GENERATION OF ELECTRICITY BY USING SPEED BREAKER

An UndergraduateCAPSTONE Project
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Faculty of Engineering
American International University - Bangladesh

Generation of Electricity By Using Speed Breaker

A CAPSTONE Project submitted to the Faculty of Engineering, American International University - Bangladesh (AIUB) in partial fulfillment of the requirements for the degree of Bachelor of Science in theirmentioned respective programs.

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DECLARATION

This is to certify that this project is our original work. No part of this work has been submitted elsewhere partially or fully for the award of any other degree or diploma. Any material reproduced in this project has been properly acknowledged.

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APPROVAL

The CAPSTONE Project titled **GENERATION OF ELECTRICITY BY USING SPEED BREAKER** has been submitted to the following respected members of the Board of Examiners of the Faculty of Engineering in partial fulfillment of the requirements for the degree of Bachelor of Science in the respective programs mentioned below on **January 2023** by the following students and has been accepted as satisfactory.

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Friends and relatives, we appreciate your understanding and kindness.

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ABSTRACT

Energy is the most fundamental requirement for the continued existence of any living thing in the cosmos. Everything that occurs in the world is a manifestation of energy flowing in some manner. However, conventional energy sources are decreasing and the global population is steadily growing. The over consumption of energy has led to insufficient energy supply during the next five years. In order to solve this issue, we must adopt practices that maximize the use of energy from traditional sources. In my work, I explain how to harness the energy released as a car bounces over a speed bump. When a car drives over it, it releases a great deal of kinetic energy. A speed breaker can double as a generator to harness the kinetic energy it creates and supply electricity to the grid. A rack and pinion system can transfer the kinetic energy of a moving vehicle into the mechanical energy of the shaft. Next, a generator will transform the mechanical energy into electricity, which will be stored in a battery. The money we save on electricity during the day can be put to better use at night when we turn on the street lights. As a result, this setup will help us conserve a significant amount of energy that may be put toward meeting future needs. Energy is a nonrenewable resource; yet, it is possible to transform one form of energy into another. The law of energy conservation is something all of us study. Energy comes from a variety of nuclear, hydro, thermal, and other sources. However, the project is moving forward in several places, particularly on the roadways.

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Chapter 1

INTRODUCTION

1.1. Overture

Energy is the fundamental and universal unit of measurement for all forms of labor, both human and natural. What we see around us is the manifestation of energy flowing in some way, and this applies to everything. When most people think of "energy," they picture crude fuels and electric power being used to power something, be it their bodies or machines. Electricity is a crucial source of energy for the average guy. Electricity is truly a scientific miracle. It's the second most revolutionary thing that's ever happened in the history of the world after man. It has changed the globe in all but name. Slowly but surely, increased reliance on electricity has led to remarkable shifts in manufacturing. It is used to operate the massive modern tools we rely on. Computers and calculators perform a wide variety of mathematical operations with pinpoint precision. Overnight, millions of copies of newspapers and books are printed.[1] All facets of human existence owe something to the development of electricity. In light of this, our current era deserves to be named the "age of electricity." In modern society, electrical power is indispensable. We heat our homes, power our factories' machinery, and propel our public transportation. It's safe to say that electric power has altered transportation forever. Because of this, we can now take planes into the freezing upper atmosphere and enjoy the experience of flying. In addition, our country is equipped with electric trains. So, with the growing population, the demand for electricity has skyrocketed. However, we all know that there is a finite amount of energy-generating resources, and that this is what has triggered the current energy crisis. In this situation, we need to create power from commonplace items[6]. In this experiment, we attempted to use roadside speed bumps as a source of renewable energy. Since the number of cars on the road is only expected to grow, installing speed bumps along major thoroughfares is a great way to harness that growth and turn it into usable energy. The generated power can be put to several uses, including powering traffic signals and streetlights. Components like a gear shaft bearing are simple mechanical necessities for this arrangement. The battery, inverter, and other electrical parts are also included.

1.2. Engineering Problem Statement

The primary component of this set up is the bearing-carrying U-shaped shaft that is attached to the top of the speed breaker. The bearing is there to allow the shafts to move relative to one another. This is how we plan to transform vertical motion into rotating motion. A return spring will be installed towards the top of the speed breaker to keep it from shifting after being pushed down by vehicles' weight. The size of the spring is determined by the mass of the vehicles that will use it. The shaft's two ends will be held in place by the bearing's assistance. Mild steel is used to make the shaft. The sprocket, which will spin in the same direction as the shaft, will be included. This sprocket will be connected to another sprocket by a chain

drive that will be installed on the opposite shaft, much like a bicycle.[3] There's a gear on the lower shaft, too. There is a gear on the generator that meshes with a gear on the lower shaft; this rotation of the D.C. generator powers the battery for later usage. This application makes use of a permanent magnet direct current generator. The DC output from the generator is 12 volts. The 12-volt lead battery stores this direct current. Inverter is linked to batteries. To power the lights, fan, and other appliances that require 230-volt, AC current, an inverter is utilized to change the voltage from 12 volts, D.C. The power rating can be raised by boosting the battery and inverter circuit's storage capacity. This setup is common on highways, and aside from the speed brake setup, everything is stored below ground.

1.3.Related Research Works

Briefly discuss the research works done related to the focused topic. Provide proper referencing [IEEE format] and indicate how the results / outcome of mentioned research works helps to build the project.

1.3.1. Earlier Research

1.3.1.1. Air Compression and Electricity Generation by Using Speed Breaker with Rack And Pinion Mechanism

Roadside speed bumps are installed in congested locations to slow down drivers. Vehicle weight lost on a speed breaker represents potential energy that can be put to good use. This paper discusses how this form of energy can be harnessed from highways and put to productive use. Compressed air is stored with the help of a piston cylinder compressor arrangement, and the steps of construction of a speed breaker device are detailed, as well as the mechanism to generate energy using a rack and pinion and speed increasing gear box and generator [4]. Any time a car is allowed to drive over the dome of a speed breaker, the dome is forced down on the vehicle. Rack at the base of the dome travels down and up in a reciprocating action while springs at the top of the dome are squeezed. Since the rack is attached to the pinion via teeth, the rack's reciprocating action can be transformed into the pinion's rotating motion, though the two gears turn in the opposite directions. A belt drive connects the shafts to the generators, which transforms the mechanical energy into electrical energy at a predetermined RPM. Because the rack is connected to the piston rod of the cylinder, the downward stroke of the rack can be used to compress air in the reservoir. An arrangement of piston cylinders that move in unison compresses air and stores it in a reservoir. Both the electricity and the compressed air that are produced have multiple potential

uses. Search Terms: Speed Breaker; Rack and Pinion; Gear; Air Compressor; Generator; Electricity Generation.

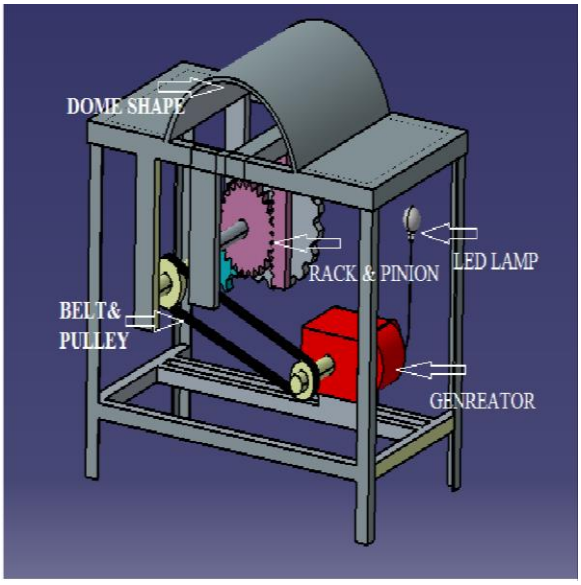

Figure 1.1: Electricity Generation by using Speed Breaker [4]

1.3.1.2. Electricity Generation Using Speed Breaker

Conventional speed bumps are swapped out for a more straightforward device that generates electricity. Whenever a car drives over the speed bumps, the rack and pinion mechanism inside the breakers gets to work, producing electricity in the process [5]. As the number of cars on the road continues to rise, this technology can be used to generate electricity efficiently. It works well at intersections, parking garage entrances, and other high-traffic areas. The motion is transmitted to a DC motor/generator using a rack and pinion, spring assembly mechanism. Using this technique, roads, highways, parking lots, etc. can effectively generate power from the kinetic energy of driving automobiles.

