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IoT Design for a Rechargeable System in an Automobile

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Abstract

This Paper belongs to a technical field of energy generations and energy utilisation and discloses a system which is able to recharge a battery of an electric car using the IOT technology. For the embodiment of these invention, it consists of a generator to generate the energy, a storage medium to store the generated energy and a monitoring system to monitor the energy that is being stored, the energy that is being generated and energy that is being utilized . The specified monitoring system comprises of various sensors to collect data. This complex system is centralised based on a Micro-Controller to control and monitor the specified activities.

Keywords: *monitoring, generation, automobile, aurdino, microcontroller, rechargeable system in electrical car.*

1. Introduction

In the real world the concept of Electric car is that, it consists of a battery which needed to be charged when the battery of the car gets over it is charged again, if the charge gets over where there is no charging station then it will be problem for the user.

This research paper of ours actually deals to remove the above problem where to overcome this we are considering *generation and monitoring* of electric power for the better utilization of it. Basically in this paper we are using two batteries where one of the battery is charged and other one is kept empty. Here Generation and Monitoring are the two important modules in this system. The *Generation module* consists of three modes, where energy is generated by using Mechanical energy, Suspension energy and Wind energy.

The energy generated from Generation Module is stored in the battery(2) which will be empty whereas the other charged battery(1) will be used for running of vehicle. After the battery(1) runs out of charge, automatically battery(2) will be used for running purpose. The generated electricity is monitored by *Monitoring module* where it uses IOT technology to show the user how much the battery is charged and how much time is required to charge the full battery. This Monitoring module monitor all the three modes of Generation module for the better improvement of the whole system.

2. Literature Survey

Wind energy systems depends mainly on the turbines, configurations, their sizes, wind conditions and their controls. The maximum generation capability is limited by the Betz limit. Hence the choice of the type of generators and the control mode becomes a point of improvement in the whole of the wind energy conversion systems.

Wind energy is directly being used as mechanical power or indirectly as electrical power. Wind turbine is the vital part of WECS that converts wind power into electrical power. A WECS is a complex electromechanical energy conversion system consists of many subsystems and components [6]

This is a complicated system as electromechanical energy conversion system consists of many subsystems and components [11]

As the existing system in any diesel or petrol vehicle the battery is charged using a DC generator which is connected to the engine. And that battery is used to start the vehicle and for other electrical equipments.

In this proposed system we are using electric vehicle so we connect the DC generator directly to the wheels

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and we generate electricity and stored it in a rechargeable battery which can be used further for travelling. The efficiency will be more compared to the existing system
The suspension system is a device converts the kinetic energy of an oscillating object into electric energy. Almost all the automobiles use shock absorbers to damp out the vibration experienced due to invariably rough roads. The energy in the conventional shock absorbers gets dissipated as heat and is not used in anyway. A suspension system was designed, fabricated and tested for the purpose of achieving energy recovery from shock absorbers, which can be further used to achieve battery charging, especially having a high output performance in off-road vehicles. This could possibly balance in small or more of the work done by the alternator, resulting in increase in efficiency.

- **Rpm Calculator** - Using IR Sensor and arduino we are able to find the rpm of the Motor
- **Speed Calculator** – By using the calculated RPM we can measure the speed of the motor

A very basic principle to calculate speed using RPM.

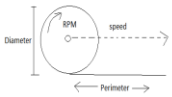

Figure 1: Workflow diagram of speed calculator

Speed = Perimeter of wheel * speed of wheel
But perimeter is Pi times the Diameter of wheel
So Speed = PI*D * speed of wheel
Speed(m/s) = Pi * D(in meter) * rps
Speed(km/hr) = Pi*D(in kilo meter) * rpm * 60

speed = 3.14159*(D/100)*(rpm/60) // speed in m/s
speed = 3.15159*(D/100000)*(rpm*60) // speed in km/hr
Here D=Diameter in cm

- **Battery Level Indicator** – Using Arduino Uno and LCD display we will display the battery level.

