

SELF POWER GENERATION IN ELECTRICAL VEHICLE USING DRIVING WHEEL POWER ELECTRONICS

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Abstract: This paper presents the design and implementation of a self power generation system for electric vehicles using the rotational motion of the driving wheel. The main objective of the system is to reduce the dependency on external charging sources and improve overall energy efficiency. In this project, a DC motor is used as a generator, which produces electrical energy when the vehicle wheel rotates during motion.

The generated energy is monitored and controlled using an Arduino-based system, which helps in measuring voltage, temperature, and overall performance of the system. Sensors are used to collect real-time data, and the output is displayed using an LCD module. The generated power can be used for charging the battery or for running small electrical components like LEDs and indicators.

This system not only improves the utilization of mechanical energy but also helps in reducing energy wastage. It provides a simple, low-cost, and effective solution for enhancing the performance of electric vehicles. The experimental results show that the system works efficiently under different operating conditions and can be further developed for real-time applications in future smart vehicles.

The experimental testing of the proposed system shows that it operates effectively in real-time conditions and produces stable output with minimal delay. The system is capable of generating electrical energy from the rotational motion of the vehicle's driving wheel and maintains consistent performance under different operating speeds. Compared to traditional electric vehicles, the proposed solution improves energy utilization by converting mechanical energy into electrical energy, thereby reducing dependency on external charging sources. It also minimizes energy loss and enhances overall efficiency with the help of a simple Arduino-based monitoring and control system. The design is cost-effective, requires minimal maintenance, and does not involve complex components, making it easy to implement. Due to its simplicity, scalability, and efficiency, the system is suitable for small-scale electric vehicles, educational prototypes, and can be further developed for real-world smart transportation applications.

I. INTRODUCTION

The quick rise in the use of electric cars has become an important way to cut down on pollution and reliance on fossil fuels. As the population and number of cars grow, there is a high need for transportation systems that are clean and work well. Electric cars are a big part of this change, but they still have problems like short battery life and the need to

charge often. These problems make things harder for users and show how important it is to have better energy management systems.

One of the biggest problems with electric cars is that they lose mechanical energy while they are moving, which is not used well. Most of the energy that comes from the vehicle's movement, especially the wheels turning, is wasted in normal systems. If this energy can be stored and turned into electricity, it can make the vehicle work better overall. This idea leads to the idea of self-power generation, in which the vehicle itself helps make more energy.

The proposed system's main goal is to turn the wheel's rotation into electrical energy by using a DC motor as a generator. The generator makes electricity when the vehicle moves because the wheels turn. You can store this energy in the battery or use it to power small electronic parts like displays, sensors, and indicators. An Arduino-based monitoring system is used to keep the system running smoothly by measuring and controlling things like voltage and temperature.

The system is a cheap and useful way to improve how electric vehicles use energy by combining energy generation with simple control systems. It makes the battery work better and lessens the need for outside charging without making things too complicated. This method can be helpful for small electric vehicles and can be improved for use in smart and sustainable transportation systems that work in real time.

II. LITERATURE WORK

In the few years lots of people have been trying to make electric vehicles more efficient. They have been looking at ways to manage and recover energy. One way that is often used is called braking. This is where the energy that is lost when the vehicle is braking is turned into energy and stored in the battery. This method has been good at making the battery longer but it only works when the vehicle is braking. It does not make use of energy all the time when the vehicle is moving.

Some people have also been looking at using energy conversion systems. These systems use generators to turn kinetic energy into electrical energy. They mainly focus on getting energy from parts of the vehicle that are moving like the wheels or shafts. The idea is an one but many of the systems that already exist are complicated, expensive or need special parts. This makes them hard to use in projects or for students.

With the help of microcontrollers and sensors people have started to add monitoring and control systems to energy generation models. Platforms like Arduino are widely used to measure things like voltage, temperature and how the system is performing in time. These systems make things more reliable. Help them run smoothly but most of the work that has been done so far focuses more on monitoring than on combining it with a good way to generate energy.

