Design and Construction of Electricity Generation System Using Exhaust fan for Industrial Application.

A report submitted to the Department of Mechanical Engineering, Sonargaon University of Bangladesh in partial fulfillment of the requirements for the Award of Degree of Bachelor of Science in Mechanical Engineering.

Submitted by

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LETTER OF TREANSMITTAL

September, 2022

To

Md. Ahatashamul Haque Khan Shuvo
Lecturer & Course Coordinator
Department of Mechanical Engineering.
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Subject: Submission of Project Report.

Dear Sir,

We are pleased to submit the project report on "**Design and Construction of Electricity Generation System Using Exhaust fan for Industrial Application".** It was a great pleasure to work on such an important topic. This project has been done as per instruction of your supervision and according to the re quirements of the Sonargaon University.

We expect that the project will be accepted by the concerned authority we will remain happy to further explanation that you may feel necessary in this regard.

Thank You
Sincerely yours,

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DECLARATION

We do hereby solemnly declare that, the work presented here in this project report has been carried out by us and has not been previously submitted to any University/ Organization for award of any degree or certificate

We hereby ensure that the works that has been prevented here does not breach any existing copyright.

We further undertake to indemnify the university against any loss or damage arising from breach of the foregoing obligation.

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CERTIFICATE OF SUPERVISOR

This is to certify that the thesis paper on **"Design & Construction of Electricity Generation System Using Exhaust fan for Industrial Application"** has been prepared as a part of completion of the BME program from Department of Mechanical Engineering , Sonargaon University (SU) carried out by Md. Mehedi Hasan, ID: BME1901017372 , Md. Foyez Ali, ID: BME1901017480, Afsana Adil, ID: BME1802015179, Md. Anowar Hossain, ID: BME1901017632, Md. Mobarak Hossen, ID: BME1803016293 under my supervision. The report or the information will not be used for any other purpose.

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ACKNOWLEDGEMENT

First, we started in the name of almighty Allah. This thesis is accomplished under the supervision of **Md. Ahatashamul Haque Khan Shuvo**, Lecturer & Course Coordinator, Department of Mechanical, Sonargaon University. It is a great pleasure to acknowledge our profound gratitude and respect to our supervisor for this consistent guidance, encouragement, helpful suggestion, constructive criticism and endless patience through the progress of this work. The successful completion of this thesis would not have been possible without his persistent motivation and continuous guidance.

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ABSTRACT

The energy demand of the world has become unbridled in the past years and is augmenting by leaps and bounds. With increase in energy demand, the conventional sources of energy (fossil fuels, nuclear) are encumbered with monumental pressure and hence, the unremitting use of it, leads to dearth of fossil fuels. This has provoked an extensive research into the area of non-conventional energy sources like hydro, wind, thermal energy, etc. Out of these, the wind energy is being discussed in this paper. Wind energy has a lot of potential and advantages but its utilization is restricted due to its irregularity, geographical conditions and its availability. Our primary goal is to suggest an idea that can surmount these conundrums and utilize the wind energy to its maximum extent. This paper deals with the wind energy that can be derived from the wasted wind energy from industrial exhaust fans. The wind force from an exhaust fan can drive a small windmill and the energy generated from it will be stored in energy storage unit. The power stored in the battery and then it can be supplied to the load and hence, this wasted power from exhaust fan can be utilized to meet the growing energy demand.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

Nowadays, a global energy consumption has in both developed and developing countries has expanded rapidly due to the population extension and it is expected to twin or more by the year 2042.The utilization of sustainable power innovation to satisfy the energy needs has been persistently expanding for as far back as couple of years. For this reason we have the chipped away at a different thought. We considered fumes fans utilizing in enterprises as a high speed and consistent breeze source Now a days, worldwide energy utilization in both created and non-industrial nations has expanded quickly because of populace development and it is required to twofold or more constantly 2040.Renewable energy (RE) resources play an important role as alternative energy sources to limit the dependency on fossil fuels for electricity generation. Recently, numerous researchers have put RE in the limelight and intensive researches were done to improve the efficiency of RE resources for energy generation.

This patented system comprises of two vertical axis the wind turbines (VAWTs) installed above an exhaust outlet in cross wind orientation to harness the discharged wind energy. The discharged wind energy from the exhaust air system is reliable for electricity generation because it is strong and consistent; allowing VAWTs to operate with minimum fluctuation. This theory is successfully utilized by the diffuser increase wind turbine (DAWT). DAWT is the hot topic to better the output power of a wind turbine. The softening of ice causes the ascent of ocean level and lesser land can be utilized for an expanding total populace, alongside the adjustments in environment. It helps to accelerate the wind speed by creating a separation region behind the wind turbine where low-pressure regions act as sucking the effect to draws a more wind compared to a conventional wind turbine.16 One of the most recent experimental investigations on the diffuser design of a horizontal axis wind turbine showed that the performance has of a diffuser-shrouded the wind turbine is better in terms of a power coefficient.

1.2 Background Study

Economic growth and energy demand are intertwined. Developed countries are known as the major users of energy globally, however, most of the increasing demand will occur in developing countries, where populations, economic activities and improvements in quality of life are growing most rapidly. Global energy consumption in both developed and developing countries is expected to double or more by the year 2040 ("The Outlook for Energy: A view to 2040," 2018). Currently, the world relies on coal, crude oil and natural gas for energy generation. However, energy crisis such as climate change and depletion of oil (which leads to the oil price inflation) becomes one of the main problems to all countries.

For that reason, generating energy from renewable sources remain relevant to be implemented and explored. To meet the energy demand without damaging the planet, the energy generation from renewable sources becomes more widespread. It is proven that the renewable energy sources available can meet many times the present world energy demand, thus their potentials are enormous. However, most of the current technologies on renewable energy generation are still at an early stage of development and not technically mature. Thus, there is an urgent call for researchers and innovators to come out with the best possible solution for clean energy.