3. Modelling and Development of system

The architecture of the rechargeable system is divided into 2 Subsystems:

- Generation Subsystem
- Monitoring Subsystem

A. Generation subsytem:

This Subsystem deals with generation of electricity from variety of sources specified below

The architecture of the generation Subsystem is also subdivided into 3 subsystems:

- Wind Subsystem
- Mechanical Subsystem
- Suspension Subsystem

1) Wind Subsystem:

Major components required: Wind Turbine, Rotor, Battery, DC generator.

Wind turbines can be positioned in front of car. The current is generated when the car starts moving. When the car starts moving it displaces the air, which causes the surrounding air to flow relative to the moving vehicle in a direction opposite to that of the vehicle. The Opposing air stream is directly passes through turbine through its blades by providing a torque which will help the rotor to rotate. The energy that is generated with rotor is transferred to generator. Further the generator is electrically connected to the charging system of the electric car. By doing these batteries are charged continuously while vehicle is moving.
Basically wind turbines are designed to extract maximum amount of energy from the wind to power the electric car.

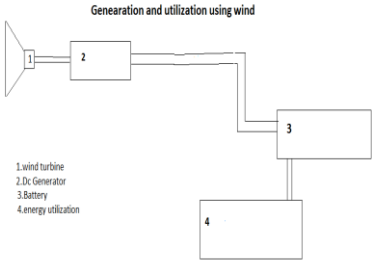

Figure 2: Architecture of wind subsystem:

To get the maximum amount of wind pressure on the blades we need to place the turbine in the right place. For this we must have the knowledge of aerodynamic design of car body. Because without proper knowledge if we place turbine in wrong place, it will affect the speed of the car and the system can't generate maximum amount of electrical energy.

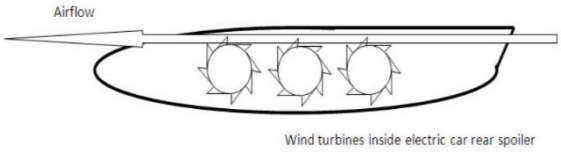

Figure 3: Wind Turbine

Figure 4: Air pressure acting on front of car.

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In some design the more pressure will act on front of a car body .so we can place the turbine in front of car body. The electrical energy generated by wind is stored in the battery and it can be used in different ways.
Utilization of energy generated by wind:

- Head lights.
- Dashboard lights.
- Indicators.
- Other electrical equipment's in car.

2) Mechanical Subsystem

Major components used: DC generator, Rechargeable battery.

As we know that rotational motion of DC generator can generate electricity and in any electrical car it is very necessary to generate electrical energy while the car is moving. Lot of kinetic energy is wasted while the car is moving. So our paper focuses on reclaiming the energy from various sources in the form of electrical energy.

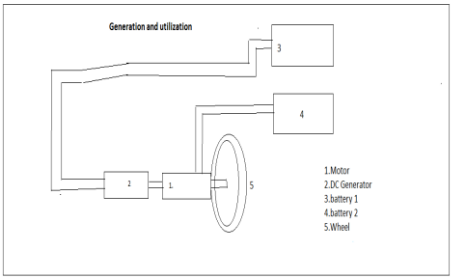

Figure 5: Architecture of mechanical subsystem.

Our aim is to create a system that can regenerate the electrical energy from the kinetic motion of fly wheel and store it in the battery and use the generated energy to run the electrical car. When the car is moving the wheel will rotate with certain amount of RPM to generate electrical energy, a DC generator is connected to the electrical motor.so when the generator rotates it generates electrical energy and that energy can be stored into a battery.
Advantages:

- No loss of kinetic energy.
- No need to charge the battery from external supply.

Disadvantage:

DC generator is attached to the wheel so it will directly affect the RPM of the wheel. And it will affect on the speed of the car. But this is not a major issue it will just slow down the speed. But car will get free electrical energy.