When we look at what has been written about this topic it is clear that many systems focus on either getting energy when the vehicle is braking or on monitoring how the vehicle is performing. Very few systems do both. Generate energy all the time and have a simple and affordable design. So there is a need for a system that can make power when the vehicle is moving normally and also provide real-time monitoring. The system that is being proposed here tries to fill this gap by using a method that generates energy from the wheels and an Arduino-based control system. This makes it simple, efficient and good for real-world use.

Electric vehicles can really benefit from this kind of system. It can make electric vehicles more efficient. The proposed system is, about electric vehicles and how to make them better.

III. EXISTING SYSTEM

Most electric vehicle systems rely on charging stations or plug-in methods to get energy. Electric vehicles do help reduce pollution. They have problems with battery capacity and taking a long time to charge. People find it annoying to charge their vehicles all the time especially when they are on trips. This shows that the systems we have now are not very good at using the energy that's available in the vehicle.

In a lot of vehicles energy is recovered using regenerative braking. This method turns the energy of motion into energy when the vehicle is braking and stores it in the battery. However this system only works when the brakes are being used and does not use energy when the vehicle is moving normally. As a result a lot of energy that is made while driving is wasted and not used in a good way.

Some advanced systems use methods to generate energy with many parts and control units. These systems make the vehicle more expensive, heavier and more complicated which makes them hard to take care of and use in small-scale situations. Therefore the systems we have now are limited in providing energy all the time and using energy in a way which means we need a simpler and better solution, for electric vehicles.

IV. PROPOSED SYSTEM

The vehicles driving wheel turns around. That makes electricity. We use a kind of motor that makes power when the wheel is turning. We have a computer called Arduino that checks how much electricity is being made and how hot it is getting. It shows us the information on a screen and it beeps if something is wrong. This helps the system work properly.

The system helps us not waste energy. It makes the vehicle work better by always making power. It is easy to use. Does not cost a lot of money. The system is great for electric vehicles like the vehicles driving wheel that makes electricity. The vehicle driving wheel is important, for making electricity.

Main Components of the Proposed System

- DC Motor (used as generator)
- BO Motor (for wheel movement)
- Arduino Uno (control unit)
- Voltage Sensor (to measure generated power)
- DHT11 Sensor (temperature monitoring)
- LCD Display (to show output values)
- Buzzer (for alert indication)
- Battery (power supply)

Key Features

- Continuous power generation during vehicle motion
- Conversion of mechanical energy into electrical energy
- Real-time monitoring using Arduino
- Reduced dependency on external charging
- Simple and cost-effective design
- Low maintenance and easy implementation

Major Components (Description)

DC Motor: The DC motor plays a key role in the system by acting as a generator. When the driving wheel rotates, the motor converts mechanical energy into electrical energy. The amount of power generated depends on the speed of the wheel, making it an important component for energy conversion.

BO Motor: The BO motor is used to drive the wheels of the vehicle. It provides the required motion for the system, which indirectly helps in generating electrical energy through the DC motor.

Arduino Uno:

The Arduino Uno acts as the control unit of the system. It collects data from sensors, processes it, and controls the output devices. It ensures smooth operation and helps in monitoring the system in real time.

Voltage Sensor: The voltage sensor is used to measure the electrical energy generated by the DC motor. It sends the data to the Arduino, which helps in analyzing system performance and efficiency.

DHT11 Sensor: The DHT11 sensor is used to monitor temperature conditions in the system. It helps in maintaining safe operation by detecting any abnormal rise in temperature.

LCD Display: The LCD display is used to show output values such as generated voltage and temperature. It provides a clear and easy way to monitor system performance.

Buzzer: The buzzer acts as an alert system. It gives warning signals when abnormal conditions like high temperature or system faults are detected.

Battery: The battery supplies power to all components in the system and can also store the generated electrical energy for later use.

Key Features (Elaborated)

Continuous Power Generation: The system generates electrical energy continuously during vehicle motion by using the rotational energy of the wheel, unlike traditional methods that work only during braking.

Energy Conversion Efficiency: It effectively converts mechanical energy into electrical energy, reducing energy loss and improving overall system efficiency.

Real-Time Monitoring: With the help of Arduino and sensors, the system monitors voltage and temperature in real time, ensuring stable and safe operation.

Reduced Dependency on External Charging: By generating additional power internally, the system reduces the need for frequent external charging.