1.3.1.3. Modeling and Analysis of Flat Spiral Spring Based Speed Breaker Device for Generation of Electricity

To be a modern person without access to electricity is a daunting prospect. To fulfill the needs of a growing population, conventional methods of electricity generation are insufficient. As a result, the authors proposed an innovative approach of harnessing electricity from unconventional sources in order to

solve this issue. In this paper, we focus on renewable energy sources, which are gaining in popularity since they are both environmentally friendly and readily available. One such source is the creative and novel concept of employing speed breakers to generate electricity. Because most highways are so congested, converting the kinetic energy of moving automobiles into electrical energy could be a viable option [6]. The invented rack and pinion mechanism stores and releases the energy of the flat spiral torsion spring, which is the system's key component, to produce electricity. The SOLID WORKS model with the spiral spring is examined in ANSYS, and the results are encouraging. Lights, signs, and streetlamps are just few of the things that benefit from the electricity that is produced.

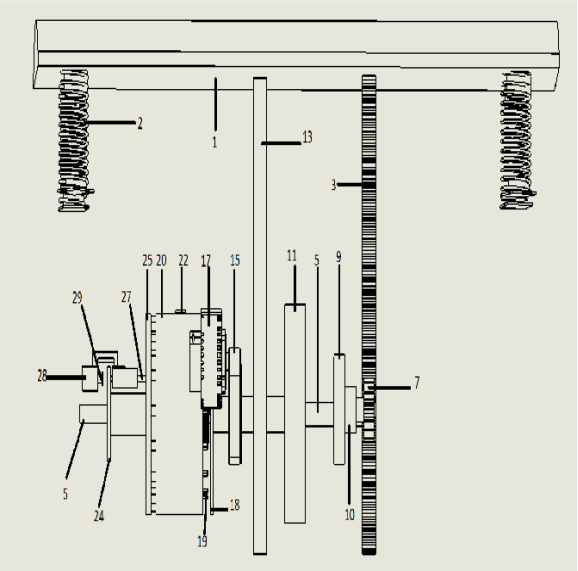

Figure 1.2: shows the detail 2D front view of working mechanism [6]

1.3.2. Recent Research

1.3.2.1. Hybrid Power Generation using Speed Breaker

For the purpose of reducing vehicle speeds in high-traffic areas, traffic calming devices such as speed breakers or speed bumps are frequently installed. In order to meet expected demands for electricity in the future, innovative methods of power generation from nonconventional sources are essential. Various experiments are being conducted on this topic in different parts of the world [7]. One of them is the use of a speed breaker to generate electricity from kinetic energy. Using a rack and pinion transmission, the suggested system is built to transform kinetic energy into mechanical power. A vehicle's momentum is converted into rotational energy when it passes over the rack through speed breaker. With a 400-kilogram (kg) vehicle, this system can provide around 224 watts of electricity at a single thrust. The energy

requirements of any developing country can be met by this technology, which can function as a miniature power plant.

1.3.2.2. Power generation using reciprocating shaft mechanism attached to speed bumpers

The typical speed bumps are swapped out for a simple system that generates electricity. High-tension springs and a reciprocating shaft mechanism power the speed breakers when cars drive over them. The increasing number of cars on the road makes this a practical means of generating power. Placements near parking lots, toll booths, and other areas with heavy traffic volumes are ideal. To transmit motion to a DC motor/generator for energy generation, a reciprocating shaft mechanism and spring assembly mechanism are provided [8]. The mechanical energy of moving automobiles on highways can be converted into electricity using this technology.

1.4. Critical Engineering Specialist Knowledge

Many sources of energy, such as those created by the friction of moving metal, are generated when a vehicle is in motion. When a vehicle with a high speed hits a rough surface, such as a road or a wheel, it generates heat energy wind. Converting potential energy into electrical energy is the underlying premise. The process of producing energy by producing motion by releasing the potential energy built up when a car climbs a speed breaker. If the When a car climbs the slope, its potential energy increases, but it goes to waste because the car never uses that extra height [9]. Common rumble strips. It's a ratchet-wheel type system where they crank a lever when the breaker is tripped. (Anything that converts angular motion into linear) that spins a geared shaft holding recoil springs. The result of this shaft's efforts is hooking up a dynamo to a source of motion to generate electricity.

1.5. Stakeholders

All life in the universe depends on the availability of energy to function. All external events can be understood as manifestations of energy in motion. However, conventional energy sources are decreasing and the global population is steadily growing. Extreme energy consumption has brought about a crisis in the availability of energy during the next few years. So, to solve this issue, we should use the methods of maximized efficiency in using existing resources; energy savings. This endeavor also addresses how to put that energy to use. This is disregarded whenever a car goes over a speed bump. A vehicle's passage over it releases a great deal of energy. The energy created by the speed breaker can be harnessed and used to generate electricity. [10] The moving Rack and pinion transmissions allow for the mechanical energy of

moving vehicles to be transferred to the shaft. Mechanism. Next, a generator will turn this mechanical energy into usable electrical energy. Using an external power source, most commonly batteries. During the day, we may conserve energy that can then be used to power street lights at night. That's why this set-up is so advantageous; it allows us to conserve resources that may then be used toward the accomplishment of future goals demands. In order to harness the energy of the speed breaker, this project employs a complex combination of gears and several electronic devices. Generating massive quantities of cheap electricity is a huge money saver. Additionally, it will be immensely useful if put into practice. to do with the government.

1.6. Objectives

The power produced by the speed breaker mechanism can be stored in batteries and used later for various tasks.

1.6.1. Primary Objectives

- To make free electricity with no cost for fuel, no pollution, and as little space as possible.
- Generating electric power from sources of speed breaker
- Demand basic building techniques.

1.6.2. Secondary Objectives

- Slow down the flow of cars and trucks to make road safer.
- Make it simple to put in place and quick.

1.7. Organization of Book Chapters

Chapter-2: Project Management

In this Chapter, the project Gantt chart has designed in this project management chapter. Then, analysis the different related issues as such strength of this project, weakness and opportunities.

Chapter-3: Methodology and Modeling

In this methodology chapter, the proposed designed with block diagram also mathematically

Chapter-4: Implementation of Project

In this the modified chapter, the proposed model will be described

Chapter-5: Results Analysis & Critical Design Review

All the graphs and project analysis will be shown

Chapter-6: Conclusion

Chapter 2

PROJECT MANAGEMENT

2.1.Introduction

Project management is a common method used to assure the success of a project. When it comes to project management, it's critical to have a clear picture of the objectives of the project, the resources this project needs, and achieve it. This chapter is all about getting down to business. The purpose of project management is to plan and execute a project in such a way that its stated goals and deliverables are met. Additionally, it includes the identification and control of potential risks, along with a thorough budgeting process and cross-organizational communication. Project schedules can benefit from using the Gantt chart. Money can be saved on the project's equipment by manipulating the data. Managing a project is a critical managerial ability. Planning, scheduling, and regulating actions to achieve a certain goal within a given time and budget are all part of the process. By completing initiatives that contribute to project aims, many businesses can meet the objectives. In most cases, projects have a specific start and end date, a specific number of participants, a specific number of resources, and a specific budget. This is planned and monitored by the group leader and adjusted just as needed.

