Faculty of Electrical and Electronic Engineering Technology

Development of Electrical Power Generation Using Speed Breaker

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Bachelor of Electrical Engineering Technology (Industrial Power) with Honours

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Development of Electrical Power Generation Using Speed Breaker

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A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electrical Engineering Technology (Industrial Power) with Honours

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

DECLARATION

I declare that this project report entitled “Project Title” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : Taufik

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Date : 9/1/2023

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours

Signature : 

Supervisor Name : MUSTAFA BIN MANAP

Date : 13/1/2023

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Universiti Teknikal Malaysia Melaka

Signature :

Co-Supervisor :

Name (if any)

Date :

DEDICATION

To my beloved mother, Yati Binti Dumun.
and father, Md Isa Bin Md Nor

To my adored family, brother and sister

To my team member, Muhammad Syukri Suliaman, Muhamad Faiz bin Ahmad Zohri,
Muhammad Haziq Kharil Azri, Muhammad Hariz bin Hasri,
Muhammed Adam Bari' bin Yuspaliza
and to all
fellow colleagues and classmates.

ABSTRACT

Power consumption has risen dramatically in recent years. Diverse setups for effective power generator have been created to meet the need for power by various units. In this project, electrical power is created in an non-conventional way by simply driving vehicle over a specifically engineered roller system. The prosess of generating electricity unrequire any electric input. This project makes use of a simple mechanical system by a roller mechanism, some electrically interfaced parts, and then a chain drive arrangement. The main idea is by using the vehicle weight and speed to transform mechanical energy into electricity from potential and kinetic energy. The process of creating electricity is described using the mechanism of an electrical power generator based on kinetic energy. The speed breaker generation system harnesses the acceleration of cars passing on a speed breaker area to generate electricity. The special design of roller mechanisme at speed breaker are major factor that generate electric energy. Once the vehicle pass over the rollers, mechanical energy is generated, and a generator capable of generating DC current is operated by a specifically built mechanism.

ABSTRAK

Penggunaan kuasa telah meningkat secara mendadak dalam beberapa tahun kebelakangan ini. Persediaan yang pelbagai untuk penjana kuasa yang berkesan telah dibuat untuk memenuhi keperluan kuasa oleh pelbagai unit. Dalam projek ini, kuasa elektrik dicipta dengan cara yang tidak konvensional dengan hanya memandu kenderaan ke atas sistem roller yang direkayasa khusus. Proses menjana elektrik tidak memerlukan sebarang input elektrik. Projek ini menggunakan sistem mekanikal mudah dengan mekanisme roller, beberapa bahagian antara muka elektrik, dan kemudian susunan pemacu rantai. Idea utama adalah dengan menggunakan berat dan kelajuan kenderaan untuk mengubah tenaga mekanikal menjadi elektrik dari tenaga yang berpotensi dan kinetik. Proses mencipta elektrik diterangkan menggunakan mekanisme penjana kuasa elektrik berdasarkan tenaga kinetik. Sistem penjanaan pemutus kelajuan memanfaatkan pecutan kereta yang melalui kawasan pemutus kelajuan untuk menjana elektrik. Reka bentuk khas mekanisme roller pada pemutus kelajuan adalah faktor utama yang menjana tenaga elektrik. Sebaik sahaja kenderaan melepasi penggelek, tenaga mekanikal dijana, dan penjana yang mampu menjana arus DC dikendalikan oleh mekanisme yang dibina khusus.

ACKNOWLEDGEMENTS

Alhamdulillah, First and foremost, be gratefull to Allah to his blessing by giving me the chance, strength and boldness to handle out and finish the entire final year project titled "Speed Breaker Power Generation".

I would like to thank my supervisor, Ts. Mustafa bin Manap, for their invaluable guidance, wise words, and patience throughout this project.

My highest appreciation goes to my parents, for their love and prayer during the period of my study. They were continuously encouraging us during the process when we felt discouraged or frustrated.

I am also grateful to Universiti Teknologi Malaysia Melaka (UTeM) for providing me with the opportunity and experience to complete the project. Neither to forgetting my colleague's willingness to share his ideas and perspectives about the project.

Finally, I'd like to thank everyone at the Faculty of Electrical and Electronic Engineering Technology (FTKEE), as well as my colleagues and classmates, Faculty members, others who aren't listed here, for their cooperation and assistance.

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LIST OF ABBREVIATIONS

V	-	Voltage
DC	-	Direct current
AC	-	Alternating current
W	-	Watt
LDR	-	Light dependent resistor
KM/H	-	Kilometer per hour
SBPG	-	Speed Breaker Power Generation
NiCad	-	nickel cadmium
NiMH	-	nickel metal hydride
Li-ion	-	lithium ion
MSB	-	Model Speed Breaker

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CHAPTER 1

INTRODUCTION

1.1 Background

Nowadays, electrical energy very important in human daily life. The amount of energy consume increasing on a daily basis. Higher electricity demand necessitates a reduction in conventional energy resources for generation, as well as an increase in pollutant emissions. However, we know that power generation resources are limited, which has resulted in the energy crisis. In order to minimize conventional energy resources, we have to find new energy that become environmentally friendly.

Otherwise, we can see that the road traffic is currently busy cause of increasing the number of vehicles. Accordingly, it makes the flow of traffic become rushed load and busier that become problem to another consumer of the road. Therefore, speed breaker is used to control the flow of traffic on some rode. Conventionally, that have a kinetic energy by the vehicle pass through the speed breaker. Electricity can be generated using the weight of vehicle in proportion to potential energy. By repurposing energy that would otherwise be wasted, this can save energy that could have been used to power up the load.

1.2 Problem Statement

The idea come when mostly equipment at road traffic like street lighting, traffic light, billboards, bus-stop and building near the road is supplied by TNB power. Besides that, the ratio of electricity demand is steadily increasing. However, we are aware that electricity producing resources are limited. As a result, we must

develop ways to increase the amount of electricity saved at road traffic. Thus, by diverting energy that would otherwise be wasted, this can save energy that could have been used to power up the load. By using potential energy on weight and kinetic energy that produced by vehicle pass through the speed breaker. This kinetic energy can be harvest and be convert to electrical energy.

1.3 Project Objective

The goals of this study are:

i. Convert the Potential and kinetic energy (dynamic of moving vehicle) for generating power.

ii. Design the generating system by pollution free energy that eco-friendly to environment.

iii. Analyze how the system work due to road way.

1.4 Scope of Project

The scope of this project are as follows:

i. Generated power for electrical component that present near the speed breaker.

ii. Generating electrical energy by using dynamic of vehicle with potential and kinetic energy bypass through the speed breaker.

iii. Battery storage module have been used to stored DC power because inability of continous source.

iv. The concept of harvest electricity for speed breaker generation by using only roller mechanism.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will talk about the theory that goes into this project. Besides that, the previous research that I gained has been understudy in order to gain valuable data for this project. It also helps me to finish this project.

2.2 System control

2.2.1 Speed breaker Power Generator

Speed-breakers are devices that impede movement and are widely employed to reduce speed-related accidents. [1] The Speed breakers are intended to be turned over at a specified agreeable pace, inflicting extreme inconvenience at greater rates. The drop in typical vehicular speed increases the security of persons in the surroundings greatly. The vast majority of these technologies may be found in underdeveloped nations. [2] As a result, several developing nations, such Ghana, India, the Egyptian Empire, Chile , and Pakistan, use speed breakers. [3]

Speed Breakers are being used to manage traffic flow on rushed loads. The annualized average of vehicle growth in Pakistan is rising by the day. Vehicle weight, in terms of the potential energy, can be used to create electricity. [4]

The research being created a way for generating power on the roads utilising speed bumps . To obtain maximum power, the movement of passing vehicles is critical. This mechanism employs a rack and pinion system. This system turns the

kinetic energy of moving automobiles into electric energy with the help of a speed breaker on the road.

This generates numerous kilowatts of power simply moving the rack lower and upward. Load causes downward motion, and restoring pressure through the use of energy stored in springs causes upward motion.

Designing a pollutant-free energy producing system is critical. The speed breaker generation system is the most contemporary approach for creating electrical energy with minimal input (SBPG). This report presents an experimental research that used SBPG to generate power. In this method, power is generated using a rack and pinion mechanism. When a vehicle passes through the speed breaker, the rack drops to generate linear to rotational motion via pinions. The rotating movement is transmitted to a direct current generator, which provides direct current power, which is stored in a battery similar the solar energy does.

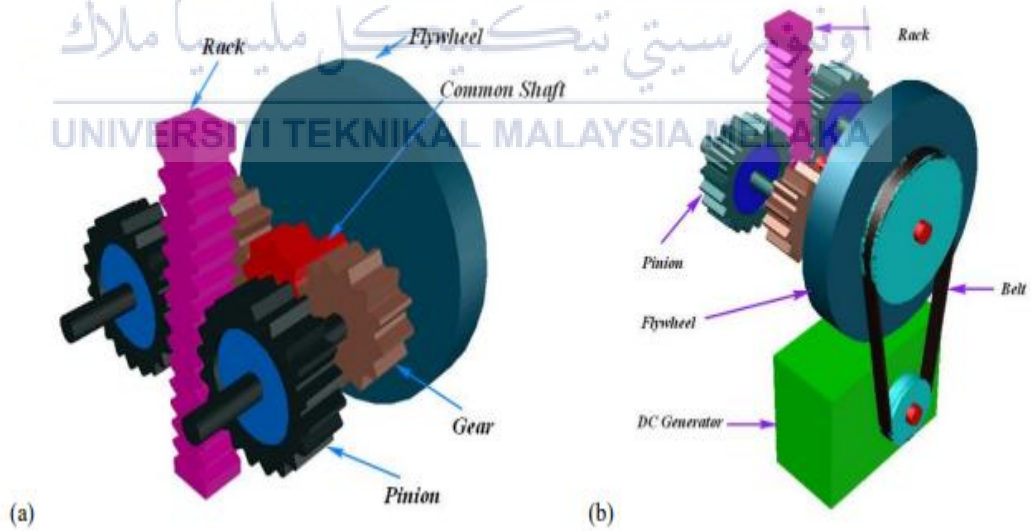


Figure 2.1Rack and pinion mechanism

2.2.2 Power Generation using Speed Breaker

Electricity is a topic that is on everyone's mind these days. It is now possible to do so while driving a car or riding a two-wheeler. When we drive or ride over a speed breaker, we can do this. You read that correctly: while riding or driving over a speed breaker.