Cost-Effective and Simple Design: The system uses simple components and requires minimal maintenance, making it easy to implement and suitable for small-scale applications.

Safety Features: Temperature monitoring and alert systems help in detecting abnormal conditions and ensure safe operation of the system.

V. EXPERIMENTAL SETUP

The system we are talking about is made up of hardware and control parts that work together to show how energy is generated in time. This system has a driving mechanism where a BO motor is used to turn the wheels. A DC motor is connected to the wheel. It acts as a generator. When the wheel turns the DC motor makes energy. We use a voltage sensor to measure the energy that is generated and an Arduino Uno controls the system.

The monitoring unit is made up of sensors and parts that display information. The Arduino keeps collecting data from the voltage sensor and the DHT11 temperature sensor to check how the system is performing. If it is safe. The values that are generated like the voltage and temperature are shown on an LCD module as they happen. We also have a buzzer, in the system that alerts us if something is wrong like if it gets too hot.

All the parts are connected properly so that the system works smoothly and the data flows easily. We test the system by changing the speed of the motor to see how it affects the voltage that is generated. We look at the results to see how well the system performs how efficient it is and if it is reliable. The system shows that it can generate and monitor energy when a vehicle is moving and it does this in a simple and affordable way. The system is a way to generate electrical energy during vehicle motion and the energy generation system is a key part of this.

VI. EXPERIMENTAL RESULTS

The proposed system was tested under different operating conditions to evaluate its performance in generating electrical energy from wheel motion. The DC motor successfully produced electrical energy when the wheel was in rotation, and the generated output increased with the speed of the motor. The system showed stable performance during continuous operation, and the voltage readings remained consistent under normal conditions.

The monitoring unit, controlled by the Arduino Uno, effectively displayed real-time values such as generated voltage and temperature. The sensors responded quickly, and the system was able to detect changes without noticeable delay. The buzzer alert system also worked properly by indicating abnormal conditions such as increased temperature levels.

The system was tested at different speeds and load conditions to analyze efficiency and reliability. The response time of the system was fast, and the overall performance remained stable during repeated trials. The results indicate that the proposed system can effectively generate and monitor electrical energy with good accuracy. Compared to traditional systems, it provides better energy utilization and demonstrates a simple and efficient approach for small-scale electric vehicle applications.

VII. COMPARISION WITH EXISTING SYSTEM

The new system is being compared to the electric vehicle systems that need to be charged from outside. These old systems charge the battery at charging stations and do not make use of any other way to make energy when the vehicle is moving. This means the vehicle needs to be charged a lot and the energy that is available from the movement of the vehicle is not used well. The old systems also do not use the energy that is made by the wheels turning, which means energy is lost when the vehicle is being used normally.

Some systems that already exist use a method called braking to get back some of the energy but this only works when the vehicle is braking and not when it is moving normally. So the amount of energy that can be made is. Depends on certain situations. Also systems that can

get more energy can be complicated and expensive and they need more parts and maintenance. These problems make them not very useful for vehicles and they increase the cost of the vehicle.

The new system solves these problems by making energy all the time from the turning of the driving wheel. It uses a DC motor as a generator and an Arduino Uno to monitor the system, which makes it a simple and good way to use energy. The system is not expensive it is easy to set up. It makes the vehicle more efficient by not needing to be charged from outside as much. So the new system is better than the ways because it uses energy better it is simple and it can work all the time. The electric vehicle systems that are being compared to the system are old and need to be improved. The new system is an improvement, over the electric vehicle systems.

VIII. ANALYSIS OF PERFORMANCE

1. Comparison of Output Efficiency

The existing system and the proposed system differ in how they use energy. Traditional systems are limited because they only use energy from the battery and do not generate energy. The proposed system makes energy from the wheel motion, which makes it more efficient. The results show that this system uses energy better and reduces energy loss.