2.2.S.W.O.T. Analysis

A project's opportunities and threats, as well as its strengths and weaknesses, can be analyzed using the SWOT framework. Using a functional approach, the internal analysis pinpoints the projects' strengths across the board (finance, management, infrastructure, procurement, production, distribution, marketing, reputational factors, and innovation) as well as its weaknesses (the same) and opportunities for growth (the same). Finding the source of competitive advantage requires a thorough internal study. In doing so, it identifies areas for investment in developing resources that will keep a team motivated. Potential advantages and disadvantages in the sector are uncovered through research on the surrounding environment, including the competition, the industry, and the broader economy. Analysis of the capabilities and assets of each competitor constitutes the competitive landscape. Competition, new entrants, suppliers, customers, and product substitution are analyzed as part of the industry's external environment using the five Forces Model. Political, economic, sociological, technological, environmental, demographic, ethical, and regulatory repercussions are examined in the context of the external

environment [12]. The objective of doing a Strengths, Weaknesses, Opportunities, and Threats (SWOT) study is to inform a company's strategy development considering its specific context. In this using SWOT analysis, the strength and weaknesses are found.

Figure 2.0: S.W.O.T Analysis [12]

2.2.1. Strengths

- Eco-friendly
- Renewable energy
- Mechanism Simplified

2.2.2. Weaknesses

- Requires downtime to recharge
- Inadequate power-supply facilities
- Maintenance of batteries are costly.

2.2.3. Opportunities

- Property ownership grants from the government
- The rising price of fossil fuels

2.2.4. Threats

- Competition from vehicles that use alternative fuels or hydrogen engines.

- The Increasingly Expensive Cost of Electricity

2.3. Schedule Management

Project activities and tasks are organized using a schedule management structure, which uses time variables to do so. Outlines what has to be done for the project's completion to be on time and within the budget. Implementing a schedule management system is crucial to getting a project off the ground, tracking its progress, and ensuring that it is completed on time.

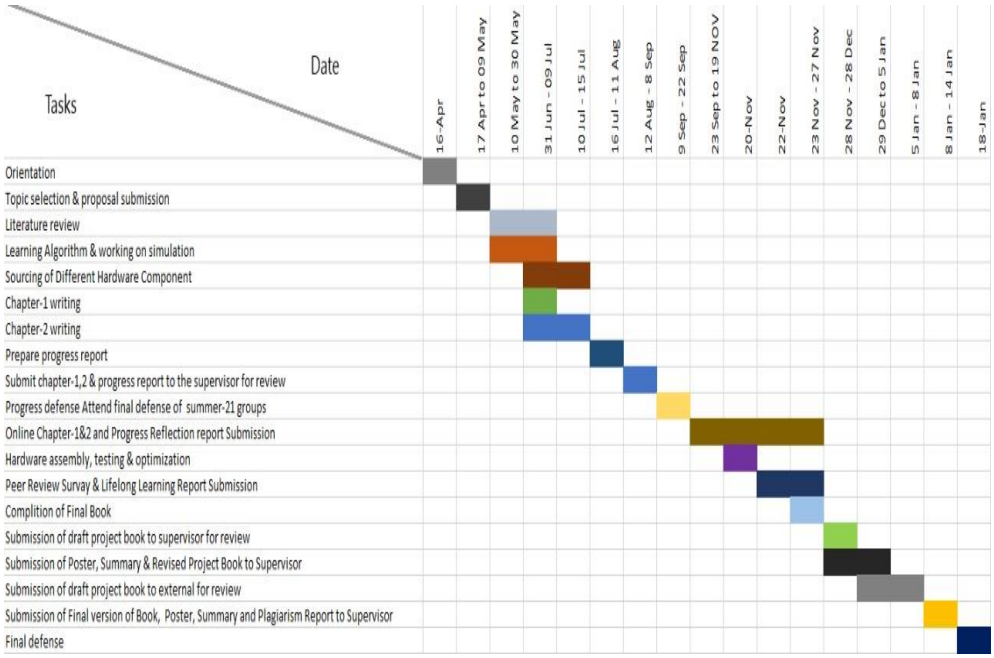

Figure 2.1: Gantt chart

2.4. Cost Analysis

The total cost analysis of both object detection and authentication devices is shown here. Here, the estimated price and the buying price of the components are shown.

SL	Name of the component	Unit Price	Quantity	Price (BDT)
1.	24 Volt generator motor	400	1	400/-
2.	LED light	10	2	20/-
3.	Racks	800	1	800/-
4.	Pinions	300	3	900/-
5.	Fly Wheel	260	1	260/-
6.	Chains pocket	400	1	400/-
7.	PWM solar charge controller	600	1	600/-
8.	12 v 5ah lead acid battery	1200	1	1200/-
9.	Boost converter module xl-6009	125	1	125/-
10.	Springs	100	4	400/-
11.	Gear	200	1	200/-
12.	Arduino uno	1100	1	1100/-
13.	Voltage sensor	90	1	90/-
14.	Buck boost converter	400	1	400/-
15.	Buck converter	120	1	120/-
16.	Switches	5	2	10/-
17.	Connectors	50	3	150/-
18.	I2C LCD Display (16x2)	360	1	360/-

Total	= 7535/-

Nowaccordingto the standarddeviation formula equation,

For standard deviation calculation,

N=2

Sum, Σ X: Online price (BDT) + Final expenditure price (BDT)

= 7535

Mean, μ: Sum /N

$= \frac{7535}{18}$

Variance $\sigma^2 = \frac{1}{N}\sum(Xi - \mu)^2$ $= \frac{+\cdots+}{} = \frac{7535}{18-1}$ =443.23

Standard deviation = $\sqrt{\text{Variance}}$ $= \sqrt{443.23}$ = 21.05

2.5.P.E.S.T. Analysis

To assess a project's current situation, future prospects, and strategic course of action, the PEST analysis is an invaluable tool [14]. Businesses and other organizations often do market analyses by considering political, economic, social, and technological (PEST) issues. A PESTLE analysis takes into account other aspects, such as those related to the law and the environment.

Figure 2.2: P.E.S.T analysis [14]

2.5.1. Political Analysis

The analysis of political structures, institutions, ideas, and behaviors, and most importantly, the political processes through which they are constantly formed and changed, is made accessible and engaging in Political Analysis. This project won't require approval from the government to carry out its initiative. This project can be implemented without any restrictions. Since the technology poses no risk to either the environment or the citizenry, it has no political implications.

2.5.2. Economic Analysis

At first, it ranks projects according to their financial sustainability, allowing for more equitable distribution of available resources. Finding out how much good a project does for people is the

objective of this research. It's a fair price, and the project's goal is for it to be affordable for anybody. Through every step of the project's execution, researchers must keep costs in mind.These speed obstacles may be manufactured at a lower cost than traditional speed bumps and solar panel lighting. There is currently a well-defined business strategy in place to provide a high-quality speed bump at the most affordable cost. We analyzed this project and find it is economical to work for current situations as the sources of natural gas and coal are limited we have to shift to renewable resources

2.5.3. Social Analysis

Analyzing stakeholder perspectives and priorities, and involving as many relevant stakeholders as possible in the development process, are all components of social analysis. This analysis is conducted in the context of the socio-cultural, institutional, historical, and political environment of Bank-financed operations. It’s a team project and we target market may be affected by certain societal trends, behaviors, or attitudes. Producing electricity from speed bumps carries significant civic and environmental weight. Indeed, it encourages citizens to work together toward the common goal of enhancing the economic and social climate.