Traditional speed breakers are only used to reduce the speed of a vehicle, which is entirely dependent on the material used to make the speed breakers.

These speed breakers are sometimes made of rubber, sometimes of concrete, and sometimes of a combination of concrete and pavements. This can be accomplished by incorporating some simple mechanisms under the speed breakers. A rack and pinion gear is one such simple mechanism, while a small generator with some wiring is another. Here is how we can implement the power generation programmed from the speed breakers with the help of these small mechanisms.

The mechanical energy is used to convert kinetic energy to electric energy in this power generation programmed. This is possible because kinetic energy is produced when the brakes are applied to the vehicle. The kinetic energy is then converted to mechanical energy using a rack and pinion gear, and the mechanical energy is converted to electrical energy by connecting the pinion gear to a generator shaft.[6]

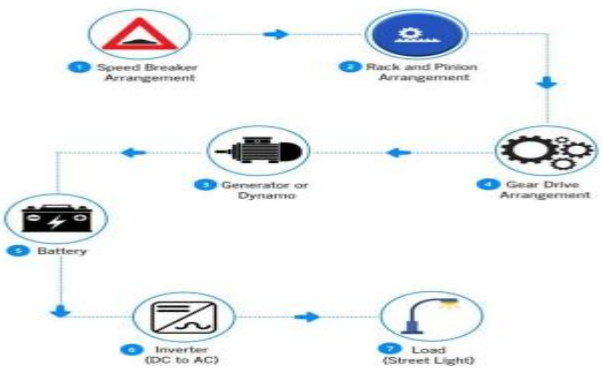


Figure 2.2 Block diagram rack and pinion mechanism

2.3 Mechanism used

2.3.1 Design of Power Generation Unit Using Roller Mechanism

A road track can be used to generate power by passing vehicles over a rollers mechanism put up. Renewable energies are recognised as an effective alternative energy for lowering carbon dioxide emissions. [7] Unlike typical speed breaker, the roller mechanism configuration will not cause vehicle damage or fuel waste while travelling over the rollers. The biggest benefit is that they produce energy for free. The Electro-Kinetic generation system can generate up to 10kW of power, which could then be utilised to power signage, street lights or stored in a battery for later use. The track is composed of steel rollers that rotate in response to those forces exerted by passing cars.

The action of the rollers powers a newly created design, which drives a generator, which generates electricity. The rollers' repeated rotations, which are further coupled with another free wheel, enabling it to rotate freely in between while vehicles travel over the track. There is limited research on kinetic energy extraction from vehicle flow on roadways. As a result, an appropriate and effective topology for the construction of a power generation system for the harvesting of kinetic energy by transportation is required.

A roller is positioned among two speed breakers in this Mechanism, and a grip is supplied speed breaker when a vehicle crosses over it, it turns the roller. This roller action is utilised to rotate the shaft of the alternating current generators via the chain drive, which enables varied speed ratios. As the shaft of a dc power generator

rotates, electricity is created. This energy is saved in a battery. The battery's energy is then utilized to illuminate the roadside street lamps. .[8]

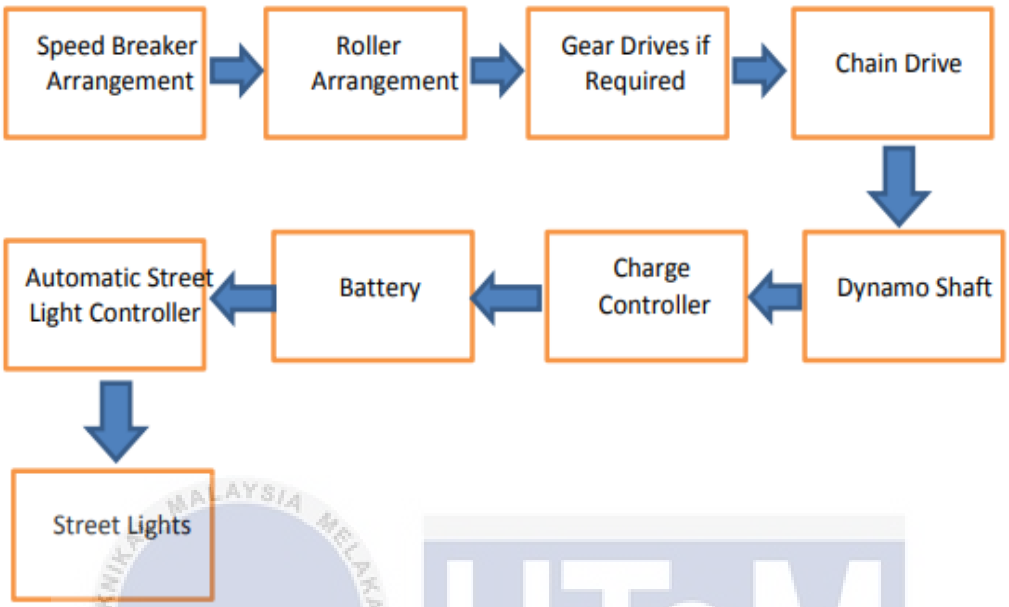


Figure 2.3 Block diagram for roller mechanism.

2.3.2 Design of a double

2.3.3 actuated mechanical speed breaker electricity generator.

The speed breaker is a sturdy frame structure made up of numerous components such as rack and pinion gears, flywheels, chains, and sprockets that are appropriately placed on shafts, as well as journal bearings, helical springs, and a dome-shaped hump.

When a moving vehicle drives up the speed breaker, the springs compress and the dome depresses. Some of the vehicle's energy is converted into rotary motion and sent to the shaft by the rack and pinion system, while the rest is stored in the springs.

Before being transmitted to the alternator, this rotating motion is doubled in the chain drive and spur gears. The springs begin to recover to their former shape when the vehicles pass through the speed breaker, releasing the energy stored to the rack and pinion gears of shafts 2 for conversion to rotary motion. The speed breaker is a sturdy frame structure made up of multiple parts such as rack and pinion gears, flywheels, chains, and sprockets that are appropriately placed on shafts, as well as journals bearings, helical springs, and a dome-shaped hump. [9]

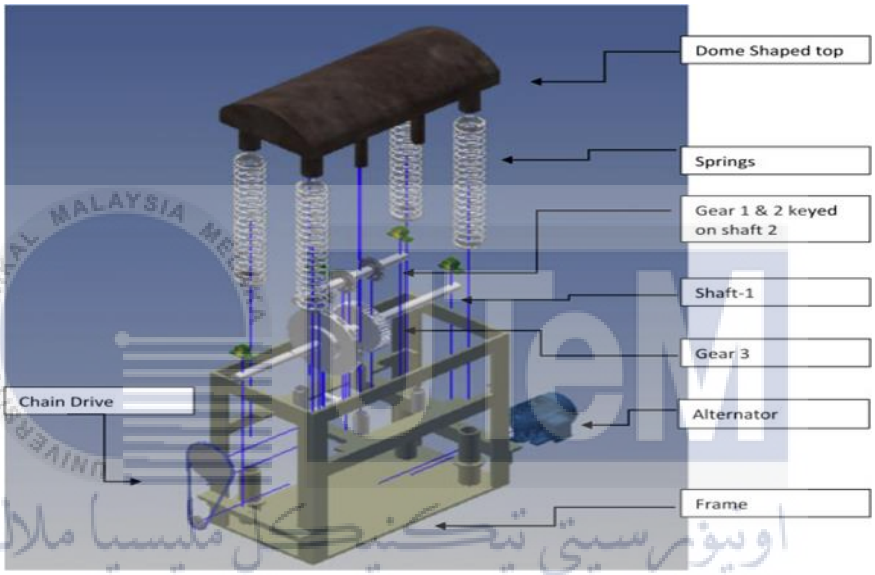


Figure 2.4 Double actuated mechanical mechanism.

2.4 Fabrication of the system

2.4.1 Design and fabrication of Speed Bump for Energy Generation

"Power Bump" is the result of three fourth-year engineering students' creativity and academic abilities. A machine created with the purpose and intent of supporting the human species in its own special manner, by converting input from vehicles which are almost untouched by its presence into power. However, considering that we live in the 20th century, continuing to analyse this invention without providing an answer to three crucial questions is pointless. To design the

energy recovery systems with the goal of producing a clean environment in mind.

A rack in constant mesh with a pinion is located beneath the upper half of the speed breaker. The pinion's revolution triggers the movement of a geartrain, which boosts the rpm by about 16 times. A dc motor is the last stop for the absorbed power before this becomes direct current; consequently, when a vehicle drives over a bump, the motor will rotate and generating direct current.

When a vehicle passes over the bump, a great deal of force is applied. This can be tapped with a suitable setup that efficiently converts some mechanical energy into electrical energy.

This component generates power by taking weight vehicle movement as an input. A firmly fixed racking is in permanent contact with such a pinion beneath the bump. The pinion is attached on a shaft between another spur gear with a variable gear tooth to enhance the rpm. [10]

2.5 Storage system

2.5.1 Storage system charging circuit

A battery is charged by the charging circuit. The inverter circuit converts the DC voltage to AC voltage, which is then stepped up by a step-up transformer. A dark sensor circuit detects the presence of darkness and turns on the street light.

