (2012, December). Modeling and analysis of hybrid energy storage systems used in electric vehicles. In 2012 IEEE International Conference on Power Electronics, Drives and Energy Systems (PEDES) (pp. 1-6). IEEE.

[4] Huang, Y., Wang, H., Khajepour, A., He, H., & Ji, J. (2017). Model predictive control power management strategies for HEVs: A review. Journal of Power Sources, 341, 91-106.

[5] Boldea, I., Tutelea, L. N., Parsa, L., & Dorrell, D. (2014). Automotive electric propulsion systems with reduced or no permanent magnets: An overview. IEEE Transactions on Industrial Electronics, 61(10), 5696-5711

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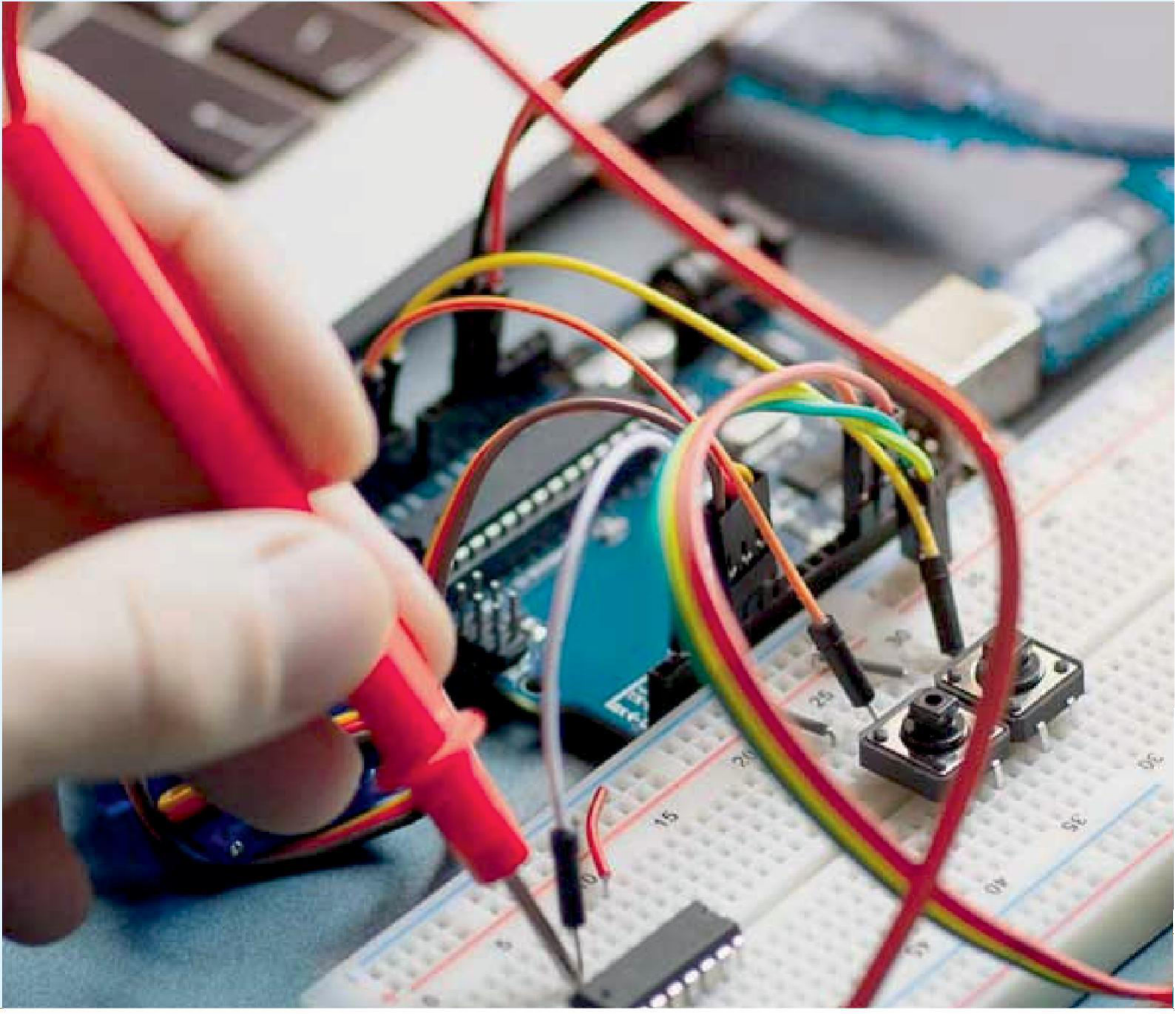

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