2.5.4. Technological Analysis

As there is already an electric car available in the market if we can increase the amount of power produced by our project, then we can develop our county not only economically and technically as well. Recently, technology has close attention to the design, the execution, and the testing to determine the experimental effectiveness of this design

2.6.Professional Responsibilities

The job of an engineer is to make sure that a system, method, or product is safe and effective. To make project a success, engineers must work well in groups and be able to work well with others. Engineers, customers, and businesses need to communicate effectively. Engineers are also responsible for the following:

- Usingcomprehensivedrawingstodrawout plans
- Preparingestimatesandbudgetsforprojects
- Definingthescopeoftheproject
- Designingexperimentsinthe fieldofengineering
- Producingcustomer-facingtechnicalreports
- Completingsafety-relatedregulatorydocuments
- On-timeandwithin-budgetcompletionofprojects

- Informingclientsandco-workersof findingsandconclusionsfromthe analysis

During this project, we tried to take some individual and team responsibility as well so that we could complete our goals.

2.6.1. Norms of Engineering Practice

Norms are the standards by which we judge behavior. The goal of normative design is to find a happy medium between technological and ethical constraints in the context of design trade-offs. Engineers are compelled to consider the societal context in which their designs will be implemented when working to such stringent guidelines. One of the most important social values in the workplace is making workers feel appreciated. The engineering management team has a duty to actively improve their employees' abilities and knowledge. The best way to make employees feel like the company cares about them is to have an ongoing conversation focused on the employee's abilities, needs, improvements, and goals, as well as to create a solid development plan. During this project, we tried to follow all the terms of engineering Practices.

2.6.2. Individual Responsibilities and Function as Effective Team Member

Name	ID No	Responsibility
Apurbo debnath	19-40468-1	Project lead&designing
Abdullah al jabed	18-37055-1	Hardware lead
A.S.M Nasim Khan	19-39926-1	Software lead
Md. Maidulislam	19-40466-1	Simulation and designing

2.7.Management Principles and Economic Models

Economists use models to generate testable hypotheses about economic behavior by simplifying their descriptions of reality. Due to the lack of a universally accepted standard for gauging economic performance, economic models are inherently subjective in nature. Economists will arrive at varying conclusions about what is necessary to explain the world as they see it. The two main types of economic models are theoretical and empirical. Under the premise that agents maximize specified objectives within well-defined model constraints (such as an agent's budget), theoretical models attempt to deduce provable implications regarding economic behavior. They give in-depth analyses of complex issues, including the

effects of asymmetric knowledge (where one party to a transaction knows more than the other) and the most effective ways to deal with market failures. Empirical models, on the other hand, try to turn the qualitative predictions of theoretical models into more concrete numerical outcomes. For instance, if we were to use a theoretical model of an agent's consuming behavior, we may predict that the outlays would increase as their income did. The theoretical model would be empirically adapted to try to put a dollar amount on the typical percentage rise in spending that occurs with a percentage increase in income.

2.8. Summary

Discussed in this section are the project's objectives, budget, task management, and SWOT analysis, as well as any potential dangers or advantages. Researchers can have faith in their decision to carry forward with the study because of what they have learnt from past initiatives and expense estimations. Due to the specified stakeholders, many more people will be able to take use of a wide variety of new possibilities.

Chapter 3

METHODOLOGY AND MODELING

3.1. Introduction

All life in the universe relies on energy to function. Everything going on around us can be understood as a manifestation of energy flowing in many directions. However, conventional energy sources are decreasing and the global population is steadily growing. The widespread adoption of energy-intensive practices has led to a severe lack of energy during the next few years. Therefore, we must adopt strategies for making best use of existing resources for energy conservation if we are to tackle this challenge. In this plan, we will figure out how to harness the energy that is currently being lost every time a car bounces over a speed bump. By passing a vehicle over it, a great deal of energy is released. If we convert the speed breaker into a generator, we can harness the kinetic energy it produces and turn it into electricity. A rack and pinion system can transform the kinetic energy of a moving vehicle into mechanical energy of the shaft. Next, a generator will transform the mechanical energy into electricity, which will be stored in a battery. During the day, we can preserve energy that can then be used to power street lights at night. In this way, we may reduce our energy consumption and free up resources to meet emerging needs. This project utilizes a gear arrangement and electronic devices to harvest energy from a speed breaker. It is possible to produce substantial electrical power while reducing costs significantly. And the government stands to gain a lot if this is put into action. When a vehicle is in motion, it generates many sources of energy, such as the heat created by the contact between the wheel and the road (assuming the road is rough). HEAT Even when a fast-moving car crashes into the wind, energy is created. The underlying concept here is the transformation of potential energy into electrical energy. The potential energy created by a vehicle climbing a speed breaker can be converted into usable kinetic energy via a mechanism that can be used to generate electricity. In a regular rumble strip, the potential energy gained by the vehicle as it travels over the inclined plates is lost. They turn a geared shaft filled with recoil springs by cranking a lever attached to a ratchet wheel type device (an angular motion converter) when the breaker is lowered. This shaft's output is connected to a dynamo, which generates electricity from motion.

3.2.Block Diagram and Working Principle

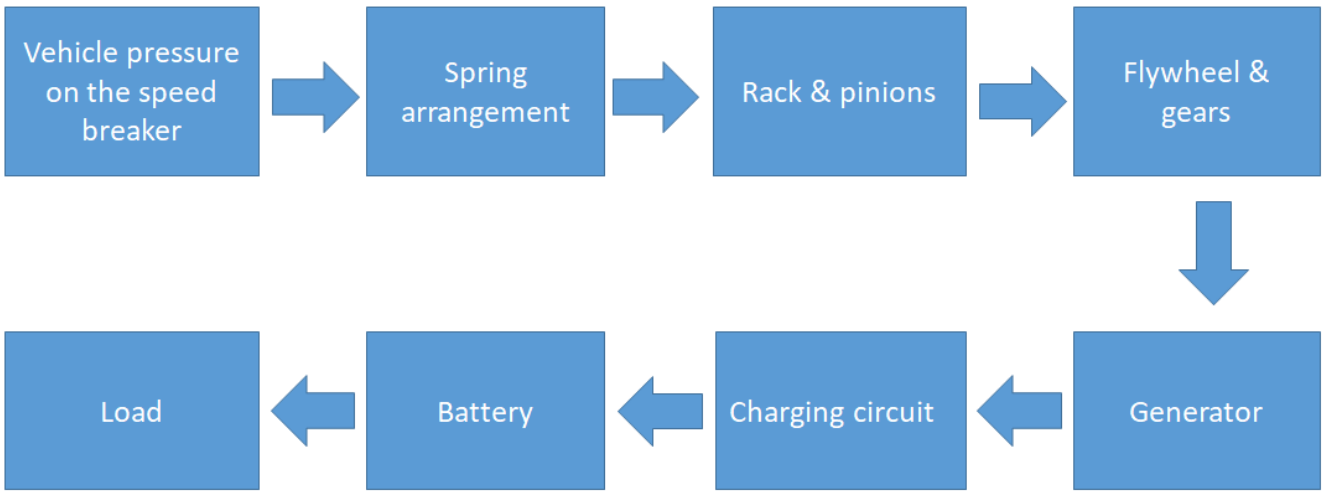

Figure 3.1: Block Diagram

With the right gear arrangement and some high-tech equipment, a speed breaker can be used to create energy, allowing for the cost-effective production of a substantial amount of power. It is possible to generate electricity from speed bumps by one of three fundamental mechanisms.

