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Research paper

Simulation of Self- Rechargeable Electric Vehicle

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Abstract

This paper proposed the self-rechargeable electric vehicle by using "Crocodile Clip" simulation. A proposed self-recharge is to recharge the battery by the rotation of the wheel and it drives the motor during generator mode. On this mode, the motor be able to produce current because the motor act as a generator. On motor mode, the system helps in increasing speed of the vehicle. The mode is switchable to the driver needs. The purpose of this paper is to overcome the problem of lack of charging station availability in the country. This paper allows the user to charge the vehicle on the go. In this paper, two motors has been designed, namely all-time motor and switchable motor. During motor mode, both motor will be rotating and it makes the vehicle travel in higher speed. Meanwhile in the generator mode maintains the speed at 13rpm.. In conclusion, the battery is allowed to be charged during generation mode and circuit itself will run the motor during motor mode.

Keywords: *Self-rechargeable electric vehicle; switchable motor to generator; generator mode; motor mode.*

1. Introduction

Nowadays, gasoline and diesel engine vehicle can be found all over the world. However, these vehicles can releases carbon dioxide gases to the atmosphere which is from the engine. Later, cars equipped with a catalytic converter, a component that trap unburnt fuel from the exhaust and release less polluted air to the atmosphere [1]. This component help reduce pollution but it is not the solution.
As the vehicle gets older, the catalytic converter gets dirtier and needed to replace. The dirtier it gets, the less it filters. From the statistics shows that 60% of the busses in the Great Britain are more than a decade old and service vehicle such as delivery van, cab, and busses are the largest number of vehicle that produce pollution [1]. One of the solution for this issue is to increase the use of electric vehicle because it is zero emission.
French automotive company such as Peugeot, Citroen and Renault are targeting fifty thousand sales of electric car per annum and their French government are supporting by giving tax free for electric vehicle and free municipal parking [2].
Manufacturers are focusing on developing batteries for electric vehicles. For example, they are developing nickel cadmium type batteries which will hold double the power of the classic lead acid [2]. Another great example of battery is lithium ion, this battery has longer life, less weight, compact and more airflow to keep the battery in temperature [2].
Nowadays, car have the plug in charging system in their vehicles and the electric charging station is starting to grow in automotive industry. This charging stations are designed especially for vehicle charging especially in shopping mall. However, the problem is, the electric car or hybrid car is parked in the user's house and housing grid are not designed to charge an electric vehicle [4].
By charging electric vehicle in house, the housing grid needs extra load, these will lead to problem in power distribution station [5]. In this project the vehicle will be charging while driving, instead of charging in charging station.

2. Design of self-rechargeable electric vehicle

Reason behind this project is to recharge the battery while running and to travel in higher speed if needed. In this paper, two motor ere individually mounted on wheel and one of the motor can be switched to motor mode or generator mode. Another motor is running as motor all the time to move the vehicle.
The circuit was designed using Crocodile Clip simulation software. The circuit was designed by using component such as gear, motor, voltmeter, diode, switch, potentiometer and 12V battery as the circuit diagram in the Figure 1 shows.
This circuit allows the battery to charge. There are two motor driving two wheel in the circuit. The left motor is all time motor but the right motor can be switched from motor to generator. A motor and a generator has a same construction but if power was supplied to the it, it act as a motor by rotating shaft by its own and if the shaft was rotated, then it will act as a generator by producing current [3]. The motor has two terminals, negative and positive, but when it was switched to generation mode, the terminal change to positive and negative allowing the produced current to be stored in the battery in the opposite direction. If the terminal remain the same, the produced power will be used without charging. The potentiometer allows to control the voltage of the motor. The higher the voltage supplied the higher the speed of the motor.