The generator is an electronic device that converts mechanical energy into electrical energy. An alternating current generator (AC generator) is a device that produces alternating current by combining stationary (stator) and moving elements (rotor). The gear is attached to the rotor. The rotor of the generator is rotated by the torque created by the gear. The rotor creates a rotating magnetic field around the

stator, which induces a voltage differential between the stator's windings and produces the generator's alternating current (AC) output.[11]

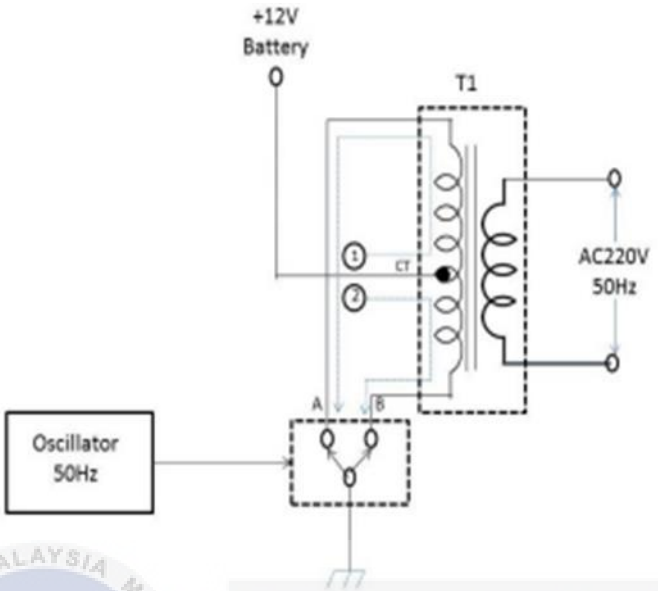


Figure 2.5 Charging circuit is used to charge the battery

A transformer that steps up the AC voltage is known as a transformer. The inverter circuit in this system transforms 12V DC to 15V AC. Step up From 15 V AC, a transformer raises the voltage to 250 V AC.[12]

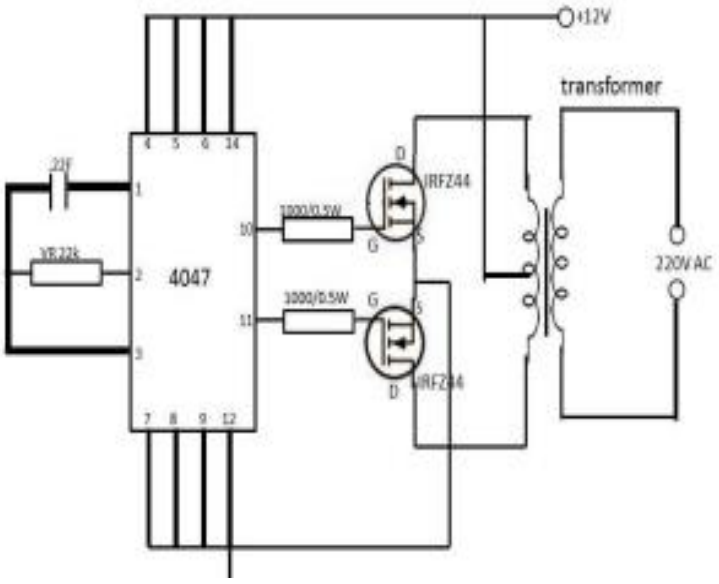


Figure 2.6 Inverters step up and convert DC electricity to AC voltage.

2.5.2 Project electrical circuit

Switches that can be rotated to various locations in order to connect with the contacts in that position. A form of electrical battery is a rechargeable battery, often known as a storage battery or an accumulator. It is a form of energy accumulator that consists of one or more electrochemical cells. Because its electrochemical reactions are electrically reversible, it is referred to as a secondary cell. From button cells to megawatt systems connected to stabilise an electrical distribution network, rechargeable batteries exist in a variety of shapes and sizes.

Lead—acid, nickel cadmium (NiCad), nickel metal hydride (NiMH), lithium ion (Li-ion), and lithium ion polymer are some of the most prevalent chemical combinations (Li-ion polymer). When a DC generator generates power, current goes via a rectifier, and a rechargeable battery is charged. Whenever electricity is required throughout the night, the selection switch is activated, and a rechargeable battery is used to provide the necessary power.[13]

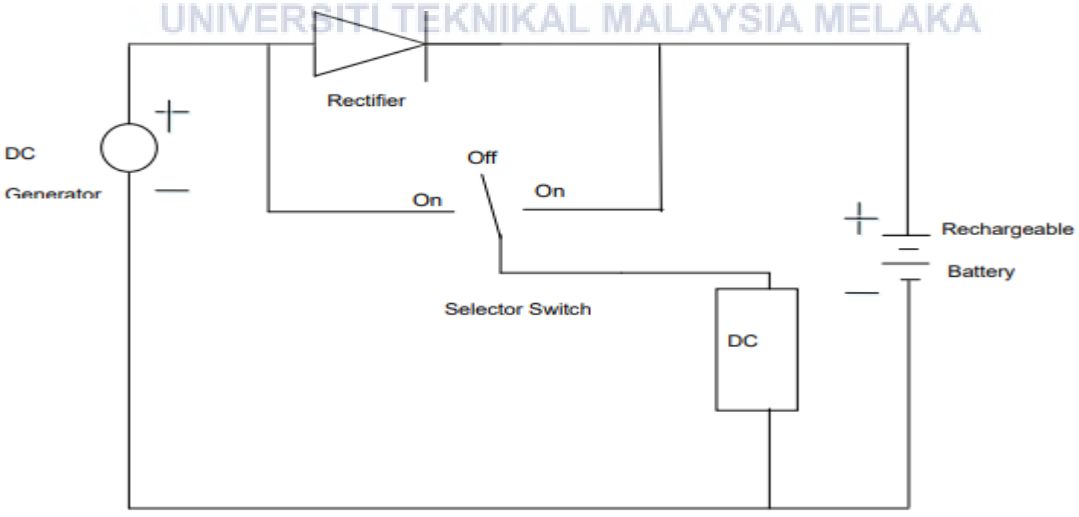


Figure 2.7 Electrical circuit digram

2.6 Vehicle weight

The system is intended for vehicles with a gross vehicle rating of up to 294 kN, the maximum allowed on our highways (National Road Traffic Regulation, 2012). Two similar MSB, however, would be placed in sequence at a specific area, and their entire length would equal a vehicle's average width. As a result, only one wheel is running on each MSB at any given moment, delivering only one of the vehicle's weight. [14]

Table 2.1 Gross Vehicle Weight Rating (GVWR)

Vehicle Categgories	Gross Vehicle Weight Rating (kN)	Weight on a Tyre
Taxi cab	18.85	4.714
Passenger car	27.65	6.909
Saloon car	14.31	3.577
Sport utility vehicle	20.7	5.174
Sienna	17.66	4.42
Station wagon	16.42	4.106
Passenger van	21.52	5.38
Cargo van	18.72	4.684
Pick up	27.78	6.948
18 seater	35.48	8.87
Coaster bus	23.85	5.968
luxury bus	75.46	9.437
Police Interceptor utility	21.26	5.312
Light armored vehicle	44.1	1.103
Medium Truck 2-Axles(single tyred)	74.48	1.862
Medium Truck 2-Axles(twin tyred)	80.36	2.009
Heavy Truck 3-Axles	137.2	2.286
Heavy Truck 4-Axles	176.4	2.205
Heavy Truck 5-Axles	235.2	2.352
Heavy Truck 5-Axles	294	2.45

2.7 Harvested energy formulas

Mechanical Energy:

The pinion gear's rotational and translational motions drive the rotational movement of a generators, which provides electricity to the system..[15]

The power input is given by :

Pin = τ dω where Pin= power input (W),

Electrical Energy:

The voltage and current of the generator are proportional to its rotational torque and speed, respectively.

V = Kvω where Kv = Generator voltage constant (Vs/rad),

V= Voltage (V) [15]

t d k I τ where I = Current (A), Kt = Generator torque constant (Nm/A)

The power output of the generator is given by Pout = IV where Pout = power output (W

2.8 Summary

The facts and data gathered from the article review are from the previous project, and the article can be used as a reference in the project. Generally, review articles feature a collection of specific concepts from several perspectives. Some of article review can provide idea and knowledge for the project that can become first step to generate main idea. From the article review that have research make some concept and process easier to understand. Article review also makes several processes easier to apply in the project.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter will go through how the process and method were implemented in this project. The method of speed breaker generator that used based on only one mechanism with is roller mechanism and rack and pinion. The project is observed by compare this mechanism for the output of electricy between this mechanism. The technique provides as a foundation for carrying out the project. Based on this chapter, it will demonstrate the project procedure from start to completion. For a better understanding, this chapter will go through each procedural step in depth. The technique should be properly followed to ensure that the project is finished correctly. This chapter would also outline the project's timetable and routine. The tasks that must be accomplished concurrently will be detailed in the planning process and routine.

3.2 Flow Chart

3.2.1 Flow chart of the roller mechanism

The process of the flow chart starts with vehicle dynamic that include potential energy and kinetic energy by pass through speed breaker modules. When an automobile vehicle is running on the Speed Breaker roller mechanism it will rotates the roller. This movement of roller is used to rotate the shaft of D.C. generator by the help of gear which is to provide different speed ratios. As a result, causing the DC generator to produce electricity. This electricity can be stored in a rechargeable battery by charging it. The generated or stored electricity is utilized to power a roadside lighting bulb at night.