1.3 Aim & Motivation

The aim is to build a system that uses Exhaust Fan to generate electricity in rural areas. The system controls all settings. Air blowers usually use medium power to move air forward. Inside the centrifugal fan there is a wheel with small blades in the circle and a case that directs the air flow in the center of the wheel and exits the edge. The design of the blade will affect the way the wind blows and the efficiency of the wind turbine. This project uses Exhaust Fan set, turbine and DC Generator. It is a renewable energy program that can reduce energy demand by creating waste energy. This system allows countries with low wind speeds, especially in urban areas, to use wind energy from fixed and predictable wind sources.

1.4 Problem Identification

The rapid depletion of natural resources and fossil fuels have led to the development of alternative sources of energy. The conventional sources of energy are non- renewable, cause pollution, not sufficient to meet the growing energy demand. Due to these reasons, it is imperative that we must start exploring and developing methods to utilize the non-conventional energy sources to reduce too much of dependence on conventional sources. One of the most arresting form of non-conventional energy is wind energy.

1.5 Objectives

The objectives of this project are:

a) To study about "**Design & Construction of Electricity Generation System Using Exhaust fan for Industrial Application".**
b) To design and construct an **Exhaust Fan Electricity Generation for Industrial Applications**
c) To test the performance of the **Exhaust Fan Electricity Generation.**

1.6 Organization of the Book

- **Chapter 1: Introduction.** This chapter is all about background study, motivation, Objectives and thesis book organization.

- **Chapter 2: Literature Review**- Here briefly describe about previous book review, Block diagram, Circuit Diagram, Components List and Summary of this chapter.

- **Chapter 3: Hardware and Software Analysis**- This chapter is discussed about our project hardware and Software . Here we describe our hole instrument details.

- **Chapter 4: Methodology–** Here briefly discuss about project methodology, working principle and our system overview.

- **Chapter 5: Results and Discussion–** Here briefly discuss about project discussion, result analysis, advantages, application and our system overview.

- **Chapter 6: Conclusion** – This chapter is all about our thesis future recommendation and this project conclusion.

CHAPTER 2
LITERATURE REVIEW

2.1 Wind Power

Wind power is the conversion of wind energy into a useful form of energy, such as using: wind turbines to make electrical power, windmills for mechanical power, wind pumps for water pumping or drainage, or sails to propel ships.

Advantages of wind energy:

- It is renewable source of energy.
- It emits no greenhouse gases and hence nonpolluting.
- It uses very little land .
- Fuel transportation are not required in wind energy conversion system.

Disadvantages of wind energy:

- Owing to its irregularity, the wind energy needs storage.
- Availability of energy is fluctuating in nature.
- Wind energy conversion is noisy in operation.
- Low energy density
- Maintenance is required.
- Wind turbines design, manufacture and installation have proved to be most complex due to several variables and extreme stresses.
- Its implementation is limited due to geographical locations.

2.2 Literature Review

Wind Energy Wind is a natural phenomenon that is caused by the uneven heating of the atmosphere by the sun, the irregularities of the earth's surface, and rotation of the earth (Bhatia, 2014). Energy available in wind is basically the energy of large masses of air

moving over the earth's surface. Blades of wind turbine receive this kinetic energy, which is then transformed to mechanical or electrical forms, depending on the end use. The efficiency of converting wind to other useful forms of energy greatly depends on the efficiency with which the rotor interacts with the wind stream (Mathew, 2006). Nowadays the utilization of wind energy for electricity generation has become very popular where the global installed wind power capacity is approximately 370 GW at the end of 2014, a 16% increase from the previous year ("GlobalWind Energy Report: Annual Market Update 2014," 2015). Wind energy is one of the earliest sources of energy when it was utilized to propel ships and boats during ancient times. The first documented design of a wind mill dates back to 200 B.C. where the Persians used wind mills for grinding grains. At the end of the 18th century, experiments began in which windmills were used to generate electricity in the United States and Denmark. The research continues until today and wind power generation has become an icon for clean and sustainable energy generation.

Exhaust Fan:

Exhaust Fan are heat removal devices used to transfer waste heat to the atmosphere; large office, buildings and Industries premises typically install one or more exhaust fans for building ventilation system. This type of Exhaust fans relies on power-driven fans to draw or force the air through the blades. Most air-conditioning systems and industrial processes generate heat that must be removed and dissipated. Water is commonly used as a heat transfer medium to remove heat from refrigerant condensers or industrial process heat exchangers. Cooling towers are commonly used to dissipate heat from water-cooled refrigeration, air-conditioning systems, and industrial process systems. Cooling towers are heat removal devices used to transfer waste heat to the atmosphere; large office buildings, hospitals and schools typically install one or more cooling towers for building ventilation system.

2.3 Block Diagram

In our project we have set up an "**Design & Construction of Electricity Generation System Using Exhaust fan for Industrial Application".** In this circuit we have used one exhaust fan for main wind source unit. Here we also use a turbine, generator motor, battery and load etc. In this diagram we will show by block the individual parts.

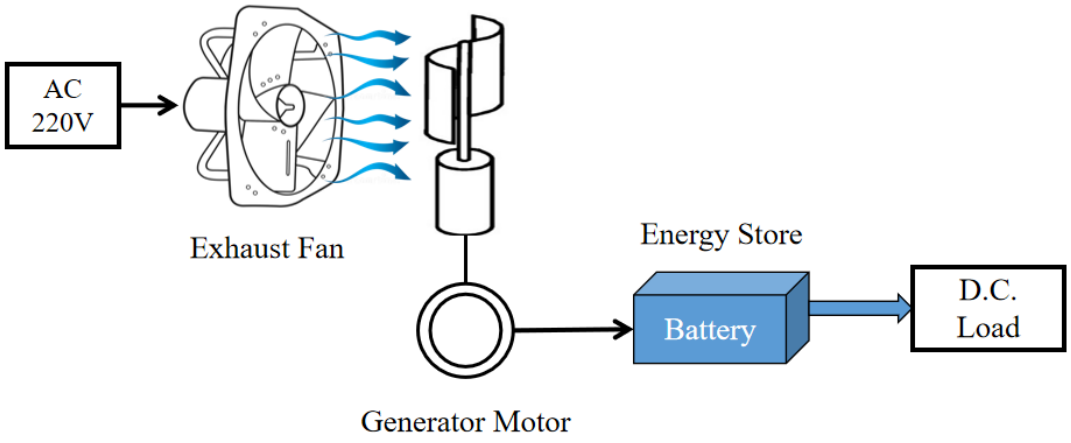

Figure 2.1: Block Diagram of "**Design & Construction of Electricity Generation System Using Exhaust fan for Industrial Application".**

2.4 Circuit Diagram

The schematic diagram here is representing the electrical circuit and the components of the "**Design & Construction of Electricity Generation System Using Exhaust fan for Industrial Application".** Here we connect equipment with he smart wire connection.