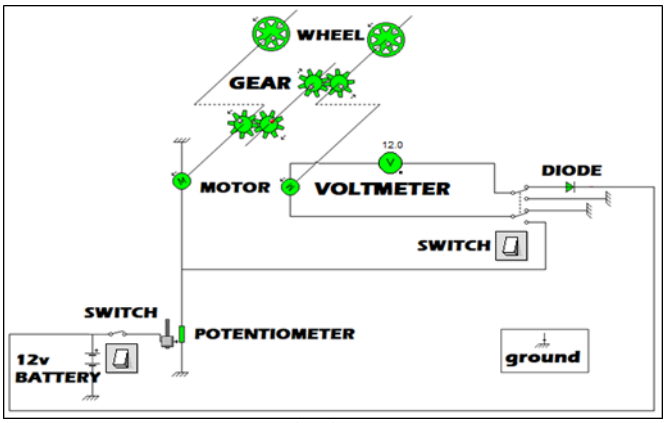

Fig. 1: Circuit diagram of self-rechargeable electric vehicle

3. Result and discussion

As the Figure 1 shows, circuit allows the battery to charge. There are two motor driving two wheel in the circuit. The left motor is all time motor but the right motor can be switched from motor to generator. A motor and a generator has a same construction but if power was supplied to the it, it act as a motor by rotating shaft by its own but if the shaft was rotated, then it will act as a generator by producing current [5]. The motor has two terminals, negative and positive, but when it was switched to generation mode, the terminal change to positive and negative allowing the produced current to be stored in the battery in the opposite direction. If the terminal remain the same, the produced power will be used without charging. The potentiometer allows to control the voltage of the motor. The higher the voltage supplied the higher the speed of the motor.
Following are the first analysis made which is comparison between generation mode and motor mode, and the red flag in the circuit indicate current flow.

3.1. Motor mode

Figure 2 shows the circuit during it was switched to motor mode. Here, both wheel are powered by individual motor. The voltmeter reading is -12V because the voltmeter are placed in opposite direction. The 12V came from the power supply.

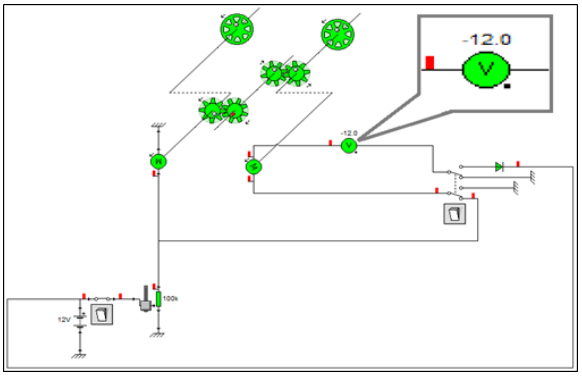

Fig. 2: Motor Mode

3.2. Generation mode

Figure 3 shows the circuit during it was switched to generation mode. Now, one motor diving both the wheel and one of the wheel is driving the motor producing current to charge the battery. Now, the voltmeter proves that the motor is producing current.

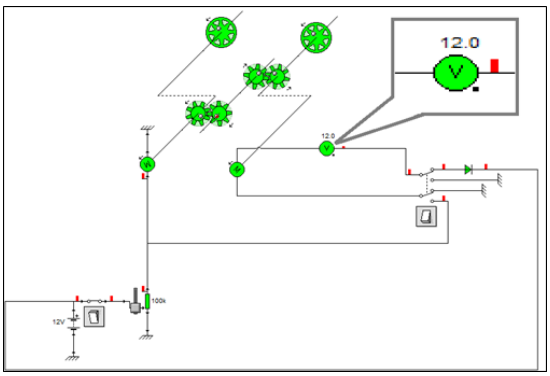

Fig. 3: Generation Mode

The second analysis, is based on the same simulation program which has a graph option in it so a sensor was placed in one of the gear to read the velocity on wheel. Figure 4 and Figure 5 shows the velocity vs. time of the wheel.

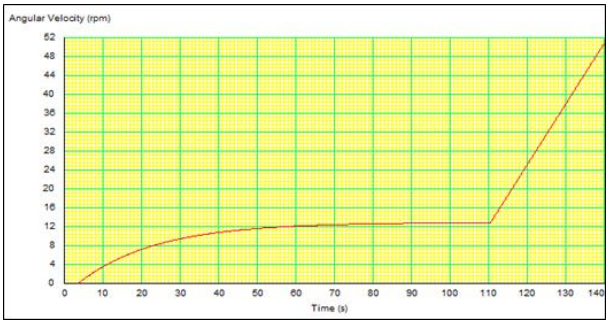

Fig. 4: Increasing speed

Figure 4 shows the graph result when the circuit is switched off, the velocity is zero and when it turned on during the generation mode is on, the speed of the wheel slowly increasing up to 13 rpm. At 110th second, the circuit was switched to motor mode. Then in just 30 seconds, the velocity increases from 13 rpm to 51 rpm. It prove that, the single wheel drive is slower than a two wheel drive which has been stated in [6].