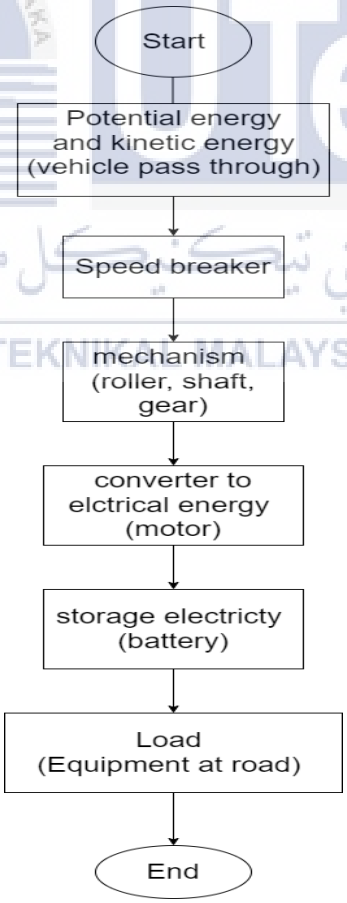


Figure 3.1Flowchart of project

3.3 Block Digrams

The concept development process is depicted in Figure 3.2 as a block diagram. The prototype is divided into five modules: vehicle cross, speed breaker, energy harvesting, energy storage, and electricity. The electric generated speed breaker is made up of both the speed breaker modules and the mechanism that generate electricity. The breaker and energy harvesting mechanism are designed to harvest energy, then store it in energy storage that will produce electricity to supply the load. The vehicle dynamics by crossing the speed breaker is kept as a variable.

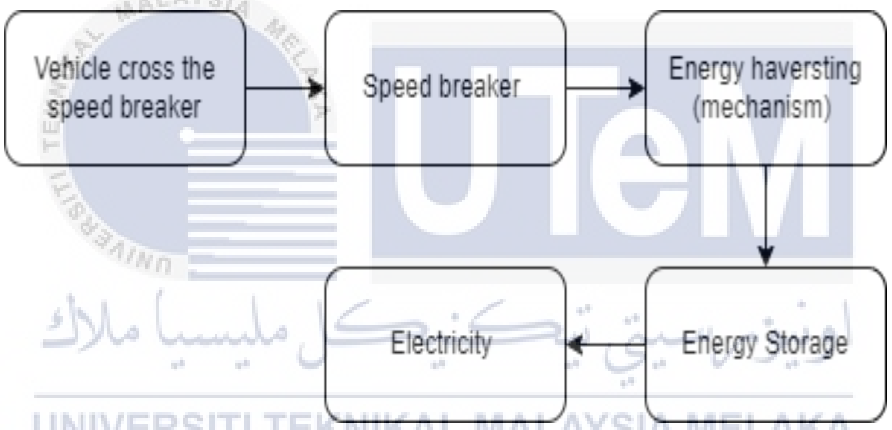


Figure 3.2 Block Diagram

3.4 Experimental setup

3.4.1 Hardware development

3.4.1.1 Dc generator or dynamo

For this project we use DC generator or Dynamo to produce electricity that convert from mechanical energy to electricity.

Dynamo - A device that generates direct current electricity by utilising electromagnetic energy. It is also referred to as a generator, but frequently called as "alternator" that generates alternating current power.

Generator - Typically, this phrase refers to an alternator that uses electromagnetism to generate alternating current (AC) . [16]

Figure 3.3 12V 30W Permenant Magnet Electric DC Motor

3.4.1.2 Battery storage

In this project we used Lead acid batteries to stored energy The most common type of battery is the lead acid battery. When compared to other battery types, lead acid batteries have a long lifespan and low maintenance requirements due to their lower energy density and low efficiency. Lead acid batteries have the particular benefit of being the most extensively used form of rechargeable battery for the majority of rechargeable applications (for example, starting car engines) .[17]

Figure 3.4 Battery stored box

3.4.1.3 Shaft and Gear

The gear shaft is a critical component of the transmission that experiences shearing stress and torsion. The transmissions, often called as the gearbox, is a system that controls the application of energy by decreasing or increasing speed, increasing torque, reversing rotation, or changing direction of the driveshaft. Every gearbox has two sides: output and input.

The output shaft takes energy from the drive shaft and operates at different speeds according on both gears and gear ratio. The motor's speed is controlled by the input shaft, which is connected directly to it. It incorporates the controller within the gearbox network and is capable of withstanding the torque produced by engaged

gears. As intersecting shaft gears, a gear shaft with gearing curves at each section is presented. Spiral Bevel gears are prominent examples of gear profiles utilised on these precision-machined shafts.

In their most typical form, gears are teeth, circular devices that translate engine speed into torque. Gears are either attached to or a part of a gear shaft. Many common gears feature a hole in the middle, called as a bore, from which the gear shafts is attached. As the gears shaft is rotated, the gear moves. [18]

Figure 3.5 Shaft chain drive

Figure 3.6 Chain and Gear Mechanism

3.4.1.4 Pillow Bearing

The project makes use of a Plummer block that is fixed to a base and into which a shaft is put to allow the inner component to rotate. Plummer block bearings, also called pillow bearing, were platform mounting bearing housings with a mounting block that contains a bearings. To achieve a tight fit, the bearing usually a little larger than the shaft, and set bolts or locking clamps can be used to guarded the shaft. The designs of plummer block and pillow block are similar, but their

applications are different. Pillow blocks are designed for light-weight applications,whereas plummer blocks were being used to transfer high power and support large industrial weights. [19]

Figure 3.7 Pillow Block Bearing

3.4.1.5 Roller

The roller is the important instrucment in speed breaker generation by using roller mechanicm. When a vehicle crosses over a speed breaker, a roller is fitted between the speed breaker and the mounted at base of speed breaker, causing the roller to turn.

Figure 3.8 Roller mechanism

3.4.1.6 Inverter

For this project, we have use the dc generator that rechargeble to battery that produce DC power. Most of the application and equipment at the road site remain used ac supply. As a result, an inverter is required to convert DC to AC power.

In regions where mains electricity is unavailable, inverters are frequently necessary. An inverters circuit is used to transform DC to AC power. Inverter circuits are excellent for generating higher voltage from a lower voltage supply or battery. [20]

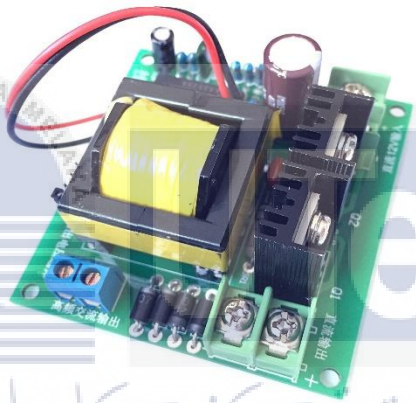


Figure 3.9 DC to AC converter 12V to 220 V

3.4.2 Software development

3.4.2.1 Sketch up

SketchUp Pro Desktop is a 3D design computer tool used in architectural, interior design, manufacturing and represent tasks, architectural features, engineering services, arts, film, and video game creation.

Tinkercad uses a simplified constructive solid geometrical method to create models. This foundation of a design is made up of foundational shapes which are "solid" or "hole." New shapes can be created by mixing solids and holes, and then assigning the solid or hole feature. In addition to the standard primitive form library, the developed JavaScript editor allows users to create custom shape generators.