1) A roller system
2) The workings of a crankshaft
3) Rack and pinion

For our project, we opted for a straightforward and efficient design for a generator based on the rack-and-pinion mechanism's proven track record of producing a high output from a little input. The goal of the project is to create a system similar to speed breakers that can be used to generate electricity. Thereby, rack and pinion setups feel the force applied by the speed breaker setup. In this case, the rack and pinion setup takes the speed-reciprocating breaker's action and converts it into rotational motion. A gear is attached to the pinion's axis, allowing it to rotate. A pinion is woven into the mesh of this gear. The available speed at the gear is approximately multiplied at the rotation of the pinion, which is related to the gear arrangement, as power is conveyed from the gear to the pinion. Here, we see two gears of varying sizes. The pinion's axis is connected to the gear's bigger dimension. This larger gear receives the speed that was multiplied at the smaller sprocket wheel. All of the pinions engaged with the gear. Therefore, the pinion that follows the gear continues to multiply the speed by a greater factor when the gear rotates at the

pinion's multiplied speed. When a result, even though the speed achieved at the first gear is lower because of the circular motion achieved there, the speed is multiplied as the power is sent to higher gears. The rotor in a generator can be rotated at this speed. The electric drive comes from the rotor's rotation within a static magnetic stator, which reduces the surrounding magnetic flux (emf). After producing an emf, the resulting alternating current (AC) is delivered to a bridge rectifier to be transformed into direct current (DC). The lead-acid battery will now get this controlled emf.

3.3.Modeling

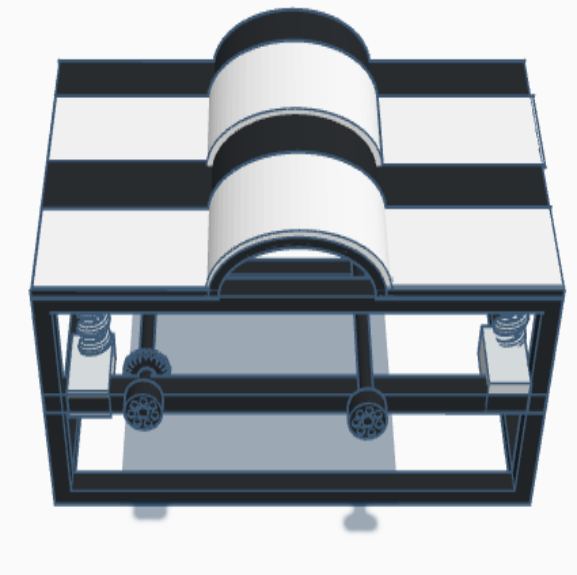

Figure 3.2: 3D Model

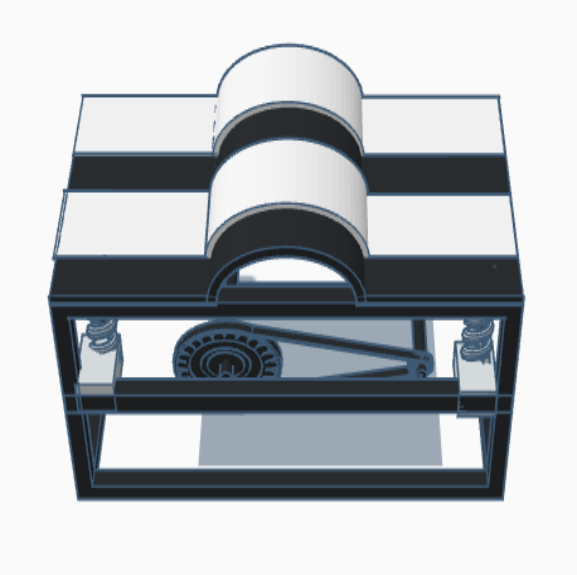

Figure 3.3: Upper 3D model view

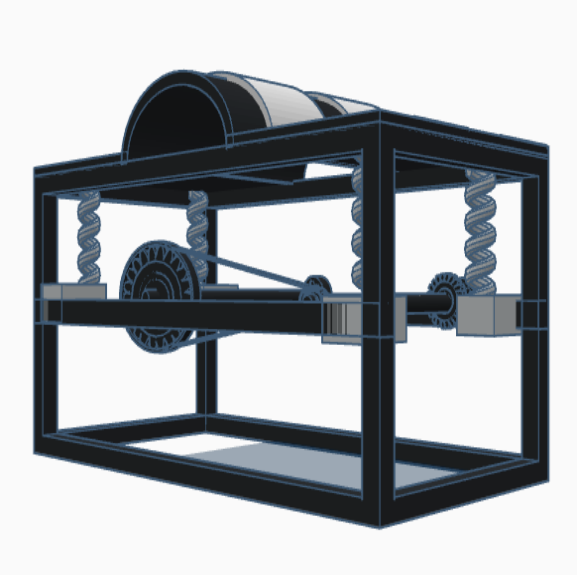

Figure 3.4: 3D model of inner view

3.4. Summary

Thischapter described the modeling and methodology of the project. The block diagram is shown and described here with details and 3D model was made and illustrated using fusion 360 software. A brief example was given using showing the 3D model of the project.

Chapter 4

PROJECT IMPLEMENTATION

4.1. Introduction

All life in the universe relies on energy to function. Everything going on around us can be understood as a manifestation of energy flowing in many directions. However, conventional energy sources are decreasing and the global population is steadily growing. Overconsumption of energy has caused an energy catastrophe that would last for several years. Therefore, we must adopt strategies for making best use of existing resources for energy conservation if we are to tackle this challenge. In this work, we discuss ways to recover the power lost every time a car hits a speed bump. By passing a vehicle over it, a great deal of energy is released. If we convert the speed breaker into a generator, we can harness the kinetic energy it produces and turn it into electricity. Through the use of a rack and pinion system, the kinetic energy of the moving vehicles can be transferred into mechanical energy of the shaft. Next, a generator will transform the mechanical energy into electricity, which will be stored in a battery. During the day, we can preserve energy that can then be used to power street lights at night. As a result, this setup will help us conserve a significant amount of energy that may be put toward meeting future needs.

4.2. Required Tools and Components

4.2.1. Fly wheel:

A flywheel is a mechanical device that stores rotational energy, a form of kinetic energy that is proportional to the product of its moment of inertia and the square of its rotational speed, via the conservation of angular momentum.The primary function of flywheel is to act as an energy accumulator. It reduces thefluctuations in speed. It absorbs the energy when demand is less and release the samewhen it is required.

Figure 4.1: Fly wheel

4.2.2. Shafts:

A shaft is a spinning machine element, often circular in cross section, used to convey power from one portion to another, or from a power-generating machine to a power-consuming machine..It is a rotating element, which is used to transmit power from one place to another place. It supports the rotating elements like gears and flywheels. It must have high tensional rigidity and lateral rigidity.

Figure 4.2: Shafts

4.2.3. Springs:

It is defined as an elastic body whose function is to distort when loaded and to recover its original shape when the load is removed. It cushions, absorbs or controls energy either due to shocks or due to vibrations.A stretchy item like this can be used to store mechanical energy. There are many varieties and styles, and they serve many functions. This phrase is commonly used to describe coil springs. When compressed or stretched, traditional springs exert an opposite force. This took place in the absence of any features that allow for the adjustment of the stiffness.

Figure 4.3:Springs

4.2.4. Bearings:

It is a machine element, which supports machinery. It permits relative motion between the contacting surfaces while carrying the loads. They reduce the friction and transmit the motion effectively.A machine element, a bearing, restricts relative motion to only the intended motion and lowers friction between moving parts. The bearing's design can allow for unrestricted linear motion or rotation on a fixed axis, or it can inhibit motion altogether by regulating the normal force vectors acting on the movable components. Most bearings work by reducing the amount of resistance to motion. In general, bearings can be categorized according to their intended function, the range of motion they permit, or the orientation of the loads (forces) they must support.

Figure 4.4: Bearings

Rack And Pinion

Figure 4.5: Rack and Pinion

Rack and pinion are mechanical components consisting of a rectangular cross-sectioned bar (the rack) with teeth on one side that mesh with teeth on a tiny gear (the pinion).

