Power Generation from Traffic Wind Turbine System



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Date of Submission: January 2024

Declaration

It is declared hereby that this thesis paper or any part of it has not been submitted to anywhere else for the award of any degree.

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ACKNOWLEDGEMENT

The report titled as on**"Power Generation From Traffic Wind Turbine System**"has been prepared to fulfill the requirement of our practicum program. In the process of doing and preparing our practicum report, we would like to pay our gratitude to some persons for their enormous help and vast co-operation.

At first, we would like to show our gratitude to the University authority to permit us to do our practicum. Specially, we would like to thank to our honorable teacher **Jannatul Nazrana,** Lecturer, Department of Electrical & Electronics Engineering, SU–Sonargaon University, Dhaka, for his valuable and patient advice, sympathetic assistance, co-operation, contribution of new idea. Deep theoretical and hardware knowledge & keen interest of our supervisor in this field influenced us to carry out this project. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior draft and correcting them at all stage have made it possible to complete this project.

Finally, we would like to thanks again to the respected **Vice- Chancellor of SU, Professor Shamim Ara Hassan** also thanks to **Head of Departmentof SU, Electrical & Electronics Engineering, Assistant Professor Md. Rais Uddin Mollah** because they are designated such an environment for learning through which we got the opportunity to acquire knowledge under Bsc in EEE program, and that will be very helpful for our prospective career.

We are, indeed, grateful to all those from whom we got sincere cooperation and help for the preparation of this report

ABSTRACT

The growing demand for sustainable and renewable energy sources has led to innovative approaches in harnessing energy from unconventional sources. One such approach involves integrating small-scale wind turbines into traffic infrastructure to capture the kinetic energy generated by passing vehicles. This study explores the feasibility and efficiency of a Traffic Wind Turbine System (TWTS) for power generation.

The TWTS consists of specially designed vertical-axis wind turbines strategically positioned alongside roadways, where the turbulent air generated by the movement of vehicles serves as a consistent and readily available energy source. The turbines are equipped with aerodynamic features optimized for low wind speeds and varying wind directions typical of roadside environments.

Key aspects of the research include the design and engineering considerations for the TWTS, taking into account factors such as turbine efficiency, safety, and aesthetic integration with the urban landscape. Computational simulations and real-world field tests are conducted to assess the performance and energy output of the system under different traffic conditions and wind speeds.

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LIST OF ABBREVIATIONS

DC	Direct Current
AC	Alternating Current.
LCD	Liquid Crystal Display
ADC	Analog-to-Digital Converter
IC	Integrated Circuit
LED	Light Emitting Diode
PCB	Printed Circuit Board

Chapter 1
Introduction

1.1 Introduction

Wind energy is the fastest growing source of clean energy worldwide. A major issue with the technology is fluctuation in the source of wind. There is a near constant source of wind power on the highways due to rapidly moving vehicles. The motivation for this project is to contribute to the global trend towards clean energy in a feasible way. Most wind turbines in use today are conventional wind mills with three airfoil shaped blades arraigned around a horizontal axis. These turbines must be turned to face into the wind and in general require significant air velocities to operate. Another style of turbine is one where the blades are positioned vertically or transverse to the axis of rotation. These turbines will always rotate in the same direction regardless of the fluid flow. Due to the independence from the direction of the fluid flow, these turbines have found applications in tidal and surface current flows. To see how effective this sort of turbine would be in air, a helical turbine based on the designs and patents of Dr. Alexander M. Gorlov was chosen. His turbine was developed to improve upon the design of Georges J. M. Darrius by increasing the efficiency and removing pulsating stresses on the blades, caused by the blades hitting their aerodynamic stall in the course of rotation, which often resulted in fatigue failure in the blades or the joints that secured them to the shaft. The turbine takes the Darrius type turbine, which has a plurality of blades arranged transverse to the axis of rotation, and adds a helical twist to their path, insuring that regardless of the position of the turbine, a portion of the blade is always positioned in the position that gives maximum lift. This feature reduces the pulsations that are common in a Darrius type turbine. In his investigations, Gorlov claims that his turbine is significantly more efficient than Darrius' and has achieved overall efficiencies between 30% and 35%. For this investigation, a helical turbine was tested inside and outside a wind tunnel using an electric generator (inside tests only) and a torque meter paired with a tachometer to measure the output power of the turbine and calculate its efficiency. In

the end, the turbine did not come close to the claimed 30% efficiency, reaching at best an efficiency of around 0.35%. Further investigations should be made to determine why the results from this investigation were as low as they are.

1.2 Methodology

This design methodology is to increase the efficiency of the windmill at first the designing steps starts with the design of windmill blades. Because this blades will mainly affects the overall efficiency of the windmill. For a particular application the wind mill blade should be in required size. Before this getting knowledge about the aerodynamic style of windmill blade in order to get the full efficiency is very much important.