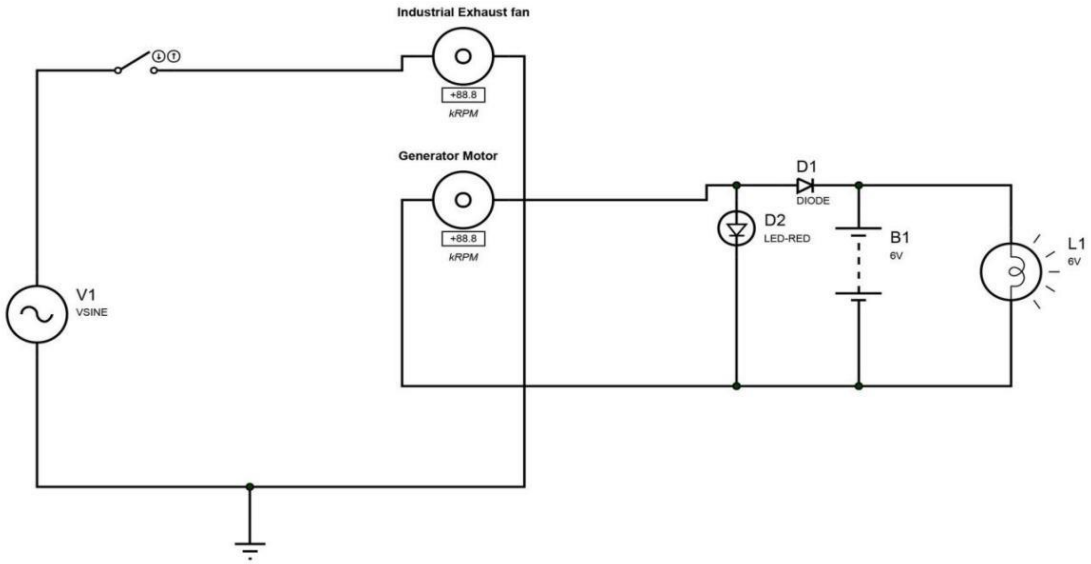

Figure 2.2: Schematic Diagram of "**Design & Construction of Electricity Generation System Using Exhaust fan for Industrial Application".**

2.5 Components List:

Hardware Part:

1. Exhaust Fan
2. Generator Motor
3. Wind Turbine
4. Battery
5. Pulley
6. Blower Fan
7. DC Light
8. Holder

Software Part:

1. Proteus

2.6 Summary

The above discussion gives an idea about the Exhaust Fan Electricity Generation for Industrial Applications.. All that work on this system already been done here, and the results of their work, the use of Exhaust Fan Electricity Generation in the situation are described in detail. From this we also got the direction of work of the project.

CHAPTER 3
HARDWARE AND SOFTWARE ANALYSIS

3.1 Wind Turbine

A wind turbine is a rotating machine which converts the kinetic energy in wind into mechanical energy. If the mechanical energy is then converted to electricity, the machine is called a wind generator, wind turbine, wind power unit (WPU), wind energy converter (WEC), or aero- generator. Wind turbines can be separated into two types based by the axis in which the turbine rotates. Turbines that rotate around a horizontal axis are more common. Vertical-axis turbines are less frequently used.

3.2 Vertical axis Wind Turbines

Figure 3.1: Vertical axis wind turbine

Vertical-axis wind turbines (or VAWTs) have the main rotor shaft arranged vertically. Key advantages of this arrangement are that the turbine does not need to be pointed into

the wind to be effective. This is an advantage on sites where the wind direction is highly variable. VAWTs can utilize winds from varying directions. With a vertical axis, the generator and gearbox can be placed near the ground, so the tower doesn't need to support it, and it is more accessible for maintenance. Drawbacks are that some designs produce pulsating torque. Drag may be created when the blade rotates into the wind.

VAWT advantages

- A massive tower structure is less frequently used, as VAWTs are more frequently mounted with the lower bearing mounted near the ground.

- Designs without yaw mechanisms are possible with fixed pitch rotor designs.

- A VAWT can be located nearer the ground, making it easier to maintain the moving parts.

- VAWTs have lower wind startup speeds than HAWTs. Typically, they start creating electricity at 6 M.P.H. (10 km/h).

- VAWTs may have a lower noise signature.

VAWT disadvantages

- Most VAWTs produce energy at only 50% of the efficiency of HAWTs in large part because of the additional drag that they have as their blades rotate into the wind.

- While VAWTs' parts are located on the ground, they are also located under the weight of the structure above it, which can make changing out parts nearly impossible without dismantling the structure if not designed properly.

- Having rotors located close to the ground where wind speeds are lower due to wind shear, VAWTs may not produce as much energy at a given site as a HAWT with the same footprint or height.

- Because VAWTs are not commonly deployed due mainly to the serious disadvantages mentioned above, they appear novel to those not familiar with the wind industry. This has often made them the subject of wild claims and investment scams over the last 50 years.

3.3 Generator Motor

A motor–generator (an M–G set) is a device for converting electrical power to another form. Motor–generator sets are used to convert frequency, voltage, or phase of power. They may also be used to isolate electrical loads from the electrical power supply line. Large motor–generators were widely used to convert industrial amounts of power while smaller motor–generators (such as the one shown in the picture) were used to convert battery power to higher DC voltages.

