Road power generation by applying conversion system

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ABSTRACT – Road power generation is a concept that converts the kinetic energy from vehicles into electrical energy. Therefore, this research is to develop road power generation which take the stroke motion of vehicles and cause the motor to rotate thus generates the electricity for street lighting. This system implement using a speed breaker with 8 cm and 15 cm height and 7 cm length of rack and to be attached to the road. The result shows that this system can generate up to 32 watt for several vehicle that slide on the plate.

1. INTRODUCTION

Nowadays, the global warming and climate change has been rises which give the acknowledge that traditional dependence on fossil fuel extracts cost from the environment. The most efficient strategies to reduce the financial and environment drawbacks of the excessive utilization of fossil fuel is by using the renewable energy and energy recovery [1]. Road power generation is a new energy sources that have been investigate nowadays which is not use in wide range because the renewable energy like solar, wind and hydro can still be use this day. India and United States of America (USA) is the most country that use this waste energy [2-3]. This road power generation system receives its kinematic energy from the vehicles that pass through the speed breaker which convert the kinetic energy to electrical energy. It is an electro-mechanical unit [3]. This research are consists of metal plate that covered by rubber liner which attach to the road. The plate is connected to a spring, rack gear and a pinion. The spring function is to make the plate back to its position after vehicle move on the plate. When vehicle move on the plate, the plate will move down wards as a rack gear move which give the pinion rotate. The pinion that rotate are install to the generator which produce electricity. The aim of this research is to convert the kinetic energy to electrical energy and analyse the voltage generated from the load of vehicles and supply to a street light. The conversion will be proportional to traffic density [3].

2. METHODOLOGY

This research is to develop a road power generator from the speed breaker with 2 different height of speed breaker; 8 cm and 15 cm. Development of this power generation system uses metal plate, spring, rubber, rack gear, pinion, and power generator motor, as shown in Figure 1. The structure of this system are designed using AutoCAD software as in Figure 2. In this design, there are a few parameter that will be affect the outcome, such as the height of speed breaker, length of rack gear, spring, time impact and pinion.

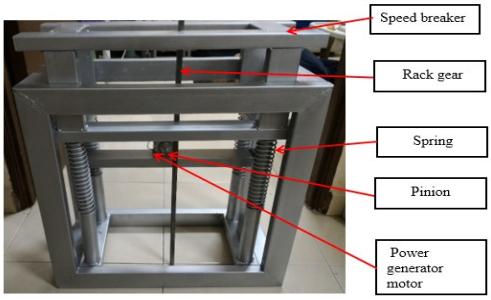

Figure 1 Prototype of road power generator

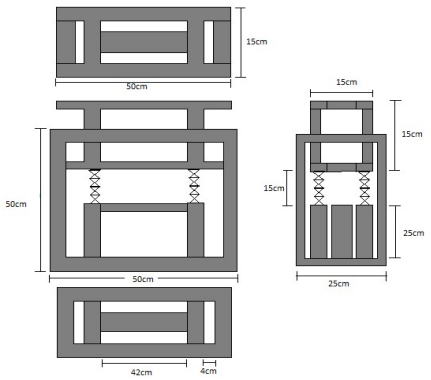

Figure 2 Design product using AutoCad

Besides that, the generator has been used in this project, was the type of Power Generator Motor, from Malaysia. This generator motor is chosen because it can produce the best power output and can generate high voltage. The specification rated power is <55W. The specification rated voltage is 120V while for rated current is 0.5A and rated speed of this motor is 2500 r/min. In order to supply a street lamp which is in AC (alternating current), the inverter (IC 4047) is used to convert from DC (direct current) that came from battery (power generator design product) to an AC. The inverter circuit diagram as shown in Figure 3.

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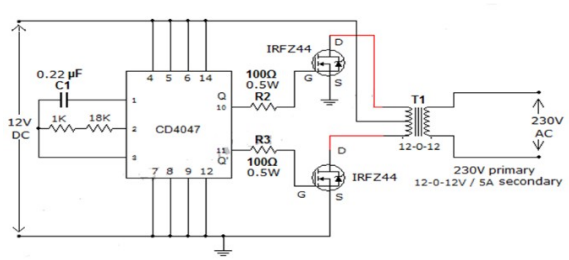

Figure 3 Inverter circuit

3. EXPERIMENTAL RESULTS AND DISCUSSION

The result has been taken by doing some experiment with using buck boost converter to get higher output and tested with different weight of vehicle. Table 1 shows the electricity power that been generated at different weight of vehicle. The voltage value are maintained at 12V because the output from the buck boost converter has been set as 12V.

Table 1 Electric power produce from different weight of vehicle due to height of speed breaker

Vehicle weight (kg)	Current (A)	Voltage (V)	Power (W)
700	1.43	12	17.17
800	1.64	12	19.62
900	1.84	12	22.07
1000	2.04	12	24.52
1100	2.24	12	26.98
1200	2.45	12	29.43
1300	2.66	12	31.88

The value of power as in Table 1 dramatically increased as the weight of vehicle were increased. This is due to the equation below.

Work done = Force x Distance (1)

Force = Weight of vehicle = 700kg x 9.81 (2)
= 6867N

Output power = Work done/sec = (6867 x 0.08)/60 (3)
= 9.156W (1 push)

One vehicle that pass the speed breaker equal to 1 minute that use in the Equation (1). The higher speed breaker been used, the higher electricity power been generated. This relationship can be shown in Figure 4 and Figure 5.

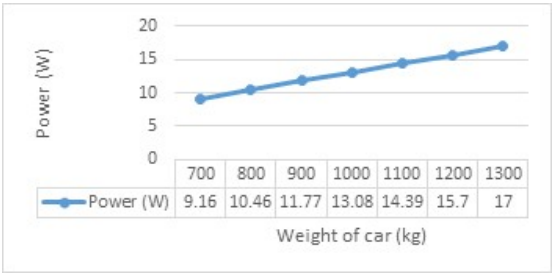

Figure 4 Vehicles weight vs power generated for 8 cm speed breaker height

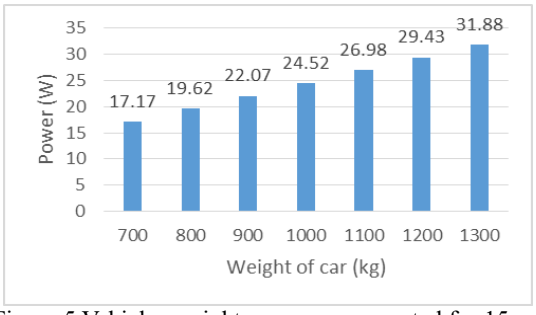

Figure 5 Vehicles weight vs power generated for 15 cm speed breaker height

Figure 4 and 5 shows the output power based in different height of speed breaker. The graph shows the power generated was increasingly steadily as the height of speed breaker are higher. The output power was calculated based on Equation (2) ~ (3). Figure 5 shows the power been generated up to 32W when the height of speed breaker was 15cm.

4. CONCLUSIONS

From the experiment, the result obtained due to the speed breaker height and different weight of vehicle been choose. The higher of speed breaker, we will get higher electricity power. The result shows for 15cm height of speed breaker, the power been generated was about 31.88W compare to 8cm height of speed breaker which only get about 17W. This system can contribute a lot of energy in electrical generation. The suitable length of rack gear and weight of vehicle might give more potential for generating the energy.

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