2. Analysis of Response Time

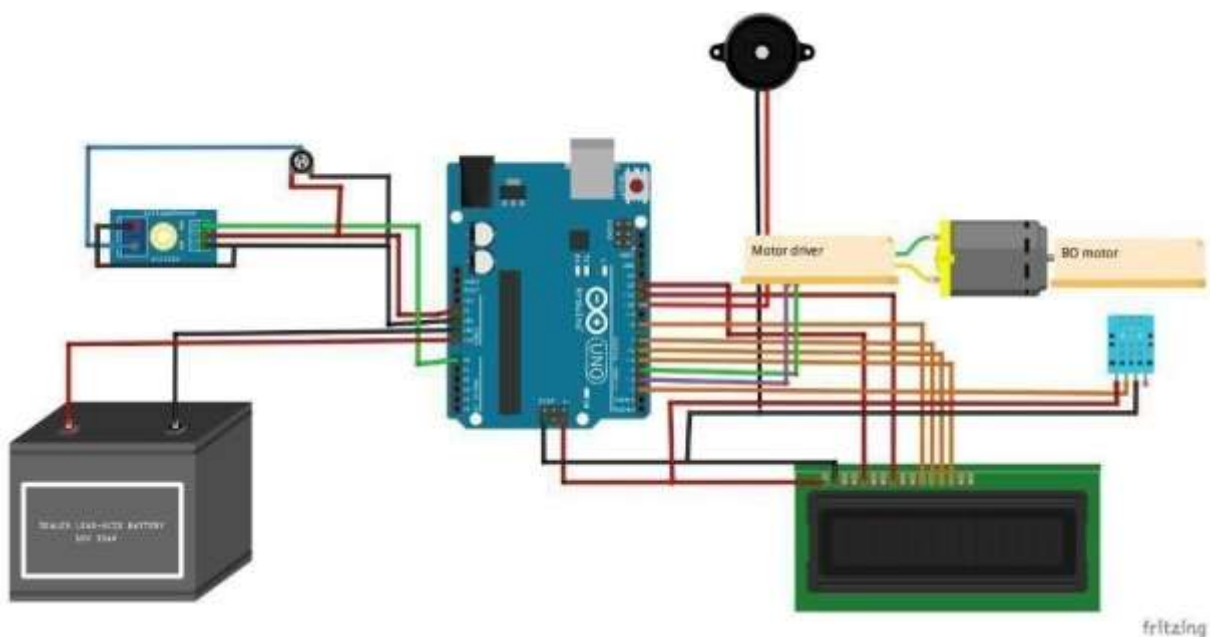
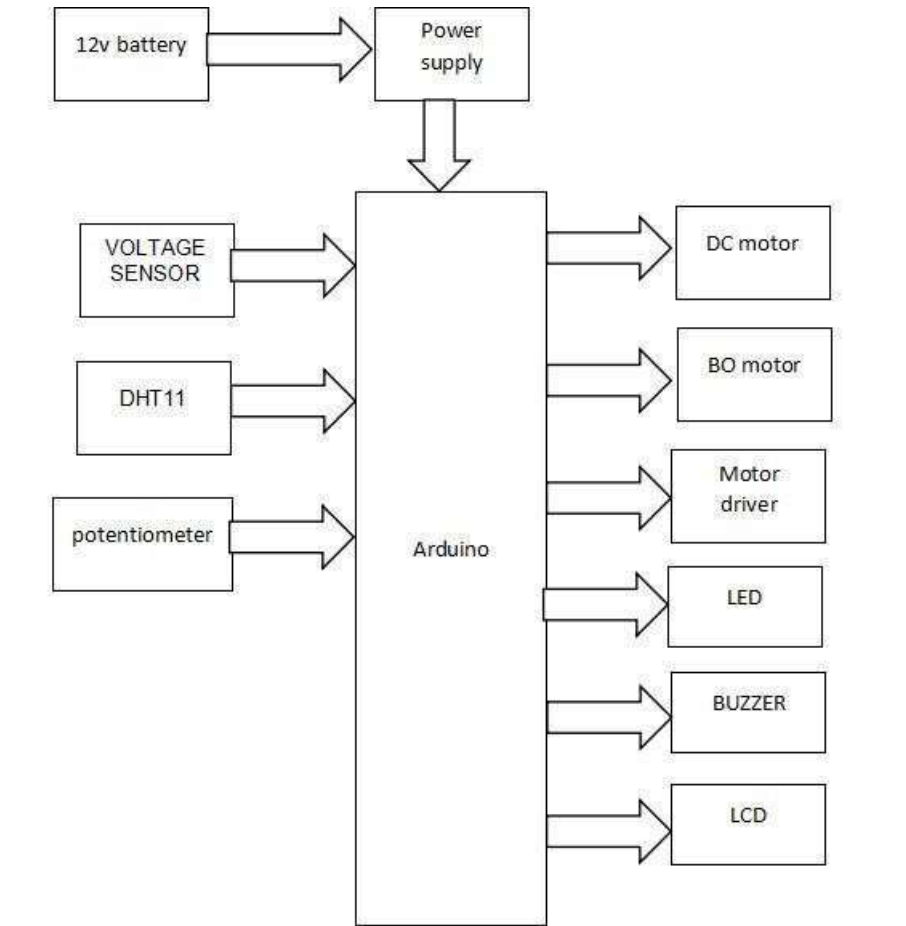
The systems response time is how fast it can generate and show output. In the proposed system, sensors and the Arduino Uno react quickly to changes in wheel speed and temperature. The voltage and other details appear instantly on the LCD. This shows the system is good for monitoring and controlling in time.