While a motor–generator set may consist of distinct motor and generator machines coupled together, a single unit dynamotor (for dynamo–motor) has the motor coils and the generator coils wound around a single rotor; both the motor and generator therefore share the same outer field coils or magnets. Typically the motor coils are driven from a commutator on one end of the shaft, while the generator coils provide output to another commutator on the other end of the shaft. The entire rotor and shaft assembly is smaller, lighter, and cheaper than a pair of machines, and does not require exposed drive shafts. Low-powered consumer devices such as vacuum tube vehicle radio receivers did not use expensive, noisy and bulky motor–generators. Instead, they used an inverter circuit consisting of a vibrator (a self-exciting relay) and a transformer to produce the higher voltages required for the vacuum tubes from the vehicle's 6 or 12 V battery

Figure 3.2: DC Generator Motor

Before solid state AC voltage regulation was available or cost effective, motor generator sets were used to provide a variable AC voltage. The DC voltage to the generators armature would be varied manually or electronically to control the output voltage. When used in this fashion, the MG set is equivalent to an isolated variable transformer. An Alexanderson alternator is a motor-driven, high-frequency alternator which provides radio frequency power. In the early days of radio communication, the high frequency carrier wave had to be produced mechanically using an alternator with many poles driven at high speeds. Alexanderson alternators produced RF up to 600 kHz, with large units capable of 500 kW power output. While electromechanical converters were regularly used for long wave transmissions in the first three decades of the 20th century, electronic techniques were required at higher frequencies. The Alexanderson alternator was largely replaced by the vacuum tube oscillator in the 1920s.

3.4 Exhaust Fan

An exhaust fan is a fan which is used to control the interior environment by venting out unwanted odors, particulates, smoke, moisture, and other contaminants which may be present in the air. Exhaust fans can also be integrated into a heating and cooling system. Common locations for exhaust fans include bathrooms and kitchens, and these fans are usually very easy to install, so they can be situated in many other locations as well. For

installation, people do need a few tools, and they must be comfortable working with electricity to wire the fan in place.

Figure 3.3: Industrial Exhaust Fan (Front Side)

Working Principle of Exhaust Fan

Exhaust fans work on the basic principle of sucking hot air, smell, moisture and dust from the room and pushing it outside. All fans work on this principle but the main purpose of an exhaust fan is to suck hot air from your house and blow it out from the other side. The exhaust fan blades are attached to a hub and the fans are angled in a way that when it rotates, it sucks air from one side and throw it from another side.

Industrial fans are bigger, consume a lot of power and are difficult to maintain. These fans are attached to warehouses and industries and commercial places. Industrial exhaust fans come in different shapes, sizes and forms but work on the same principle as a consumer exhaust fan. The main purpose of these fans is to maintain the temperature, moisture and humidity and remove foul smell.

Figure 3.4: Industrial Exhaust Fan (Backside)

Benefits of an Exhaust fan

1. Removes smell and odour from rooms.
2. Removes small dust particles.
3. Cool the rooms.
4. Removes heat and moisture from rooms.
5. Help prevent the building of fungus.
6. Easy to maintain and clean.
7. Energy-efficient.

3.5 Blower Fan

A **blower**, commonly known as a **blower**, is a gardening tool that propels air out of a nozzle to move debris such as leaves and grass cuttings. Blowers are powered by electric or gasoline motors. Gasoline models have traditionally been two-

stroke engines, but four-stroke engines were recently introduced to partially address air pollution concerns.

Blowers are typically self-contained handheld units, or backpack mounted units with a handheld wand. The latter is more ergonomic for prolonged use. Larger units may rest on wheels and even use a motor for propulsion. These are sometimes called "walk-behind leaf blowers" because they must be pushed by hand to be operated. Some units called **blower vacs**, can also suck in leaves and small twigs via a vacuum, and shred them into a bag.

Figure 3.5: Blower Machine

Benefits of Blowers

Blowers and fans are a highly efficient and maintenance free method for moving high volumes of air at high pressure. Every industrial operation needs to improve the ventilation in its workspace for the safety of its workers. In this age of ecological awareness, this has become an even more important part of facility management and planning.

Low Maintenance

The most notable factor regarding centrifugal blowers is their low maintenance cost. After spending thousands of dollars on equipment repairs and installation, the low cost of a centrifugal blower helps in maintaining and controlling operating costs.

With other methods of air circulation, it is important to frequently check for the build up of dust and dirt. This is not necessary with industrial centrifugal blowers. A small vacuum to clean the motor and vents is all that is needed. The somewhat simple modular design of centrifugal blowers makes them easy to maintain and service.

Energy Savings

With any form of industrial device, efficiency of operation ensures lower cost and improved productivity. The constant and even air flow from a centrifugal blower generates energy that reaches 84% static efficiency, which is an ideal standard for maintaining large air flow systems.

Versatility

One of the main reasons that centrifugal blowers are so widely used is their ability to be adapted, adjusted, and configured to meet the needs of any industrial operation. Centrifugal blowers are capable of operating in any air flow system and can be adjusted to meet the needs of a changing and growing operation. Centrifugal fans and blowers can be found in any type of industry from paper mills to automobile plants. In each case, they serve a different purpose at the highest possible efficiency.

Prevent Overloads

Part of the versatility of centrifugal blowers is in their ability to be engineered to prevent overloads that would shut down other blowers. Centrifugal blowers can be engineered with a horsepower curve that prevents the motor from overloading. This particular feature is especially important for operations that require a constant and even air flow.

Durability

Many modern day manufacturing processes require equipment that can withstand hazardous and harsh conditions due to the operating environment. Centrifugal blowers

and fans are designed to perform in corrosive, toxic, high temperature, and high humidity conditions. Each type of centrifugal blower is engineered to meet the needs of the manufacturing conditions and offer exceptional performance.

3.6 Battery

Ultra-Fire 18650 3.7V 3000mAh Rechargeable Lithium Batteries Without Protection has high discharge performance Li-ion Rechargeable Battery. More than 500 charge-discharge cycles.