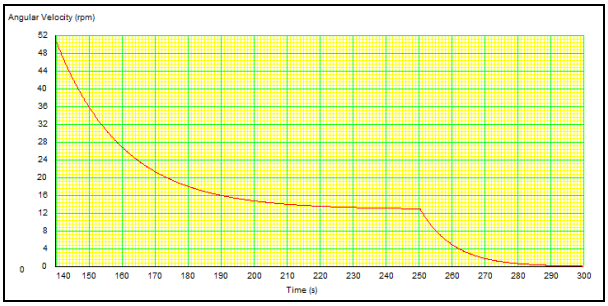

Fig. 5: Decreasing speed

Figure 5 shows the continuation from the figure 4. At 51 rpm the circuit was switched to motor mode again. Then the velocity slowly drop to 13 rpm again and at 250th second, the circuit was turned off, it takes 50 second to slow down and stop. This proves that Hyundai research which is two wheel drive slower than four wheel drive. In this case, during generation mode, it is single wheel drive and during motor mode, its two wheel drive and it gain back power losses. [6].

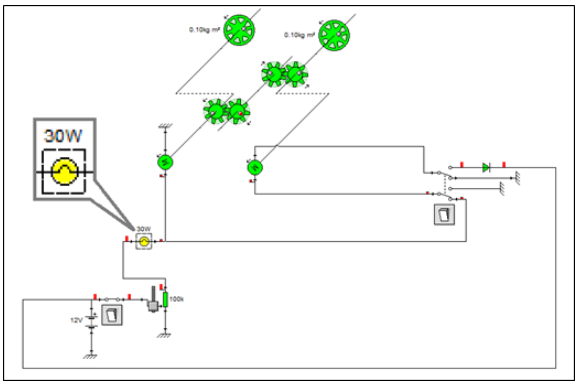

Fig. 6: Highest brightness of the bulb at 30 Watts

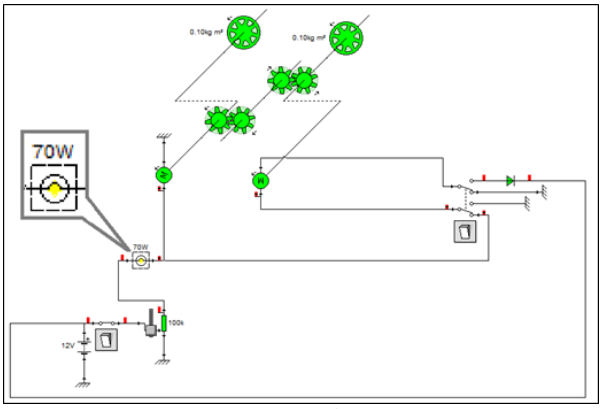

Fig. 7: Medium brightness of the bulb at 70 Watts

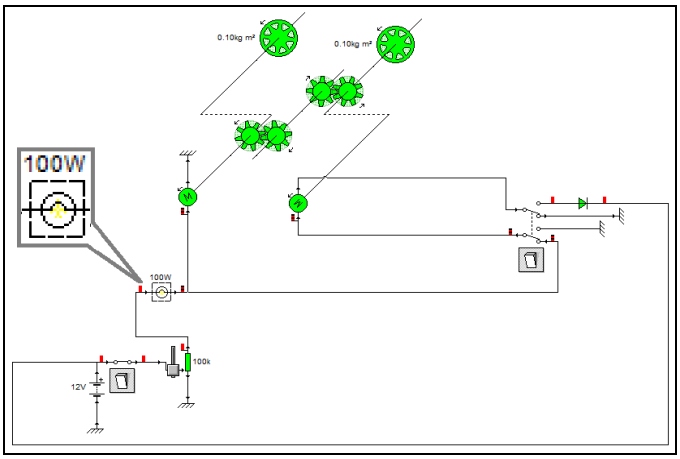

Fig. 8: Lowest brightness of the bulb at 100 Watts

The final analysis, bulb was added to the circuit because in any vehicle, there are electrical accessory for the entertainment of the user. Here, a bulb of 30W, 70W and 100W in the Figure 6, Figure 7 and Figure 8 are used in the experiment to find out suitable watts suitable for this application.

As Figure 6, the 30W accessory is suitable for this application because the bulb glow brighter, in Figure 7, the 70W accessory can be used but not recommended because medium brightness from the bulb. And finally Figure 8, the 100W accessory not recommended at all because it is glowing very low and it can be useless.

4. Conclusion

With this paper, it proves that the vehicle able to generate power to charge to the battery on the running condition during generation mode. The circuit can be switch to motor mode and the motor will no longer charge the battery but it will run the vehicle and allow to increase the speed. This circuit can applied to electric bicycle, electric skateboard or anything equivalent. For heavy duty application such as cars, higher battery capacity and bigger motor needed

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