3.5 Project Design

3.5.1.1 Front view

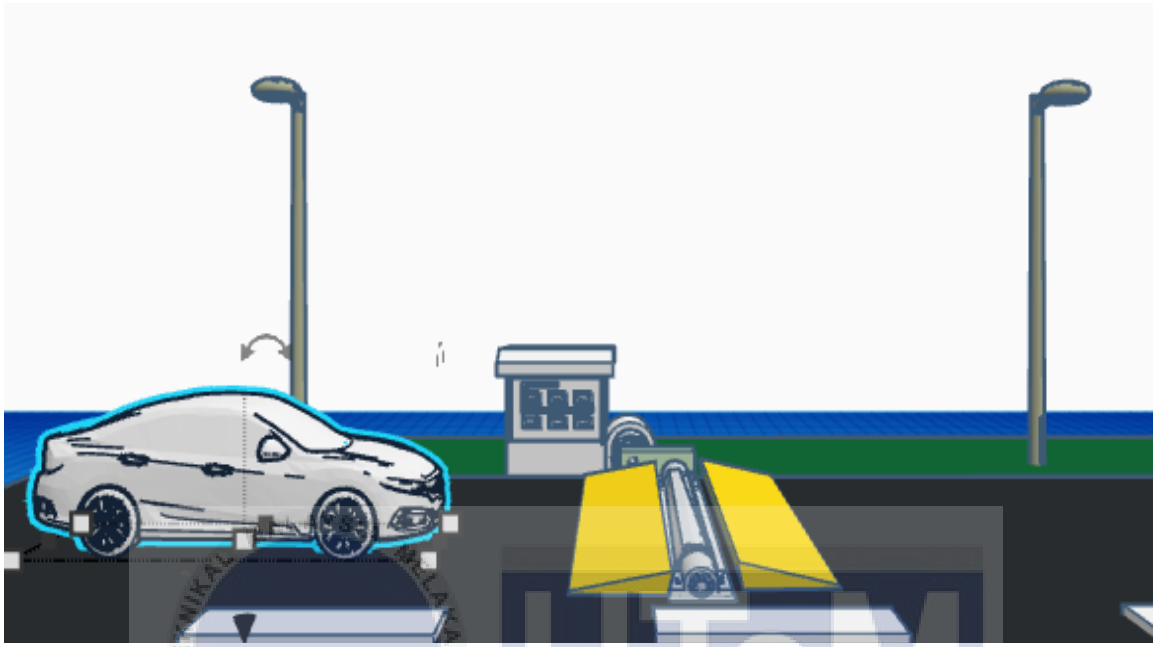


Figure 3.10 front view

3.5.1.2 Top view

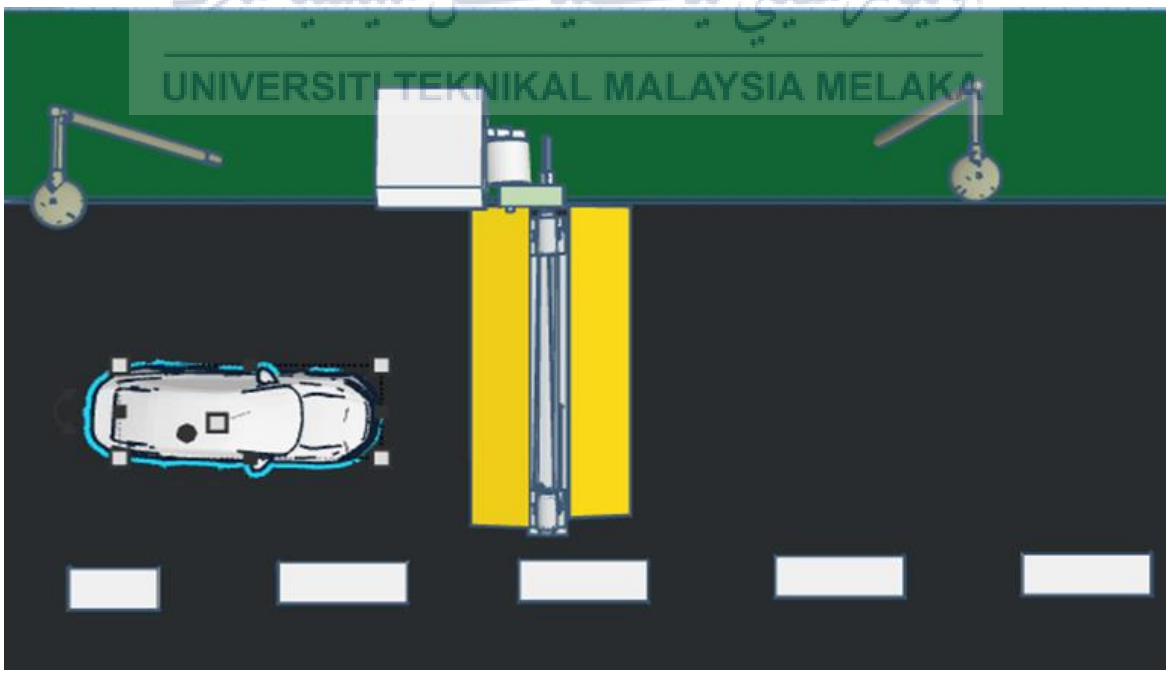


Figure 3.11 Top View

3.5.1.3 Right view

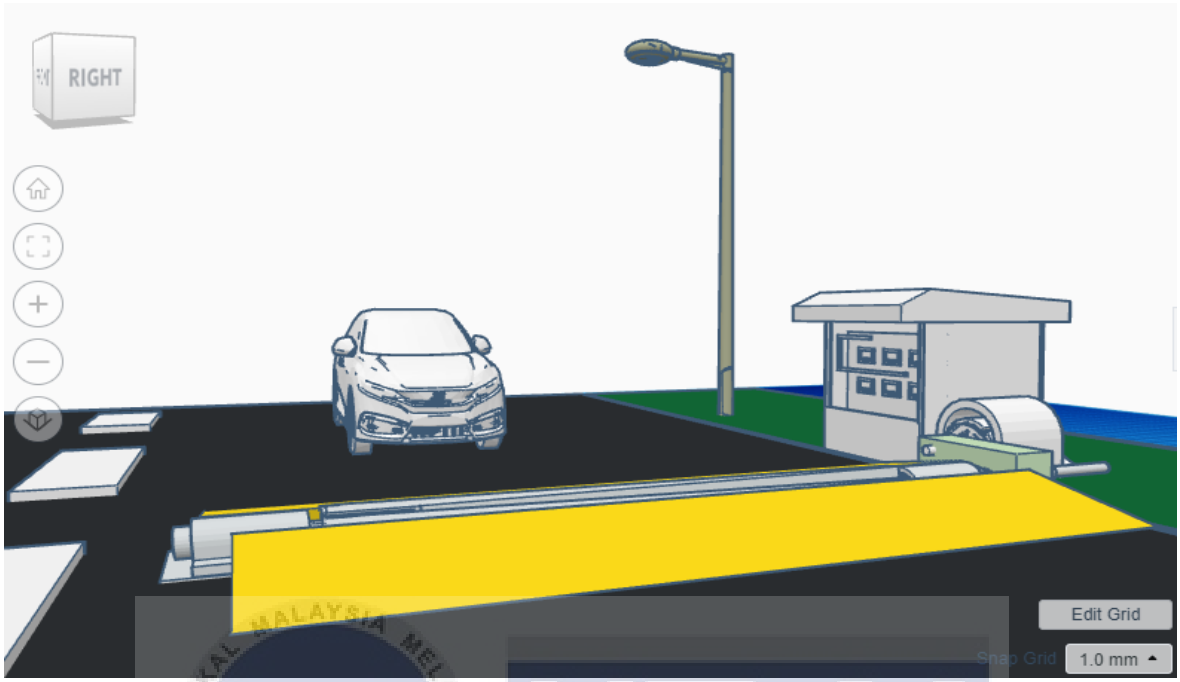


Figure 3.12 Right view

3.5.1.4 Back view

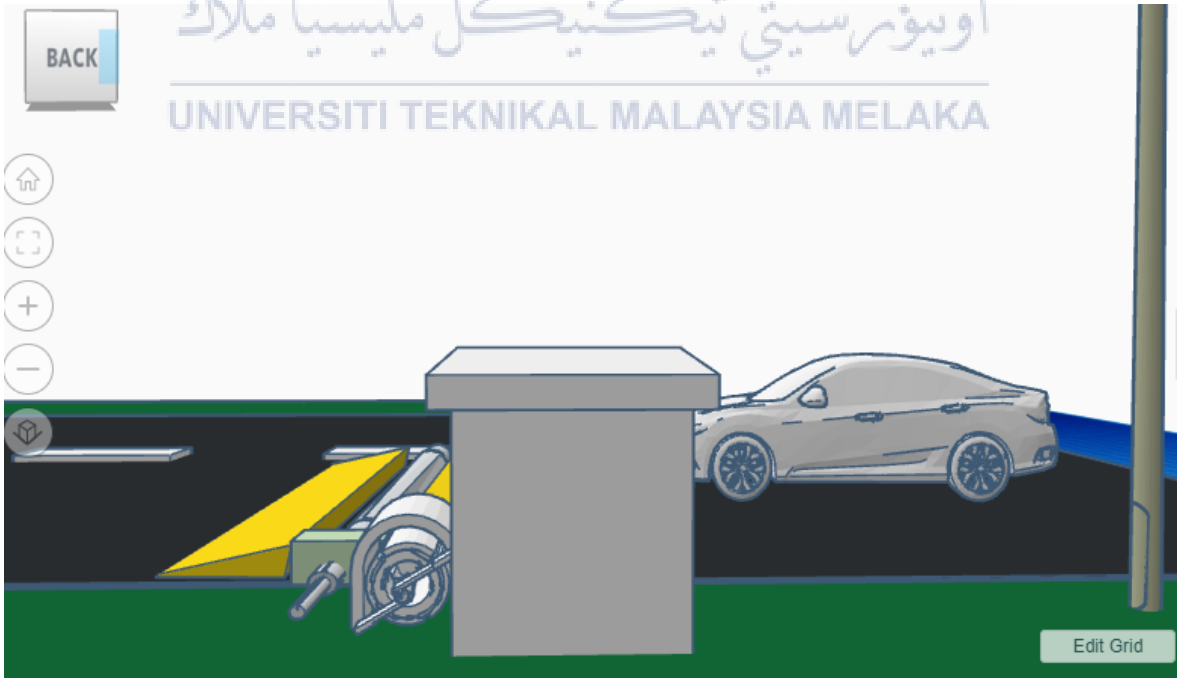


Figure 3.13 Back view

3.5.1.5 Breaker and roller design

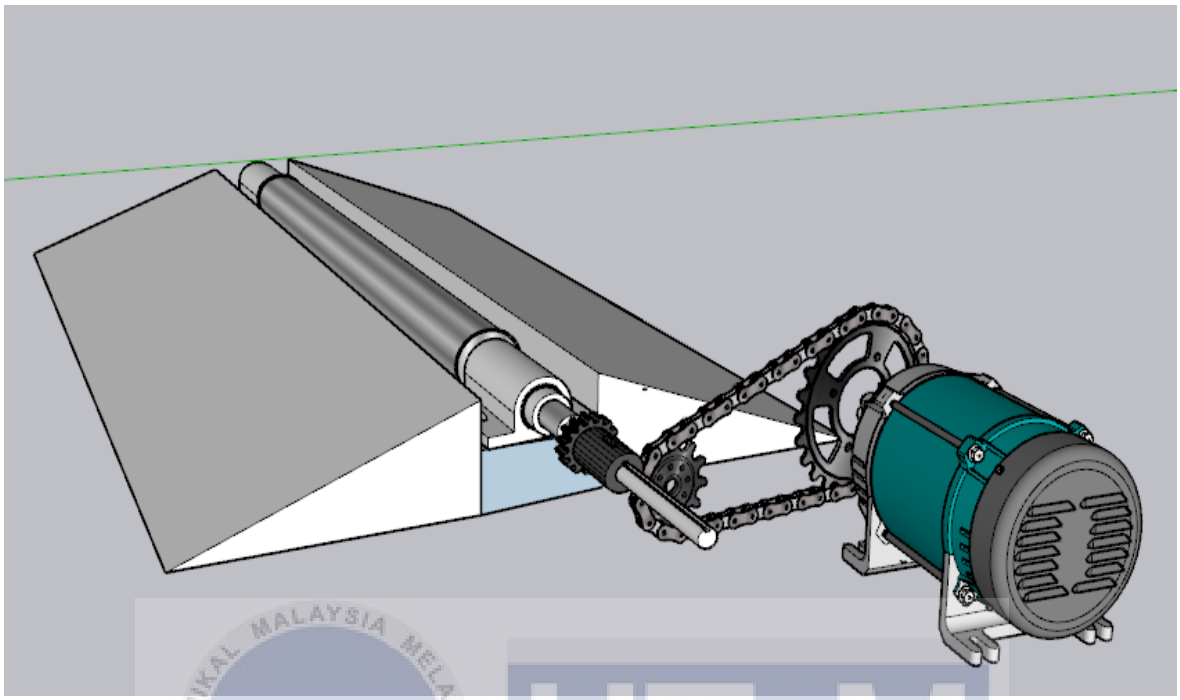


Figure 3.14 Roller Mechanism

3.5.2 Summary

As a summary of Chapter 3 (methadology), the method of developing this project, and the materials utilised, followed by an initial sketch of the project. Based on it, the project will be built and planned properly. The method and component that offered laterally of the project's design. The values of various components may fluctuate according to the suitability of the circuits. Changes will be done in the future or throughout the project's development to improve its performance.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

In the this chapter, the development of a speed breaker power generation was demonstrated and further explained. This chapter describes the operation of each component used as well as how they were implemented in the project. The hardware and software that were used in this project are summarised at the end of this chapter. All test findings, experimenting, analysis of data, and the project's functionality will be completely defined on this chapter.