Figure 3.6: Battery

Specification:

- Type: B8630
- Capacity: 3000mAh
- Rated Voltage: 3.7V
- Charge Termination Voltage: 4.2V

- Discharge Termination Voltage: 2.75V
- Maximum Charge Current: 6000mAh
- Maximum Discharge Current: 6000mAh
- Material: Lithium

3.7 Motor Pulley

A pulley is a mechanical device which contains a wheel and rope/belt/chain to lift the heavy objects. The wheel of the pulley is generally fixed to a hinge and rotates on an axle or shaft. In a simple arrangement of the pulley, chain/rope/belt/cable is the driving element that drives over the wheel. At the one end of the rope, the object is loaded, and from the end, when the rope is pulled down the object lifts. To lift large objects an assembly of pulleys are used. These are also used to transfer power from one rotating shaft to another. The advantage of the use of pulleys is that by applying a little force heavy objects can be lifted. In other words, the pulleys multiply the force to lift the heavyweights which cannot be lifted with bare hands.

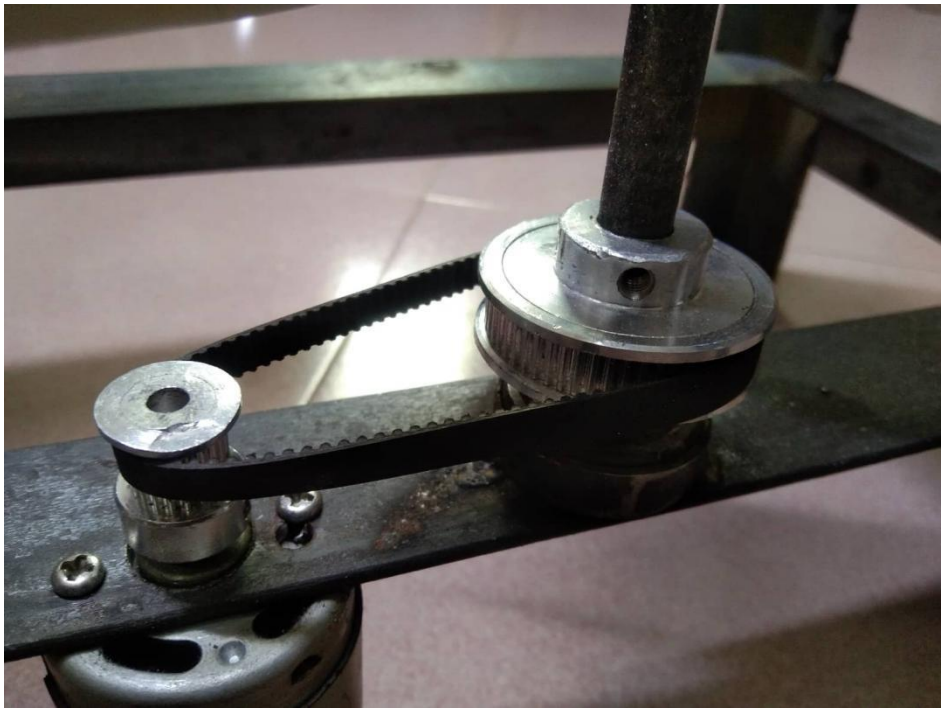

Figure 3.7: Pulley

Types of Pulleys

In the process of doing some work, a pulley is a simple machine that changes the direction and magnitude of the applied force. The rope and pulley system is also known as black and tackle system. There are three types of pulleys,

Fixed: A fixed pulley is mounted on an axle that has bearings at its centre. The wheel of the pulley is fixed on this axle in such a way that it rotates on its centre point. A rope is now surrounded by this wheel so that it can move circumferentially. Sometimes this wheel has grooves which help to rotate the rope around it easily.

Movable: In a movable pulley, the block is mounted on a movable axle which moves along with the weight to be lifted. These pulleys are often attached to the object and multiply the operator's force which the operator applies to the machine. The movable pulley does not change the direction of the object. It is useful to pull up heavier loads as the operator has to exert less force and the resultant force on the load is the multiplication of the operator's force.

Compound: In this class of pulleys, several pulleys are fixed and several pulleys are attached to these fixed pulleys with single or multiple ropes. More is the number of wheels less the effort or force to apply to lift heavyweight. This system not only changes the direction of the load but also requires less force to lift heavy objects.

Measurement of the Performance of Pulley

A term mechanical advantage is coined to calculate the effectiveness of the pulleys. The mechanical advantage of a system is the ratio of force utilised to the force applied to the work. To calculate the mechanical advantage of pulley and rope system, it is assumed that the weights of pulleys and ropes are negligible and there is no loss of energy due to friction between rope and wheel's grooves. And it is also assumed that the ropes/belts/chains used in the operation do not deform (elongate) during the operation.

The mechanical advantage of the pulley system is directly proportional to the number of loops of the rope. In a single loop system, the efforts required to pull the weight is equal to the weight itself. By introducing another loop of rope (adding another wheel attached to the

first wheel by additional rope) the effort requires to pull the same weight becomes half as compared to the previous arrangement.

In this case, the mechanical advantage will be 2. If another loop introduced, the effort becomes one third as compared to the first arrangement and therefore, the mechanical advantage is 3. To increase the mechanical advantage, more pulleys can be added. But after a certain number of pulleys, the mechanical advantage does not change and becomes constant.

Advantages and Disadvantages

- **Advantages**

The main advantage in the use of pulleys is that the effort becomes less as compared to the normal lifting of the weights. In other words, it reduces the amount of actual force required to lift heavy objects. It also changes the direction of the force applied. These two advantages in the use pulleys make them an important tool for heavy lifting. It also provides a mechanical advantage.

The other advantage in the use of pulleys is that the distance between the operator and weight. There is a safe distance between them which avoids any disaster. Pulleys are easy to assemble and cost-effective. The combination of different directional pulleys can change the position of the load with little effort. Though there are moving parts in the pulley system they require less or no lubrication after installation.

- **Disadvantages**

Apart from the above-said advantages while using pulley systems, there are several disadvantages in their use. The main disadvantage in the use of the pulley system is that it requires large space to install and operate. The mechanical advantage of pulleys can go to higher values but need more space to install them.