Mechanical Gear

Figure 4.6: Mechanical Gear

Cogs are gears, which are wheels with teeth that mesh with one another. Turning one gear causes the other to rotate in tandem with it. The turning force can be amplified by using gears of varying diameters. The larger wheel rotates slowly but with more force, whereas the smaller one rotates swiftly but with less force.

Chain Pockets

Figure 4.7: Chain Pockets

Transmission of mechanical power from one location to another is the primary function of a chain drive. Traditional chain drives feature the chain and two or more sprockets. For use with a sprocket, the chain's links must have holes that align with the teeth of the gear.

4.3. Implemented Models

4.3.1. Simulation Model

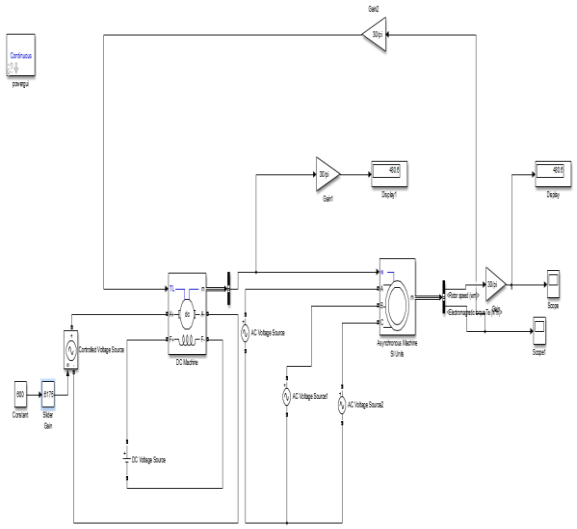

Figure 4.8: Matlab Simulation

For the simulation model, we used Matlab 2021 version and used a voltage controller to control the voltage which the motor produced and the asynchronous motor and inverter to make DC to AC current.

4.3.2. Hardware Model

Figure 4.9: Hardware Implementation

For marking this hardware model we took help from some workshop laborers and most of the parts we collected from different locations in Bangladesh but we guided the laborers to do our 3D model which we designed on fusion 360 software

4.4. Engineering Solution in accordance with professional practices

When the vehicle is allowed to pass over the dome, the rack at the bottom of the dome travels upward and downward in a reciprocating manner, compressing the springs linked to the dome. There is a conversion of the rack's reciprocating action into the rotating motion of the gears via the rack's teeth, but the two gears revolve in the opposite direction. In order to keep the energy consistent and reduce any peaks and valleys, a flywheel is installed on the shaft. The dynamos, which transform mechanical energy into electrical energy, are connected via a belt drive to the shafts, allowing them to revolve at a predetermined rate of speed. The ratio of conversion to traffic density will be 1 to 1. An electromotive force (EMF) is generated in an armature when it spins through a field created by the north and south magnetic poles. The induced EMF is generated by a revolving coil in an armature, which is turned by a long shaft. The rotational energy of moving vehicles is converted into electromagnetic flux. The power can flow in either direction, thus a specialized component called a zenor diode is used to turn it into a unidirectional source.

The speed breaker and the other mechanisms can be stored inside the dome. The energy produced can be magnified and stored using various electrical devices.

4.5. Summary

In this chapter, we discuss how we implement this project and the parts and tools we used to accomplish our goals. Besides we discuss how our simulation, hardware, and 3D were made and designed. we took some workshop labor help to complete our hardware as we cannot make it on our own also there is a financial issue as well because we need very high voltage to joint it.

Chapter 5

RESULTS ANALYSIS & CRITICAL DESIGN REVIEW

5.1. Introduction

The use of speed breakers to create electrical power is the primary focus of this article. The goal is to install a technology system in place of conventional speed bumps. The world's population is rising at an alarming rate, and the Energy is becoming scarcer as a result of a decline in supply. Our research focuses on a potential solution involving the recycling of energy lost when cars travel over speed bumps. The rollers attached to a generator spin as the vehicles drive around. This method will be a remarkable way to generate electricity, especially considering the brisk pace at which the number of automobiles is growing. It has a wide range of possible applications. This system makes it easy to utilise the energy stored during the daytime hours during the night. Contrarily, the price of raw materials for production is quite low.

5.2. Results Analysis

The generation of electricity has become a major issue in modern civilization, making the pursuit of improvement all the more pressing. Speed breakers can be used in three distinct ways to generate electricity: as it is a prototype project so we could not do real-time experiments using heavy vehicles. We took various weights 5kg to 40kg and measured the output voltage and current using a multimeter and we ensure 220-ohm resistance during this process. The result we got was not sufficient as there were multiple losses such as friction, torque, and mechanical loses. In light of this, this article explores the potential of the highway's speed breaker as a source of renewable energy.

5.2.1. Simulated Results

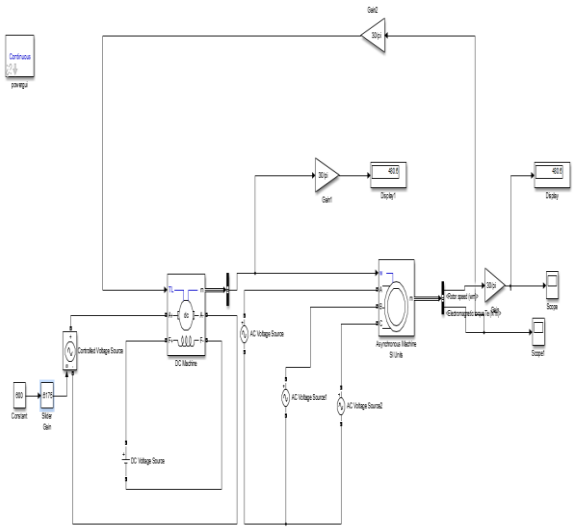

Figure 5.1: Simulation Result

5.2.2. Hardware Results

Figure 5.4: Hardware Implementation

This model demonstrates how a voltage can be produced from the movement of vehicles on the road. The city as a whole has extremely heavy traffic, and some roads move at a snail's pace. The primary component of this set up is the bearing-carrying U-shaped shaft that is attached to the top of the speed breaker.

We don't need to rely on those unreliable external power sources to get the job done. The increased volume of traffic on the roads in today's major cities is a major nuisance for residents there. However, this novel method can harness this traffic to produce electricity. If installed on high-traffic roadways, the shafts can generate mechanical power using the weight and kinetic energy of passing vehicles, which is then transformed back into electricity. These are more reliable than any other power source because they do not rely on an external source and traffic will never be diminished. Moreover, from the perspective of the customer, it is possible in the ways that

Figure 5.5: Inner view

The bearing is there to allow the shafts to rotate in relation to one another. This is how we plan to transform up-and-down motion into round-and-about motion. A return spring will be installed towards the top of the speed breaker to keep it in place after being displaced by the downward weight of vehicles. The load capacity of the spring is calculated based on the mass of the cars that will be driving over it. The aid bearing will be used to secure both ends of the shaft. Mild steel is used to make the shaft. The sprocket, which will spin in the same direction as this shaft, will be included. The chain drive will connect this sprocket to another sprocket positioned on the other shaft; this mechanism is similar to a bicycle's gear set-up. There's a gear on the lower shaft, too.

Figure 5.6: Upper Inner view

The mechanism for winding and unwinding a roll able blind includes a support element, a drive sprocket rotatable mounted on the support element for transmitting rotational movement to a blind supporting member, and a manually movable elongate flexible drive element which includes a plurality of interlinked tooth-engaging elements.

A	B	C	D
Time(s)	Voltage(V)	current(mA)	charge(mC)
1	1.1	5mA	5mC
2	1.5	6.8mA	13.6mC
2.5	1.7	7mA	17.5mC
3	2.4	10.9mA	32.7mC
3.6	2.8	12.7mA	45.72mC
4	2.8	12.7mA	50.8mC

Figure 5.7: Output Data of the project

In this study, we present the development of a prototype hardware system for generating power using the aforementioned method. Electricity will be produced by these piezoelectric generators when

Figure 5.8: Graphical Representation of the Voltage output

Applying force mechanically. A millimeter is used to determine the voltage in volts. The electricity is then fed into a rectifier circuit, which uses the energy to smooth out the DC output from the generator. A battery will be used to store this direct current electricity.