3) Suspension Subsystem

Major Components used: DC generator, Rechargeable battery, Shock Absorber, Rack & Pinion, Chain, Fly Wheel

This Subsystem uses suspension mechanism to generate electricity. This subsystem generates electricity when a car triggers the break mechanism.

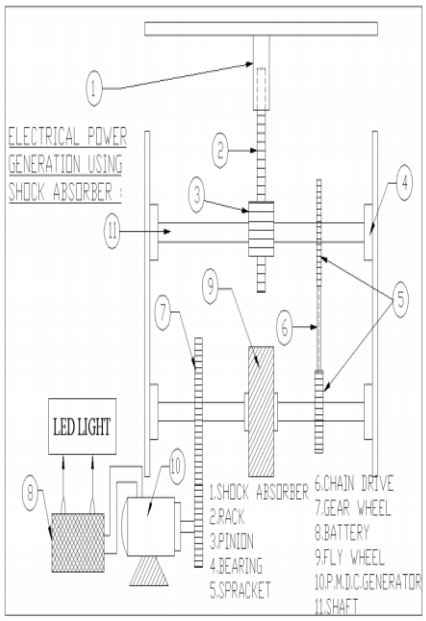

Figure 6: Architecture of Suspension Subsystem

Our aim is to create a system that can regenerate the electrical energy from amount of pressure applied on seat or spring and storing in the battery. By using the generated energy to run the electrical car. When the brake is applied or at the humps pressure is applied to the springs which is connected to Rack & Pinion which helps fly wheel to rotate with certain amount of RPM, to generate electrical energy a DC generator is connected to the electrical motor or it can be connected to the wheel also .so when the generator rotates it generates electrical energy and that energy can be stored into battery. Once the battery1 will be completely discharged. We can switch to battery 2 which is charged and run the vehicle.

B. Monitoring Subsystem

This Subsystem deals with the monitoring the generation SubSystem.

The architecture of the monitoring subsystem is divided into 2 parts that is

- RPM and voltage Calculator
- Battery Level Indicator

1) RPM and Voltage Calculator:

Major components used: LCD 16X2 display, aurdino, IR Sensor

This Subsystem is used to calculate the RPM of the motor and voltage generated by that motor

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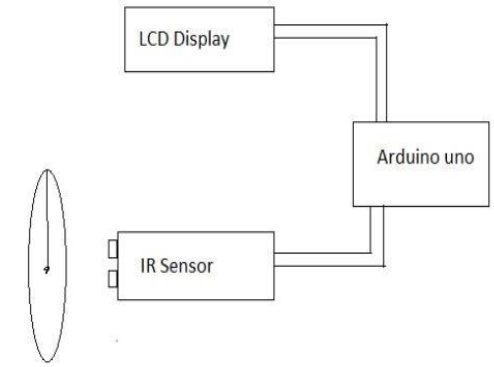

Figure 7: Architecture of RPM and Voltage Calculator

2) Battery level indicator:

Major components used: LCD 16X2 display, aurdino, Battery.

This Subsystem is used to monitor the Battery Level and display the percentage onto the LCD display