In some cases, the ropes/belts move over the wheel with no grooves, the chances of the slip of ropes/belts from the wheel are inevitable. If the system is installed to use for a long time,

they require maintenance and regular check-up of ropes/cables as the friction between the wheels and cables/ropes occur causing wear and tear to them. Continuous use of the system makes the ropes weak. The rope may break while using the system causing damages to the operator, surrounding place and the load which is being lifted.

3.8 DC Light

An LED lamp or LED light bulb is an electric light that produces light using light-emitting diodes (LEDs). LED lamps are significantly more energy-efficient than equivalent incandescent lamps and can be significantly more efficient than most fluorescent lamps. The most efficient commercially available LED lamps have efficiencies of 200 lumen per watt (Lm/W). Commercial LED lamps have a lifespan many times longer than incandescent lamps. LED lamps require an electronic LED driver circuit to operate from mains power lines, and losses from this circuit means that the efficiency of the lamp is lower than the efficiency of the LED chips it uses. The driver circuit may require special features to be compatible with lamp dimmers intended for use on incandescent lamps. Generally the current waveform contains some amount of distortion, depending on the luminaires' technology.

Figure 3.8: DC Light

3.9 LED Light

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons (Energy packets). The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.

Figure 3.9: LED Indicator Light

Appearing as practical electronic components in 1962, the earliest LEDs emitted low-intensity infrared (IR) light. Infrared LEDs are used in remote-control circuits, such as those used with a wide variety of consumer electronics. The first visible-light LEDs were of low intensity and limited to red. Early LEDs were often used as indicator lamps, replacing small incandescent bulbs, and in seven-segment displays. Later developments produced LEDs available in visible, ultraviolet (UV), and infrared wavelengths, with high, low, or intermediate light output, for instance white LEDs suitable for room and outdoor area lighting. LEDs have also given rise to new types of displays and sensors, while their high switching rates are useful in advanced communications technology with applications as diverse as aviation lighting, fairy lights, automotive headlamps, advertising, general lighting, traffic signals, camera flashes, lighted wallpaper, horticultural grow lights, and medical devices.

3.10 Proteus Software

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronics design engineers and technicians to create schematics and electronics prints for manufacturing printed circuit boards. The first version of what is now the Proteus Design Suite was called PC-B and was written by the company chairman, John Jameson, for DOS in 1988.

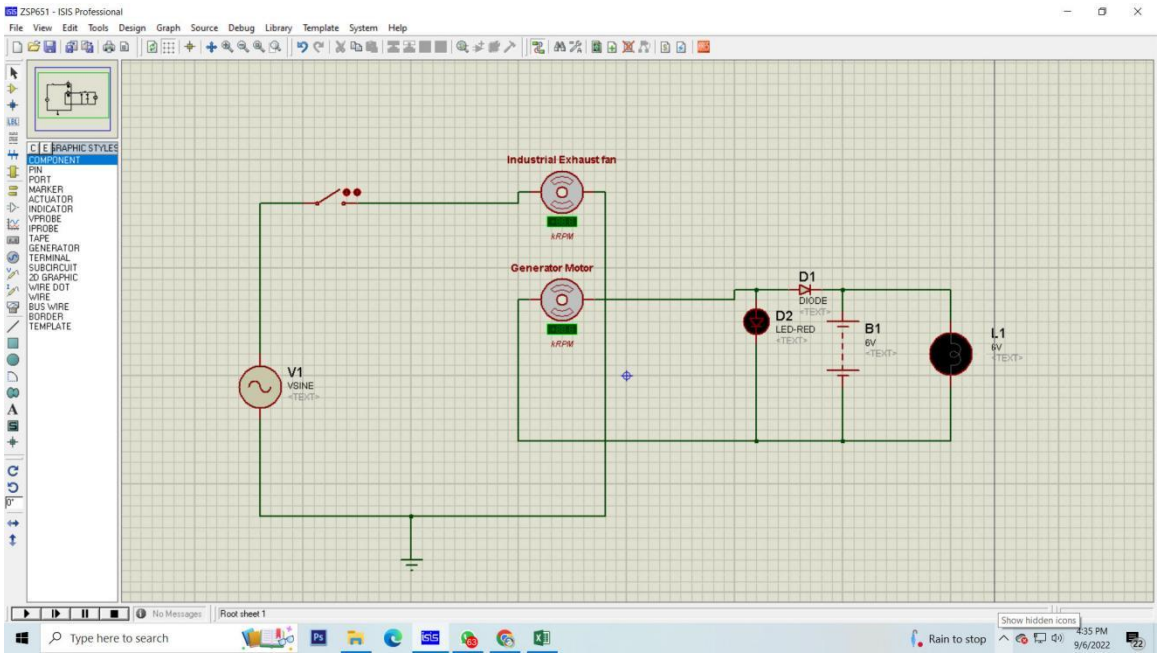

Figure 3.10: Proteus Software Interface

Schematic Capture support followed in 1990 with a port to the Windows environment shortly thereafter. Mixed mode SPICE Simulation was first integrated into Proteus in 1996 and microcontroller simulation then arrived in Proteus in 1998. Shape based auto routing was added in 2002 and 2006 saw another major product update with 3D Board Visualization. More recently, a dedicated IDE for simulation was added in 2011 and MCAD import/export was included in 2015. Support for high speed design was added in 2017. Feature led product releases are typically biannual, while maintenance-based service packs are released as required.

CHAPTER 4

METHODOLOGY

4.1 Our methodologies for the project:

- Creating an idea for the design and construction of "**Design & Construction of Electricity Generation System Using Exhaust fan for Industrial Application"** And designing a block diagram to know which components we need to construct it.
- Collecting all the components for our desired system.
- Setting up all the components in a system. Then assembling all the blocks in a system and finally running the system to check if it actually works or not.