This chapter presents the results and analysis on the development of electrical generation using speed breaker. The result based on the power generated by speed breaker generator using roller mechanism. The analysis is observed from the data that have collected by havesting the dynamic movement of vehicle pass through the speed breaker generator.

4.2 Results and Analysis

4.2.1 Hardware setup

The full hardware setup that combine with roller mechanism (mechanical energy part), pulley and timing belt (energy transfer part), permenant motor (converter energy part), battery (storage part) and load with circuit.

4.2.2 Full project hardware setup

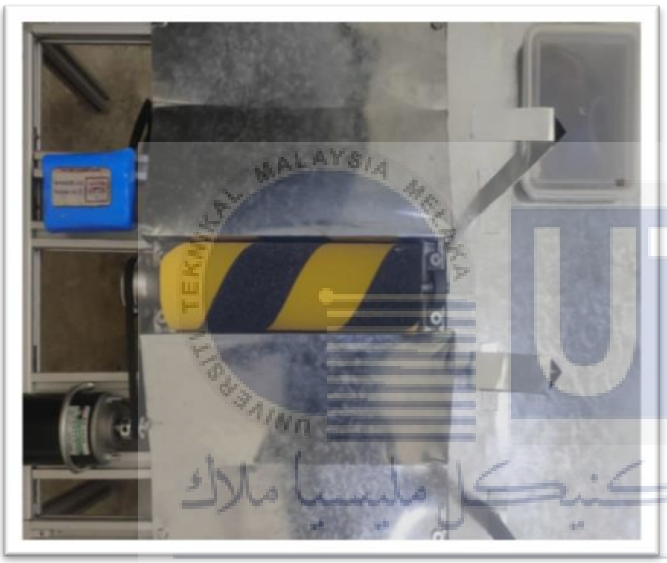


Figure 4.1 Top view

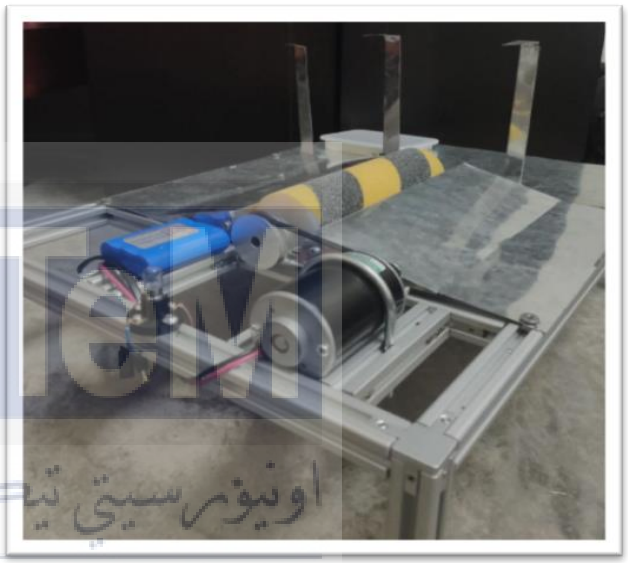


Figure 4.3 Perspective

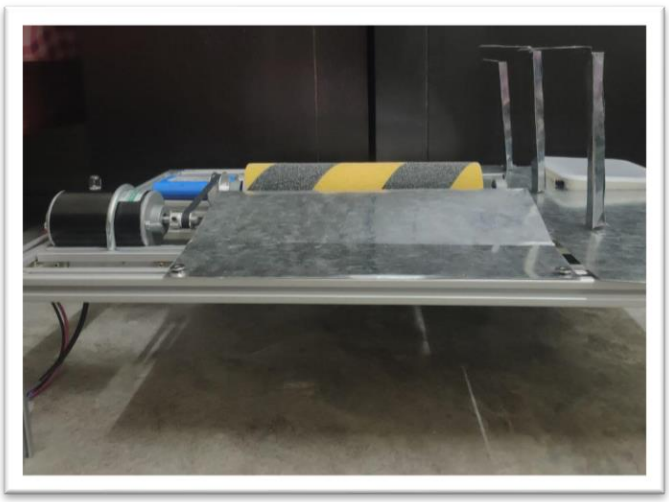


Figure 4.4 Front view

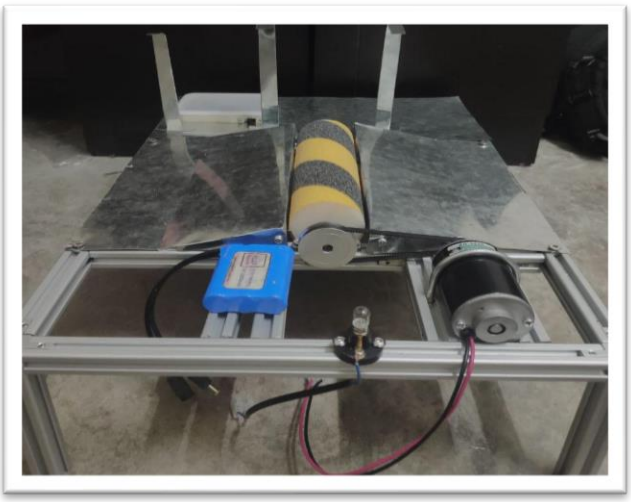


Figure 4.2 Side view

4.2.3 Energy Transfer Mechanism Part

Energy transfer mechanism part consist pulley and timing belt to transfer the mechanical energy to the electrical energy. The pulley mechanism use of ratio 3:1 to distribute the energy from the roller to the motor

Figure 4.5 Pulley and timing belt transfer mechanism

4.2.4 Converter energy mechanism part

The motor that change to generator that become a converter from mechanical energy to electrical energy . The roller mechanism as a primover for move the motor that produce electrical energy

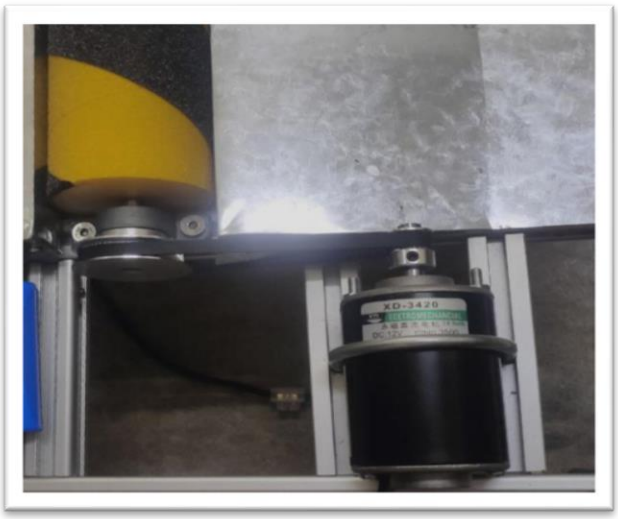


Figure 4.6 DC motor setup with roller mechanism

4.2.5 Load and electrical circuit .

For the circuit we use a arduino for the microcontroll. The ldr sensor is use for photo sensor to indicate sense of light at the night time. Then, the relay for switching method in the circuit.