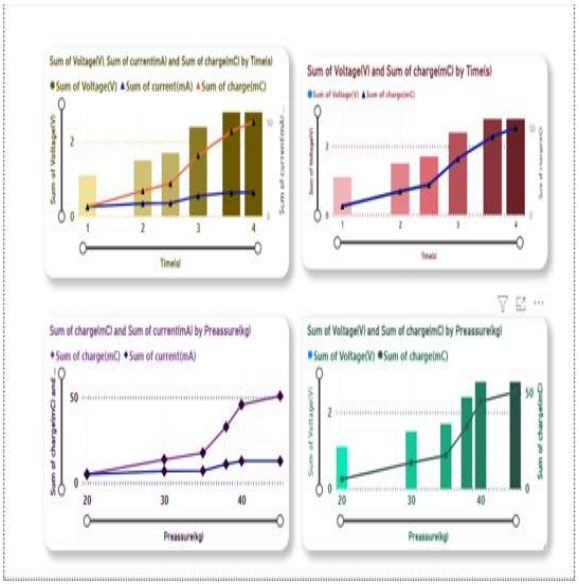

Figure 5.9: Graphical Representation of the current output

Applying force mechanically. A millimeter is used to determine the voltage in millivolts. The electricity is then fed into a rectifier circuit, which uses the energy to smooth out the DC output from the generator. A battery will be used to store this direct current electricity.

5.3. Comparison of Results

Through a rack and pinion system, the kinetic energy of moving vehicles can be transformed into the mechanical energy of the shaft. The electric dynamo, to which this shaft is connected, generates power in direct proportion to the volume of traffic. Zener diodes can be used to control the output of this generator to provide a steady supply of electricity. The hump-shaped speed bump can hold all this machinery. The electricity produced can be utilized for anything, including public utilities like lamps and traffic signals. Assembling these power humps in a series increases their electrical output. Various electric gadgets can be used to amplify and store this power. Maintaining hump is essentially free. If we implement this plan, we can meet the future needs, at least partially.

The potential for a speed breaker to generate power is an emerging field of study. The primary idea behind this project is to harness the kinetic energy of the ever-increasing number of vehicles on the road by converting it into the rotational motion of a roller, which in turn generates a sizable amount of electricity. In this design, a roller is installed between two speed breakers and secured by a grip, such that the roller spins when cars drive over the breakers. The D.C. generator's shaft is rotated by this roller movement thanks to the chain drive, which provides a speed ratio of 1 to 5. The shaft of a direct current (DC) generator generates energy as it revolves. The battery stores this energy until it is needed. The battery's power is then channeled to the roadway's lampposts. Daytime street lighting no longer requires power, thus a manual control switch is being used instead. A wire runs from the control switch to the battery terminal. The ON/OFF function of the control switch allows electricity to flow only when necessary.

When a car or other large vehicle traveling at 100 mph on the road passes over this roller, installed at road level, the roller picks up speed, reaching over 90 mph (due to losses). For example, if a cyclist traveling at only 20 mph tries to pass a roller traveling at 90 mph, the two vehicles will collide. This is the basic rationale behind the design of the speed breaker.

5.4. Summary

This chapter described about the projects results analysis & critical design review of the whole hardware model along with all the systematic foundation of the project. This chapter also shows the in-depth analysis of the project hardware and implementation.

Chapter 6

CONCLUSION

6.1.Summary of Findings

The approach to power generation is novel. Energy sources like coal, oil, etc., that are currently in use may not be sufficient to fulfill future energy needs. Traditional energy sources are also dwindling and may be depleted by the turn of the next century. Therefore, engineers need to make genuine and persistent efforts to investigate the feasibility of extracting energy from a variety of other sources. This endeavor represents the first stage along the route. The overarching objective during the creation of the speed breaker System was to keep the engineering, producer, and customer models under control. This feature was preferred over others because its effects on the whole system would be more noticeable. One can achieve the desired size, weight, and capacity by adjusting the asking price and size. We surveyed the market to determine the relative sizes of various storage options. Many lessons were gleaned about what to do and what not to do when conducting a survey.

6.2.Novelty of the work

To transform heat energy into mechanical linear motion, engineers in the automotive industry have turned to pistons. The mechanism's crank shaft transforms the linear motion of the crank into a rotating motion. The crankshaft rotates, creating rotary motion, which is transmitted to the differential via the power transmission system. The crank shaft mechanism in this power plant employs kinetic energy, rather than thermal energy, to either force the piston down or generate linear motion. As a result, the speed breaker's piston is depressed anytime a vehicle travels over it because of the impact of the vehicle's kinetic energy. As a result, the piston drives the crankshaft to rotate halfway. Inertia plays a role in the design of the crank, which means that the crank itself completes the second half of each revolution to lift the piston. In this way, the piston is able to return to its starting position by resetting the brake. The circular motion is generated by a crank shaft mechanism. Transmission system transfers circular motions to the generator.