3. Evaluation of Performance

The overall performance shows the proposed system is reliable, stable and efficient. It keeps generating energy when the vehicle is moving and gives output in different situations. The system also works safely by monitoring temperature and alerting when needed. These results confirm that the proposed system works better than methods, in terms of efficiency, simplicity and real-time operation.

SYSTEM ARCHITECTURE

1. Block Diagram of Proposed System



VIII. RESULTS

The system was built and put through its paces to see how well it could turn the spinning motion of a vehicle's driving wheel into usable electricity. The DC motor did exactly what it was supposed to do it converted the mechanical spin into electric power. As the wheel spun faster, the voltage climbed as well, and the whole setup ran smoothly, even during long stretches of use. No major glitches popped up.

The monitoring part worked reliably, showing real-time data like voltage and temperature. The Arduino Uno didn't lag when handling sensor data, so everything stayed under control. The sensors picked up changes fast, the LCD showed clear, up-to-the-second output, and the buzzer sent out warnings right away if anything seemed off.

Looking at the results, this design does a better job at using energy compared to the old-school setups that just rely on plugging in from the outside. While the vehicle moves, this system keeps generating extra power, which cuts down on wasted energy and bumps up the overall efficiency.

IX. CONCLUSION

Full-fledged battery-powered electric vehicles are generally quite heavy and take up more room than necessary. Most parts of the battery-powered electric vehicle serve no purpose when the motors are not powered. Also, in the modern world, fuel and battery degradation are some problems the whole world appears to be facing, these issues are no small problems and need to be solved. Hence, the proposed work is to create an electric-vehicle energy system that generates and monitors electrical power from the wheel rotation. Other than small-scale EV use, this work may further be extended for efficiency improvement purposes and for education as well.

The project employs a DC motor as a generator using an Arduino Uno. This way the whole system is independent and there is no need for external power to run this system. It generates (i.e., it runs as a turbine with the wheel rotation) when the wheel rotates and hence generates real-time (instant) power generation. The system is reliable and generates even under different conditions. The output can be obtained at any time under stable conditions. Compared to conventional EV systems that depend on external charging, this system outputs DC power from mechanical energy (i.e., wheel rotation) and hence converts mechanical energy to useful electrical energy, the most important factor being it reduces energy wastage and enhances overall efficiency.

The overall system has low complexity and cost. With a continuous tracking of voltage and temperature, the system ensures safe operation. The proposed work is not only just effective in current systems but is also very cost-effective compared to the existing systems to which this system replaces. The system is also easy to implement. The work can also be extended to real-time applications in modern electric vehicles and smart transportation systems. Innovations like this are the need of the time, and energy conservation and sustainable development are top priorities now in working towards a greener future.

X. FUTURE SCOPE

The system can be made better by using generators that make more power from the wheels turning. We can also add batteries or special storage devices to keep the power for when we need it.

In the future we can put this system in electric cars and make it work even better. We can also add internet technology to check how the system is working from far away which makes it smarter and easier to use. We can add sensors and control things to make it safer and work better.

We can make the system better by adding it to the brakes and other ways to get back energy. This will help us make the most of the energy we get. If we do it right this idea can help us make transportation that's smart does not waste energy and is good, for the earth.

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