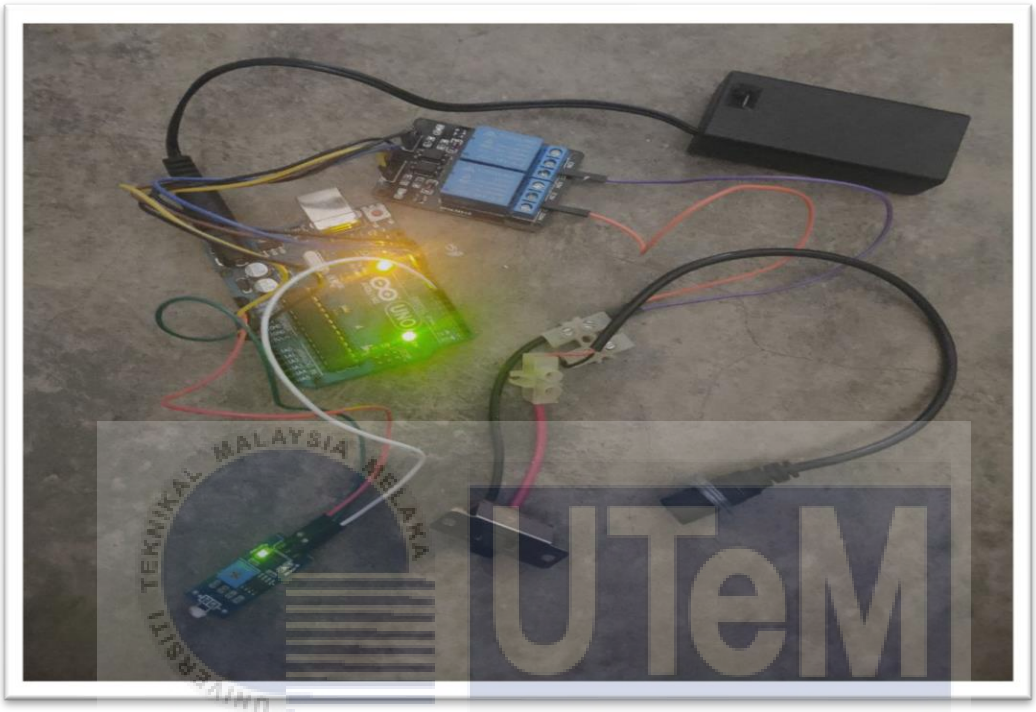


Figure 4.7 LDR System Setup For Lamp

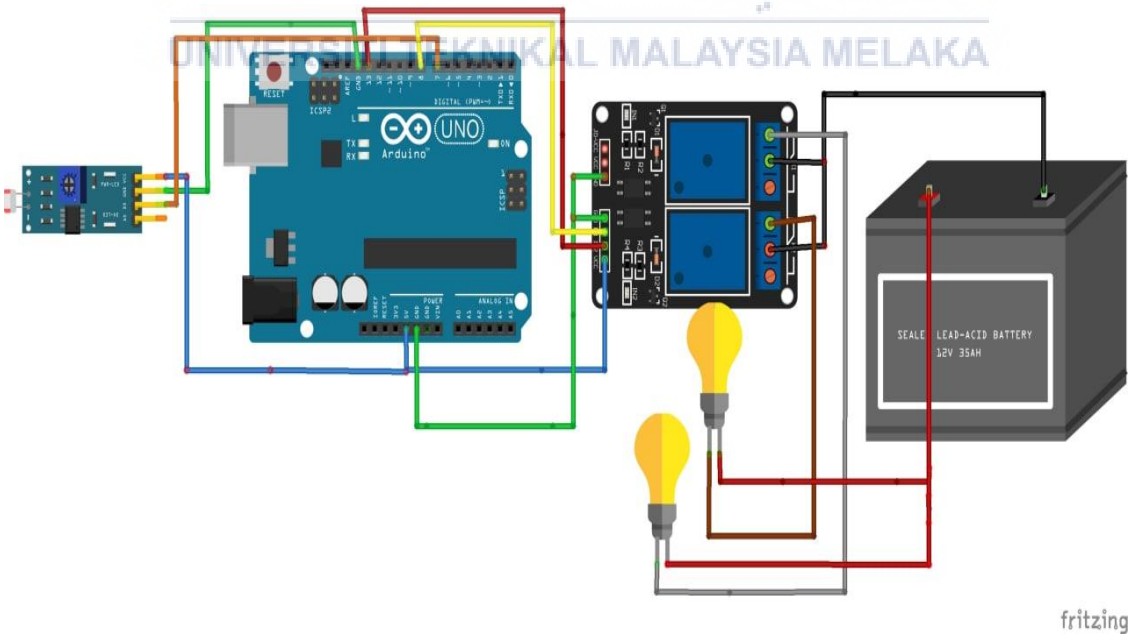


Figure 4.8 Circuit Diagram of Microcontroller

4.3 Analysis data

4.3.1 Analysis Speed (km/h) vs Power (watt)

The analysis is performed to investigate the speed againts the output of the speed breaker power generation. The analysis is carried out by rolling the roller by using a speed from the motorcycle. The experiment running by using constant speed of the motorcycle in stages to measured the output of speed breaker power generation. The digital multimer is used as a measuring tool for collected the data.

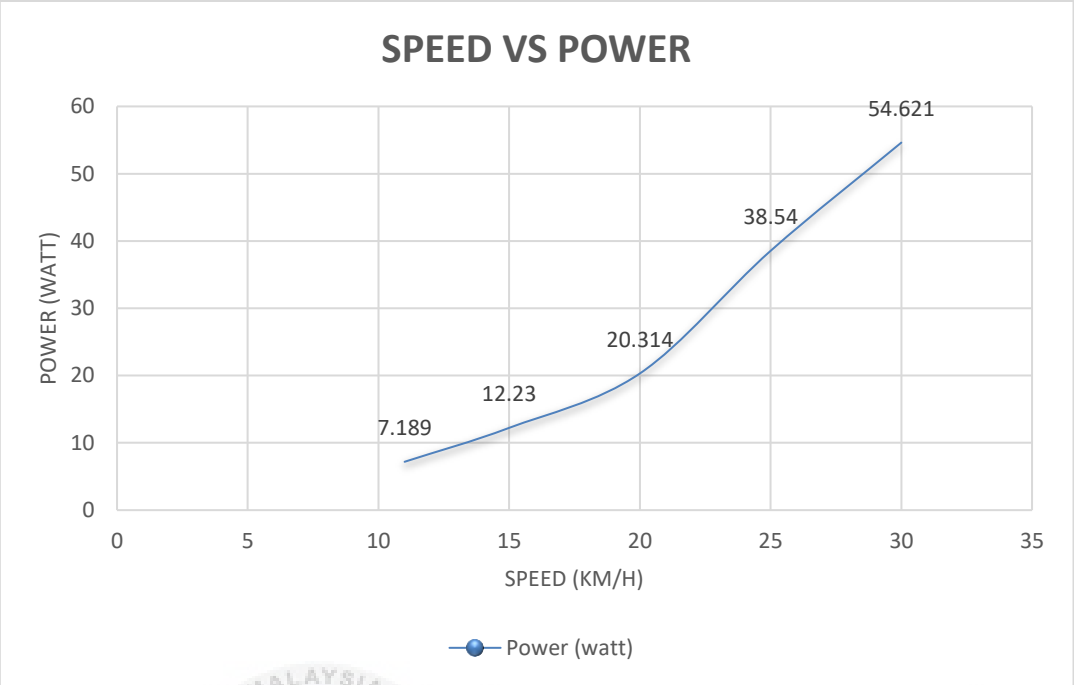
CHARACTERIS OF THE MOTOR

PM dc motor
Dc = 12 v – 20 v
Max current = 2 - 3.7A
Max load power = 30w
Rated speed = 3500rpm

Mechanism = pulley and timing belt

Table 4.1 Analysis result Speed (km/h) vs power (watt)

Speed (km/h)	Current, I	Voltage, V	Power (watt)
11	0.79	9.1	7.189
15	0.91	13.44	12.23
20	1.4	14.51	20.314
25	2.25	17.13	38.54
30	2.7	20.23	54.621



Graph 4.1 Speed (km/h) vs Power (watt)

From the graph 4.1, we observed that the graph is linear graph trend. The power generated is directional proportional with the speed (km/h) . The value of the data that have measured is ascending order based on the increasing of the speed (km/h). We can see that when the speed increase, the power generated by the speed breaker will increase. Thus ,we can determined that, the power that have is directly proportional with the speed of the vehicle pass through the speed breaker power generation.

From the data table 4.1, we can see that for speed 11 km / h stages, its produce 7.189 watt, and fastest speed can be measured is 30 km / h with 54.621 watt. This shown that, the limit of the power generation for the motor is 25 km / h is sufficent in produce power generation in continous speed km/h generation but in real situation the car slow down on the speed breaker are enable to use full speed for the generation. This leads to decreasing of the power that can be generated.

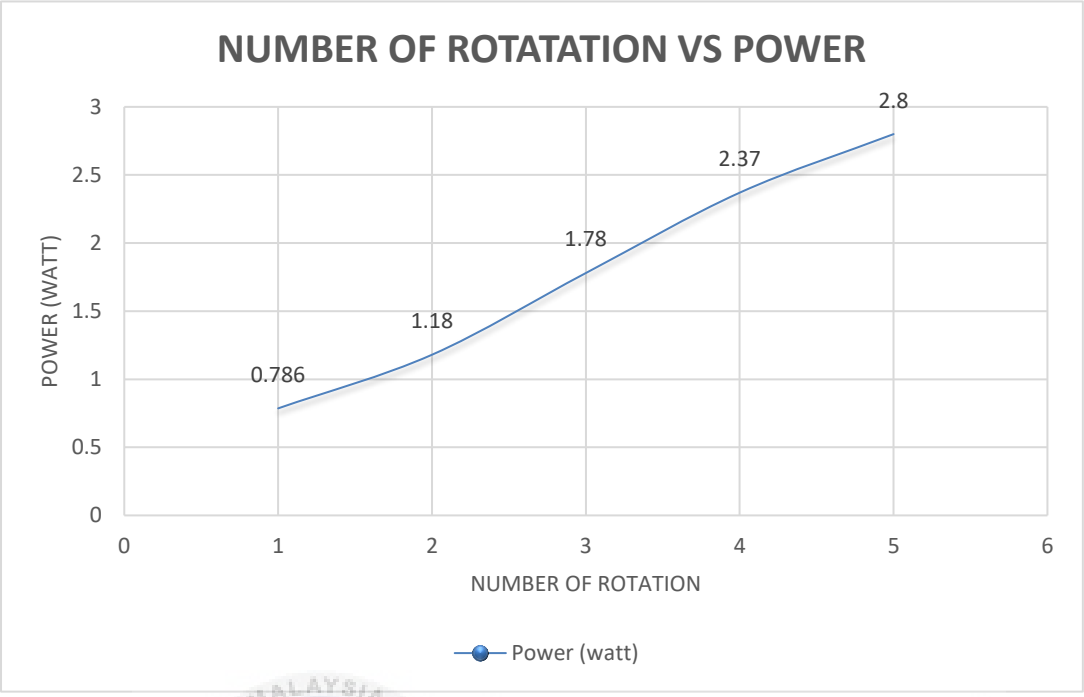
4.3.2 Analysis number rotation vs power generation.

The next analysis is runned to investigate the number rotation of the roller againts the output of the speed breaker power generation. The analysis is carried out by using the number rotational of roller in the stages. The experiment is use weight of 400g that have been set for constant weight along the experiment running as a force for rolling the roller. The rotation of roller measured using a rope that have been tied to one point that been set by wrapping the entire diameter of the roller. The rope released on tied to the weight at the other end and the output power generated by the motor will be measured. The digital multimer is used as a measuring tool for collected the data.