4.2 Our Final System view

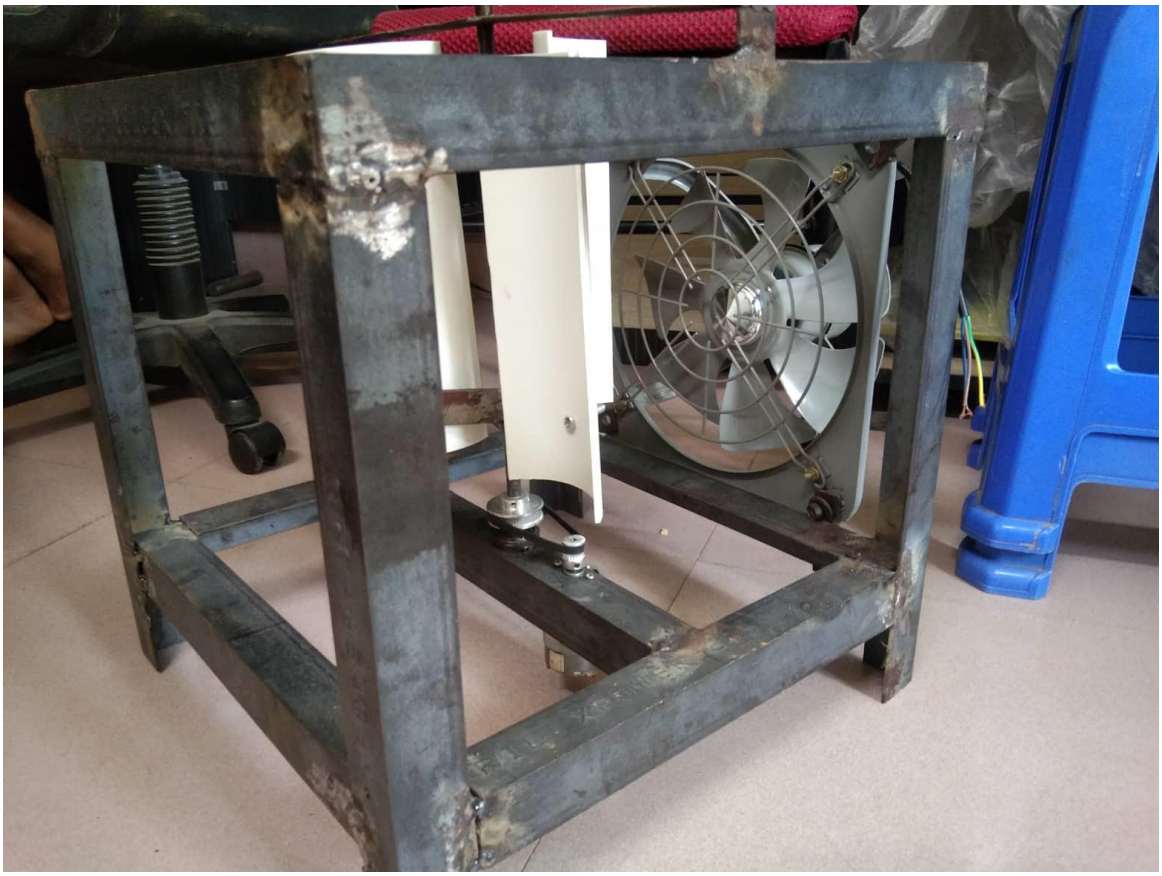

Figure 4.1: Our Final System Overview (Side View)

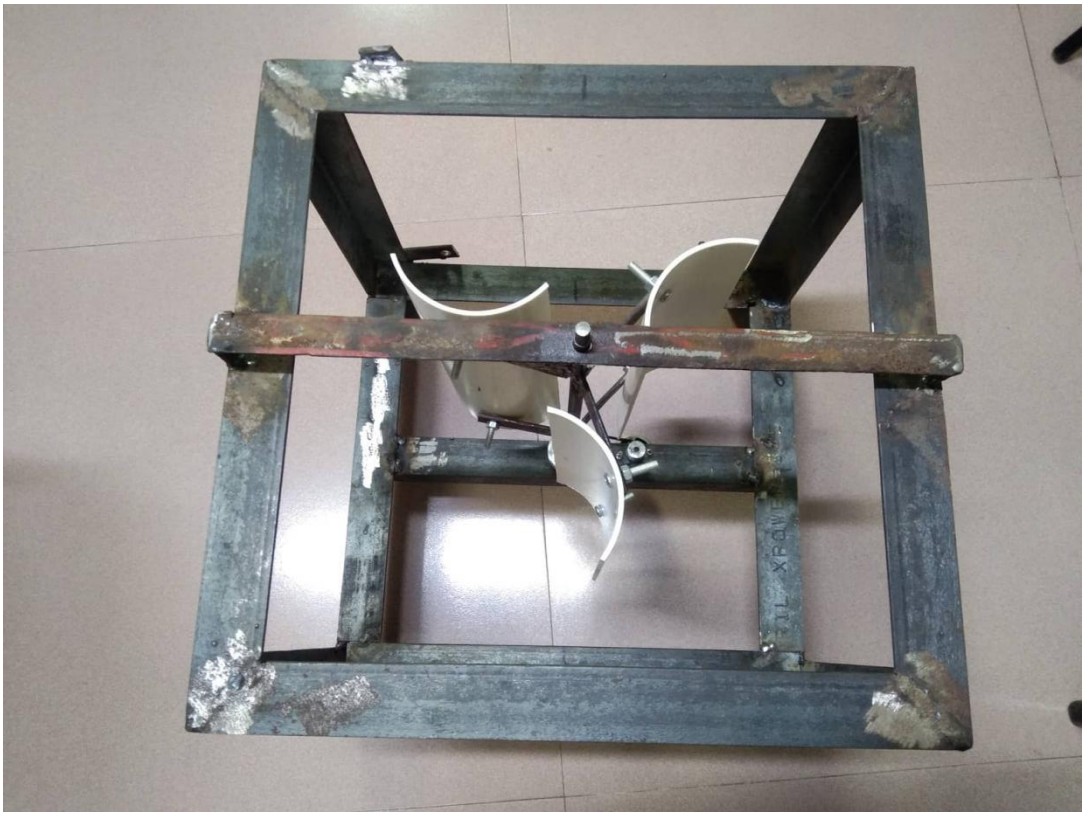

Figure 4.2: Our Final System Overview (Top View)

4.3 Working Principle

The exhaust air energy recovery wind turbine generator is a novel idea on generating green energy by harnessing unnatural wind resources using a micro-wind generation system. The integration of the exhaust air energy recovery wind turbine generator is not identical for all the unnatural wind resources.