6.3. Cultural and Societal Factors and Impacts

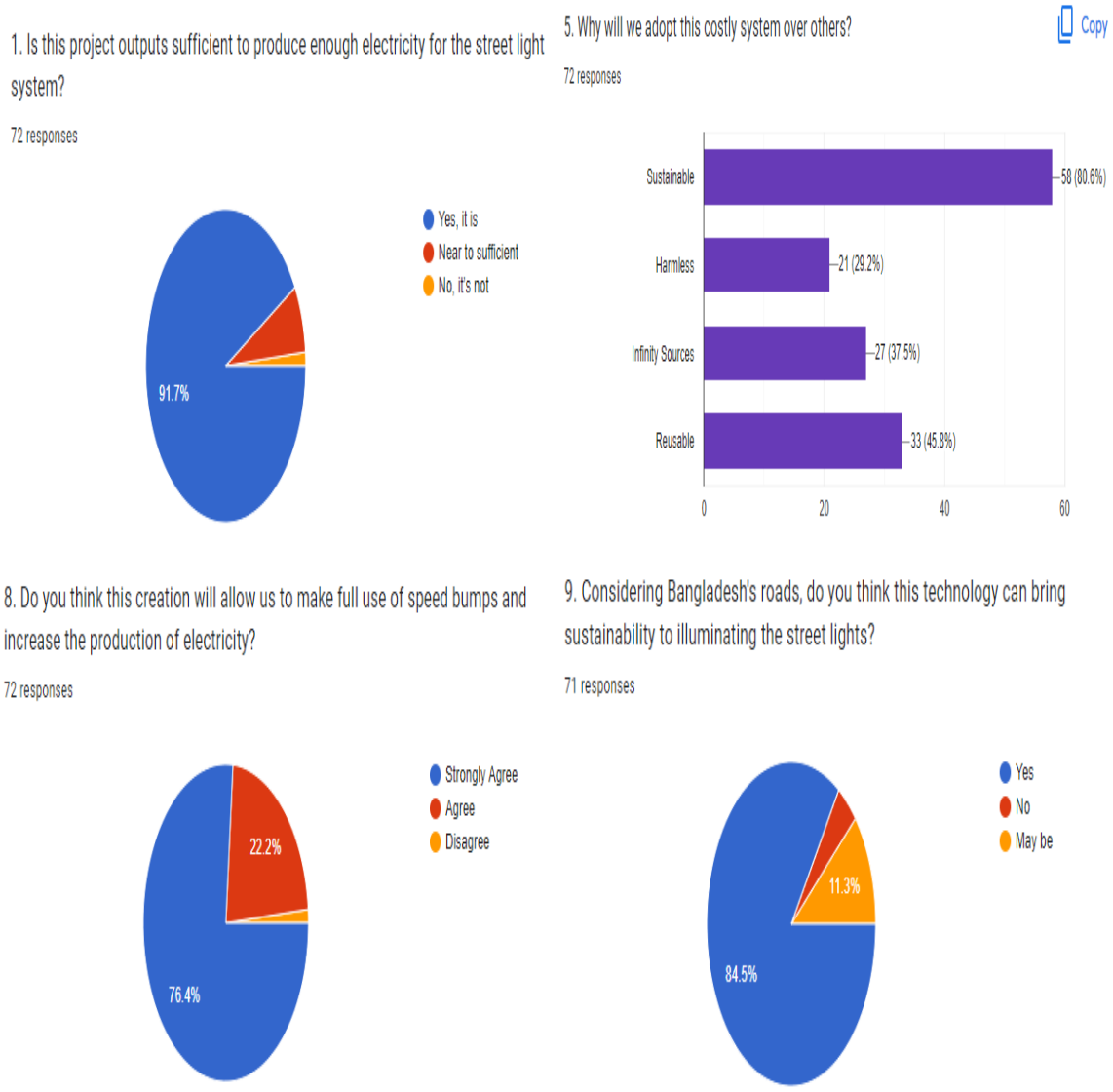

Fig 6.1: survey graphical representations

6.4. Limitations of the Work

Torque, which is essential for energy generation, will not be provided by the bumpy or flat route. Whenever a car drives over a speed breaker, it slows down. Potential energy is increased due to the relatively high altitude of these breakers. The goal of this effort is to employ a gear arrangement to extract energy from a speed breaker. Integrating a pressure transducer into the system is a great way to improve its performance. The energy produced is suitable for municipal purposes, such as powering streetlights and traffic signals. Modifying the electrical setup can increase output.

6.5. Future Scopes

The long-term goal of this research is to make speed breakers that are more environmentally friendly by experimenting with new materials. It is also possible to improve the system by incorporating alternative power generators. Speed bumps can boost the generator's output by raising the input torque. Optimal and smaller-scale techniques to improve productivity. Near 65,000 villages in Bangladesh still face access to power, according to a depressing report published as part of an investigation into the country's energy consumption. Therefore, additional investment in scientific study and technological innovation is required. The energy from these sources can be used to power the lights along the highways, and the excess energy can be used to supply electricity to the surrounding villages. Light vehicles are also an option

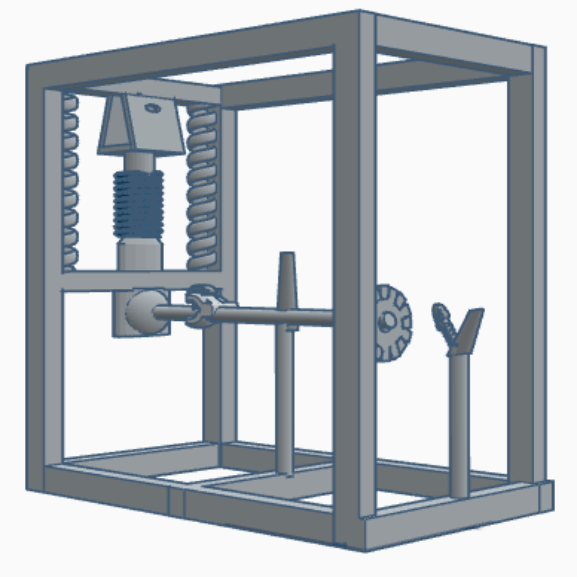

Fig 6.2: High technical and developed Speed breaker mechanism

There is an opportunity to improve the rpm or generator by using this model and mechanism but this crankshaft is not commercially available in Bangladesh. If in future this part will available in our country then we can make this design as well. Because of the financial situation, we faced some limitations but in the future, we can improve this with better technologies.

6.6. Social, Economic, Cultural and Environmental Aspects

6.6.1. Sustainability

Having access to reliable and affordable energy is crucial to our survival. As people become more reliant on automated systems, so too do their energy demands. This, along with the world's growing population, has resulted in an unprecedented need for power. Traditional energy sources like fossil fuels are responsible for meeting the vast bulk of this need. As a result, we're rapidly running out of our planet's natural resources. High levels of pollution have had a negative impact on the global climate, and this pollution has been exacerbated by the use of fossil fuels. We can speed up the transition to non-conventional energy sources by expanding their use in the real world. This study demonstrates the potential for making use of the otherwise wasted kinetic energy of moving automobiles. A speed breaker model is used to turn this kinetic energy into mechanical/vibrational energy, which is then translated into electrical energy by means of piezoelectric materials. This electrical energy is clean and can be utilized to power street lights, recharge batteries, and charge electric vehicles. The only way to achieve long-term growth and a good standard of living is to reduce our reliance on fossil fuels and instead switch to renewable energy sources.

6.6.2. Economic and CulturalFactors

Converting one form of energy into another is the cheapest and most promising new energy source. Renewable energy sources are gaining popularity as a result of their low environmental impact and abundance in the natural world. This study details one such form of energy. The daily count of cars going over the road's speed breaker is rising. Heavy-duty vehicles' need for a greater input torque results in a greater output power from these types of speed bumps. Efficient mechanisms, both large and little, abound. The energy produced can be used to light up the areas around the speed bumps, which will be especially helpful to the surrounding rural communities. This research focuses on the development and practical application of a rack and ratchet (pinion) mechanism for extracting power from speed breakers.

6.7.Conclusion

Electricity is crucial to the way people live. The current power generation is insufficient to meet our needs because of the rapid increase in the human population. We find a dependable mechanism for generating electricity from speed breakers, and this method will aid in the preservation of our planet's natural resources. As it approaches days, this will show to be an enormous benefit for the global community by

reducing the amount of power generated by power plants that is squandered on lighting streets. Traditional sources are dwindling rapidly, so it's time to start considering replacements. It is imperative that we conserve the energy produced by traditional means. Therefore, this concept not only offers selection, but also benefits the national economy.

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Appendix A

```
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 16, 2);
#define Volt_Meter A0
float Vout = 0.00, voltage = 0.00, voltage1 = 0.00;
float R1 = 100000.00;
float R2 = 7300.00;
 int val = 0, perc = 0;
void setup()
{ pinMode(Volt_Meter, INPUT);
Serial.begin(9600);
lcd.init();
lcd.backlight();
}
void loop()
{
val = analogRead(Volt_Meter);
Vout = (val * 5.00) / 1024.00;
voltage = Vout / (R2 / (R1 + R2));
if (voltage < voltage1)
{
val = analogRead(Volt_Meter);
Vout = (val * 5.00) / 1024.00;
 voltage = Vout / (R2 / (R1 + R2));
}
voltage1 = voltage;
if (voltage < 0.09) //condition
{
voltage = 0.00;
}
perc = map(voltage, 17.0, 24.00, 0, 100);
 if (perc >= 100) {
perc = 100; }
if (perc <= 0)
{
 perc = 0; }
if (voltage >= 26)
{ lcd.setCursor(0, 0);
lcd.print("Battry Charging..");
 lcd.setCursor(0, 1);
lcd.print(" ");
}
else
{ lcd.setCursor(0, 0);
```

```
lcd.print("Voltage:");
lcd.print(voltage);
lcd.print("V ");
 lcd.setCursor(0, 1);
 lcd.print("V. LVL :");
 lcd.print(perc);
 lcd.print("% ");
}
Serial.print("Voltage= ");
Serial.println(voltage);
 Serial.print("Battery level= ");
 Serial.print(perc);
 Serial.println(" %");
 delay(3000);
}
```

Appendix B

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ORIGINALITY REPORT

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SIMILARITY INDEX

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