Table 4.2 Analysis result number of rotation vs power generation

Number rotaton	Current, I	Voltage, V	Power (watt)
1	0.43	1.82	0.786
2	0.46	2.57	1.18
3	0.52	3.43	1.78
4	0.54	4.38	2.37
5	0.56	4.98	2.8

From the data we obtain on the table 4.2, we observe that the current that produce by rotational increased slightly. The current does not increased much for each rotation number. By the way, the output voltage and current is directional proportional to the number of rotation. Thus the power increase proportional folowed by the number of rotation in the data based on formula P=VI.



Graph 4.2 Number of Rotation Vs Power

Based on the graph 4.2, the trend that shown on the graph is linear graph. From the graph we can observe that the power generated is directional proportional with the number of rotation on the roller. The increasing the number of rotation may increase the power generated. The number of rotation affecting the power generated by the speed breaker. Thus we can determined that, the number of rotation pass through the speed breaker power generation directly proportional with the power generated. We can summarize that the more the number pass throught the speed breaker, the higher power can generate by speed breaker power generation.

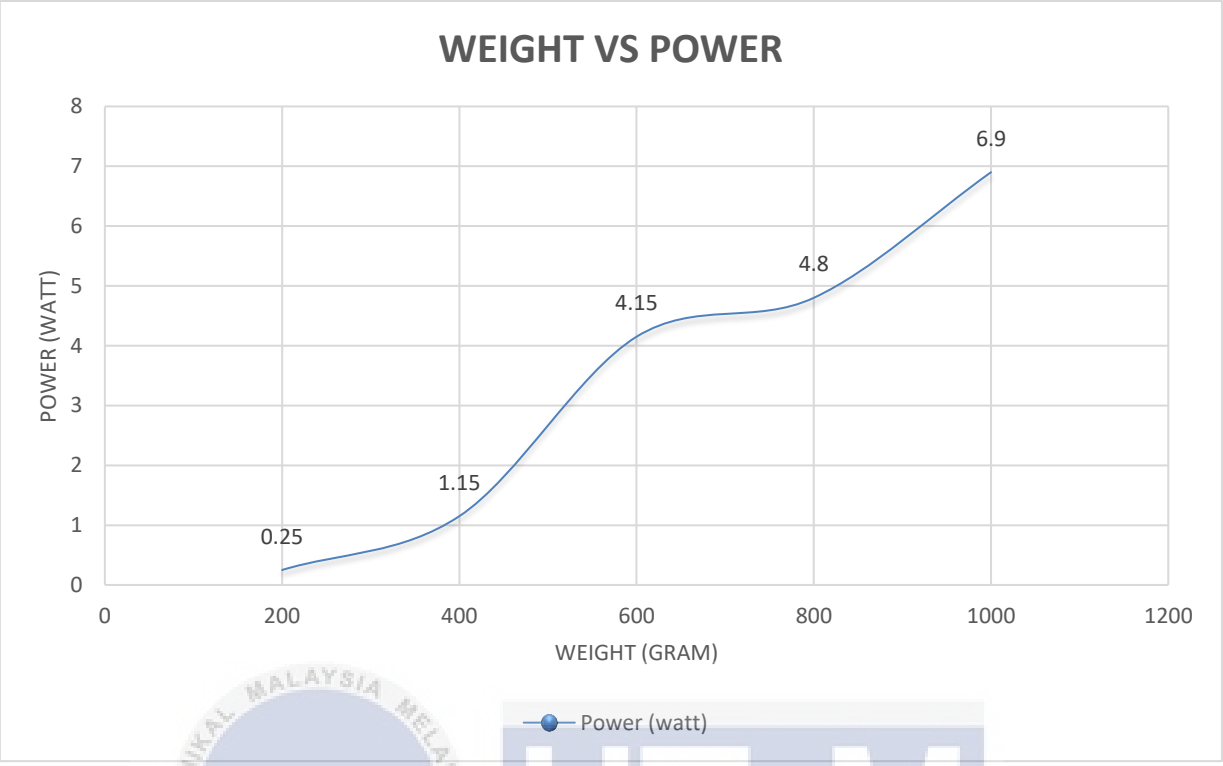
4.3.3 Analysis weight vs power generation.

The analysis carried out to investigate the weight of mass againts the output of the speed breaker power generation. The analysis is perform by using weight that increases on the 200g until 1000g in the stages for the weighing variable. The experiment is use 2 number of rotation for constant rotation along the experiment running as rotation distance. Similar procedure of the experiment in analysis 4.3.2 but the weight is the variable while the number of rotation is fixed by 2 turn only. The rotation of roller measured using a rope that have been tied to one point that been set by wrapping the entire diameter of the roller. The rope released on tied to the weight at the other end and the output power generated by the motor will be measured. The digital multimer is used as a measuring tool for collected the data.

Table 4.3 Analysis result weight vs power generated

Weigh (g)	Current, I	Voltage, V	Power (watt)
200	0.13	1.89	0.25
400	0.47	2.45	1.15
600	0.87	3.28	4.15
800	1.28	3.75	4.8
1000	1.48	4.67	6.9

From the data we obtain on the table 4.3, we observe that the current and the voltage that produced from the weight force increased directly. There are significant change of the both output followed by the weight force. We relize that, the output voltage and current is directional proportional to the number of rotation. Thus the power increase proportional folowed by the number of rotation in the data based on formula P=VI



Graph 4.2 Weight Vs Power Generated

From the graph 4.2, the trend that shown on the graph is linear graph. We can observe that the power generated is directional proportional with the weight force on the roller. The increasing the mass of weight, the increasing the power generated. The mass of weight affecting the power generated by the speed breaker. Thus we can determined that, the number of rotation pass through the speed breaker power generation directly proportional with the power generated. For the discussion, we can summarize that the weight of vehicle can be one of the factor increasing of the power generation because of the biggest force that have produce by the heavier vehicle pass through the speed beaker power generation.

4.1 Summary

For the summarization, the prototype that have been build are helpfull in doing the experimental for the analysis purpose. The analysis part is the important part to determine wheather the project is efficient or not for a certain senario or situation that be investigated. The analysis that produce can be the information for study and data for the future work. Then, the analysis give us analyze the condition and behavior of project or investigation.

The first analysis for this project is to examine the relationship between the speed and the output power generation. The second analysis is investigate the relationship between rotaion againts outputs power generation. The third analysis is to define the relationship between the weight againts the outputs power generation. Various factor are studied to determining the efficient analysis. Thus, the analysis is important to analyze the project from its intiation to become a completion product or development.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

4.2 Conclusion

The idea of my project is to introduce the new development for harvest energy by using speed breaker power generation. The goal of development succesfully achieved because of all the objective is meet the target in this project. The main operation is to convert the potential and kinetic energy for generating power has accomplished by using roller mechanism as a mechanical part while the motor as a converter from mechanical energy to electrical energy. The combination of the both `mechanism allow the energy can be harvesting. The system that had designed is comply for pollution free that eco-friendly to environment. The system analyzed by performable analysis that identifying the relationship of several factor to be investigated for the performance and efficiency for speed breaker power generation.

Based on the result from the analysis on the factor of speed, number rotation and weight against the power generated by the speed breaker power generation, we can analyze that the power generated is increasing linearly with the the factor increase. Thus ,we can determined that, the power that have generated is directly proportional with the speed , weight and number of the vehicle pass through the speed breaker power generation.

Nonetheless, the speed breaker power generation not suitable to be implemented due to limit of the speed. As we know, the average vehicle's speed passing through the speed breaker around 10 – 15 km/h. Although, the low power

genaration can be overcome with heavy traffic, the generated energy is still not efficient to supply the load.

4.3 Future Works

For future improvements, the reliability and efficiency of the speed breaker power generation can be improve such as the recomemendation as stated below:

i. Make improvement to design in the future that can be implemented on real common use in term of size, durability of material and mechanism.
ii. Change the application for speed breaker power generation to the another function that can use full ability in convert the energy by the roller.
iii. Study for more releven generation system that can be impliment for the road traffic.
iv. Make the future study that use the concept of the generation at other location like zebra crossing, the yellow line or at the highway that use fastest speed.
v. Futher study about how to step up or boost the ouput power generated by the speed breaker power generation that can be supply for the higher load near the road.

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APPENDICES

Appendix A Gant Chart

YEAR		2022														
WEEK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NO	TASK															
1	Data Collection for Propose Title															
2	Discussion Propose Title															
3	Title confirmation															
4	Research Article/Journal															
5	Writing Literature Review															
6	Methadolody finding															
7	Report Writing (Chapter 1,2,3)															
8	Report PSM 1 Submission															
9	Presentation PSM 1															
10	Revised Report 1 Submission															

YEAR		2022 - 2023														
WEEK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NO	TASK															
1	Hardware Setup															
2	Software Setup															
3	Analysis Data Collection															
4	Draft Report Submission															
5	Writing Analysis															
6	Full Report Writing															
7	Logbook Submission															
8	Turnitin Report															
9	BDP Presentation															
10	Final Report Submission															

Appendix B Arduino programming

taufik_arduino | Arduino 1.8.13

File Edit Sketch Tools Help

taufik_arduino §

```
#include <LiquidCrystal.h>

 const int ldr = 7;
const int light = 13;
const int light2 = 12;

void setup() {
  pinMode(ldr,INPUT);//define pin as input sensor
  pinMode(light,OUTPUT);//define pin as output sensor
  pinMode(light2,OUTPUT);//define pin as output sensor
}
void loop() {
int y =digitalRead(ldr);//read the sensor
if (y==1){
  digitalWrite(light,HIGH);//turn on led
}else{digitalWrite(light,LOW);//turn off led
}

if (y==1){
 digitalWrite(light2,HIGH);//turn on led
}else{digitalWrite(light2,LOW);//turn off led
}
delay(50);
}
```

Appendix C Analysis

Experiment - Speed vs output power

Experiment rotation vs output power

Experiment weight vs output power