Here we use an industrial exhaust fan and a blower fan for external air flow on this system.Here we also use vertical turbine, dc generator motor and a battery.Our exhaust fan connected with the 220V AC line. When we start our air flow system (exhaust fan and blower machine) then the turbine will rotate, which is mounted with a dc generator motor with the help of pulley and pulley belt. Here turbine shaft attached with 80teeth of pulley, and generator motor shaft attached with 20teeth of pulley. That's why when turbine rotate one turns then generator motor pulley rotate 4 turns. So here we will get 4 times better voltage from our system. This electricity will be store in a battery. A load is connected with the battery. This is the main process of our system.

CHAPTER 5
RESULTS AND DISCUSSION

5.1 Discussion

While working on our project, we did face some difficulties as it is a very complex system but the end results, we came up with were quite satisfactory. We have put the whole system through several tasks to validate our work and also have taken necessary notes for future improvements. Some future recommendations that we have involves improvement in system design and wiring, adding features for more efficient.

5.2 Results

Now, it's time to talk about the results.

- When this project is run then the exhaust fan will be rotate and turbine will be rotate for air blow.
- This system also has a turbine, generator motor and battery.
- When the turbine rotate then the generator motor will be rotate with the turbine. Produce voltage and store it in battery.
- A load will be connected with this battery.

5.3 Calculations

Here we get,

Dc generator generate voltage, V=7V

Dc generator generate current, I=3A

Turbine Shaft, N1=640 RPM

Turbine pulley teeth, T1=80

Generator motor pulley teeth, T2=20

DC Generator generate power, P=?

Generator motor shaft, N2=?

We know,

P=VI

=7*3watt

=21 watt

So output power =21 watt

again, N1/N2=T2/T1

640/N2=20/80

N2=2560 RPM

5.3 Advantages

There are certainly many advantages of our project and some of the major ones have been given below:

- Less skill technicians is sufficient to operate.
- Simple construction
- Ease of operation
- It will be plentiful, renewable and eco friendly source of energy.
- The stored energy can be used when main supply is cut off. Hence, can be used as an Emergency unit.
- It is renewable source of energy.
- It emits no greenhouse gases and hence nonpolluting.
- It uses very little land Fuel transportations are not required in wind energy conversion system.

5.4 Disadvantages

- Owing to its irregularity, the wind energy needs storage.
- Wind energy conversion is noisy in operation.
- Maintenance is required.
- Cost is relatively high.

5.5 Applications

This project has applications in many fields due its necessity. We have selected a few of them and they are given below:

- It can be use in industrially.
- It can be use in cold storage .

CHAPTER 6
CONCLUSION

6.1 Conclusion:

It is observed that the wind from the exhaust can work as a very good source of electricity. The wind speed is sometimes more than the natural air speed and hence can generate even more electrical power than what is produced from natural air. As it is discussed earlier that wind from exhaust fan may get dispersed after some time, there should be some kind of directors/connectors that will guide the wind from the exhaust fan directly to wind turbines without getting the average speed of the wind decreased as the velocity of the wind is most important factor in the system.

6.2 Future Scope

As we have already discussed about the limitations of our project so definitely there's room for improvement and thus, we have lots of future scope of work available to us for this project. Some of these are listed below:

- In future, we are thinking about IoT monitoring system.
- In future, we are thinking about increase its accuracy.
- In future development this project can be develop by more protective and measuring sensor.
- In the future we will use emergency alarming system.

Reference

[1] The Energy Efficiency and Conservation Authority “Power from the people: a guide to micro-generation,”.

[2] “What is micro generation,”. [Online]. Available: http://www. microgeneration. com/ professional-zone/Climate-Change/What-ismicrogeneration. [Accessed: 29 - July - 2018].

[3] F. Mendonça, J. Azevedo, “Design and power production of smallscale wind turbines,” in Proc. Int. Conf. in Energy and Sustainability in Small Developing Economies, 2017, pp. 1-6.

[4] M. Luna, M. Pucci and G. Vitale, “Design of a Simple, Effective and Low Cost Micro-Wind Energy Conversion System,” The Open Renewable Energy Journal, vol. 4, pp. 34-41, 2011

[5] “6 Ways to Ventilate Your Home (and Which is Best),” February 5, 2014.

[6] S. Siddiqui and B. Mehfooz, “Influence of Housing Quality on Public Health in Lahore, Pakistan,” in Proc. of the Pakistan Academy of Sciences: B. Life and Environmental Sciences, vol. 54, no. 3, pp. 237–257, 2017.

[7] G.M. Masters, Renewable and Efficient Electric Power Systems. Hoboken, NJ: John Wiley and Sons, 2004.

[8] S.W. Mohod and M.V. Aware, “Micro Wind Power Generator with Battery Energy Storage for Critical Load,” IEEE Systems Journal, vol. 6, no. 1, pp. 118–125, March 2012.

[9] The Royal Academy of Engineering, “Wind Turbine Power Calculations,”. [Accessed: 01 - August - 2018].

[10] R.S. Bajpai, M. Goyal and R. Gupta, “Modeling and control of variable speed wind turbine using laboratory simulator,” Journal of Renewable and Sustainable Energy, vol. 7, pp. 053127(1-19), 2015.

[11] “Characterizing a Mechanical Ventilation System's Performance,”. [Online]. [Accessed: 28 - January - 2019].

[12] The Enginnering ToolBox, “Duct Velocity: Calculate velocities in circular and rectangular ducts - imperial and SI-units,”. [Online].

[13] A. Patnaik, S.M. Ali, “Industrial exhaust fans as source of power,” Int. J. of Elec., Electr. and Data Comm., vol. 1, no. 9, pp. 38-41, 2013.

[14] “Density of air,”. [Online]. Available: https://en.wikipedia.org/wiki/ Density_of_air. [Accessed: 29 - January - 2019].