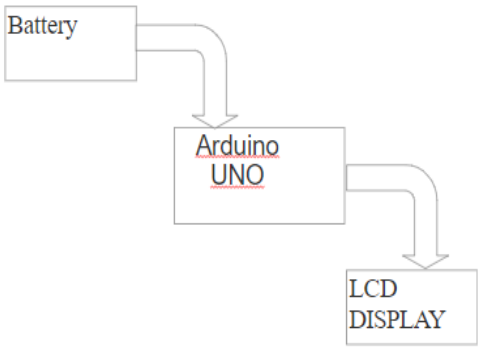

Figure 8: Architecture of battery Level Indicator

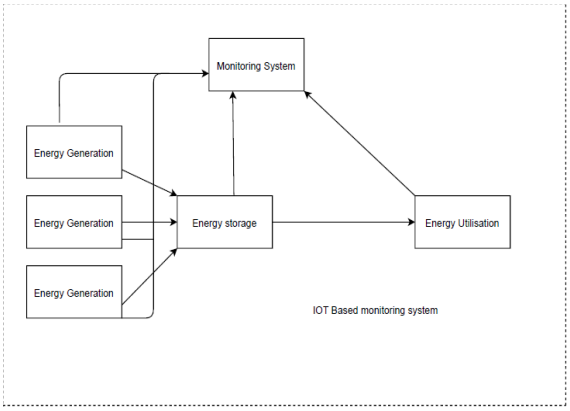

Figure 9: The Block diagram of the prototype

4. Methodology

In the existing electrical cars, the system is designed to charge the battery from external supply. But once the battery is completely discharged, we need to charge it again from the external supply but there may be a situation where once the battery is completely discharged and we don't have any charging facilities available nearby, thereby we face the problem of a dead battery. To avoid the specified problem, we carefully designed a rechargeable system. This system can reclaim the waste energy in the form of electrical energy.

In this system we are going to use 2 batteries. Battery1 is used to supply electric energy to the engine and battery2 will be recharged by the electrical energy generated by the Generation system. Once the battery1 is completely discharged. We can switch to battery2 and supply electricity to run the electrical car and Battery1 will be recharged. By using this system, we will get free electrical energy leading to a potential free energy car

The below diagram shows the workflow of the prototype

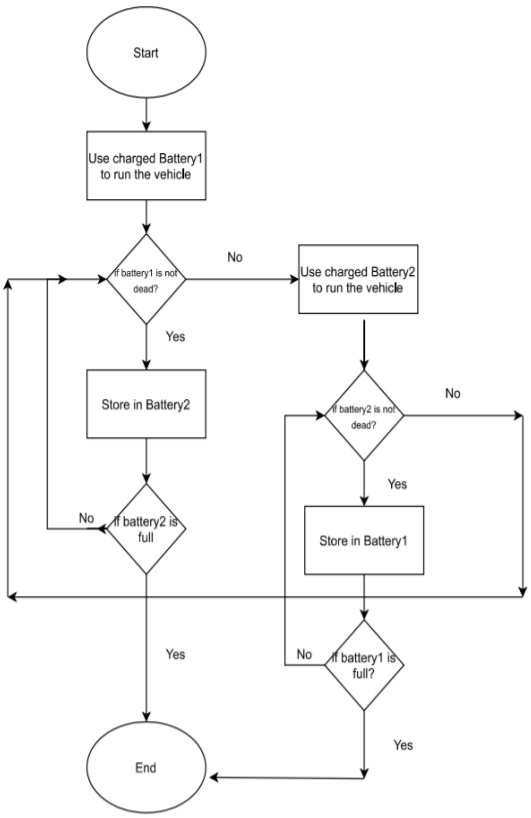

Figure 10: The Workflow flowchart of the prototype

5. Result and Conclusion

The proposed system in this paper was successfully implemented and we got the desired result. According to *monitoring module* the battery percentage was displayed in LCD. This module can show us the battery percentage when the battery is charging and discharging. This module also show us how much time is required to charge the full battery and other characteristics.

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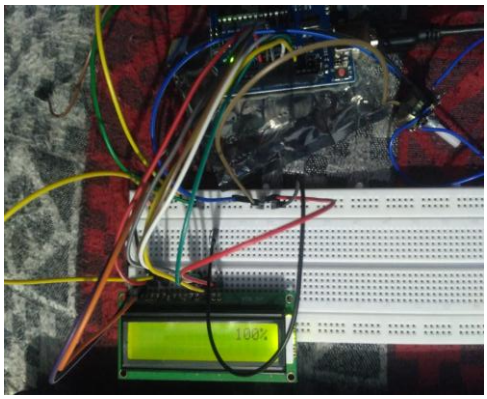

Figure 11: Monitoring system showing battery percentage

6. Further Enhancement

By referring this paper, you will be able build the *generation module* so the whole system will be completed. In addition to that by building the three required modes of the prototype of generation module you will be able to get the desired results.

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