1.3 Outline of the project Book

- Chapter-1: Gives a brief introduction to the background of the project, objectives, and report organization.
- Chapter-2: Focuses on the theoretical background with literature review.
- Chapter-3: Focuses on the design of real-time based monitoring and required components and the working procedure of them.
- Chapter-4: Concludes the overall discussion about the software that is used here to design Circuit Diagram and creating programs with controlling software also.
- Chapter-5: discuss the block diagram, circuit diagram, working procedure, and full over view of proposed system.
- Chapter-6: Focuses on the operational output and results of proposed system.
- Chapter-7: includes the advantages, disadvantages, future work and conclusion also in this chapter.

Chapter 2
Theoretical background

2.1 Introduction

However, recent concerns about fossil fuel depletion as well as greenhouse gas emissions have brought increasing interest in wind power. Modern wind turbines operate under the same principles as historic windmills. They convert the momentum of the wind into kinetic energy of rotating blades, which is then channeled into a rotating shaft. Within this general definition, there are two subgroups: horizontal axis wind turbines (HAWT) and vertical axis wind turbines (VAWTs). The main reason behind developing Vertical Axis Wind turbines is that they work regardless of the wind direction. VAWTs do not require a yaw mechanism and are very fixed in the sense that no change to their direction or that of the blade is made once installed. The lack of a yaw mechanism is one of the reasons VAWTs are not as expensive or complicated to make. This makes them ideal for small-scale applications such as remote areas with very small electric load. Their blades do not require a mechanism to change their angle as they work with any wind direction. VAWTs are considerably less noisy than HAWTs, which makes them more socially accepted. In addition to this, the small size means they can be integrated easily within an urban setting, and present no danger to the wildlife in rural areas. They still share many components with HAWTs however, such as the shaft, the gearbox, the tower, and the generator unit. The placement of these units is different, since in VAWTs the gearbox and generator are placed at the base of the unit and do not require as much support as HAWTs. This means easier access for maintenance and repairs, which lowers the overall cost of such systems. As mentioned before, the way the Betz limit is derived uses some assumptions that are not applicable to VAWTs. However, in general VAWTs are far less efficient than HAWTs. Their small capacity makes them ideal for light load application such as communication systems in remote areas. VAWTs can be used for large capacity installations, but the materials needed and the massive investment make them undesirable. VAWTs are also suitable for either low wind speeds at which HAWTs do not function or high wind speeds at which HAWTs are

shut off. As stated “a HAWT can achieve higher efficiencies, but only if the energy quality of the wind is high. High wind turbulence, wind fluctuations, and high directional variability can cause significant problems for a HAWT, whereas VAWTs can operate well”.

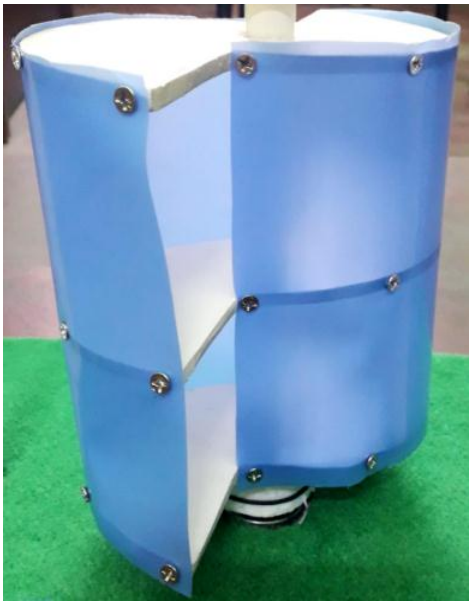


Fig 2.1. Vertical Axis Wind Turbine

2.2 Literature Review

Chongyang Zhao, Jun Luo, “Experiment Validation of Vertical AxisWind Turbine Control System based on Wind Energy Utilization Coefficient Characteristics," [1], states that wind power generation system experimental platform is established and wind generator external characteristics are measured. Wind energy utilization coefficient characteristics is in good agreement with wind energy utilization coefficient characteristic theory. Aravind, Rajparthiban, Rajprasad, “Mathematical Toolbox and its application in the Development of Laboratory Scale Vertical Axis Wind Turbine”, [2], states that power generated is directly proportional to the wind speed available. Design of vertical turbine due to its advantage of operating at a low wind speed over that of horizontal turbine. Yan Li, Fang Feng, “Computer Simulation on the Performance of a Combined-type Vertical Axis wind Turbine”, [3], staes that A combined type straight-bladed vertical axis wind turbine (CT -SBV A WT) was designed in this study by setting a Savonius rotor having good starting performance into the SB-VA WT Savonius rotor set in the SB-V A WT can greatly improve the

starting performance of the SB-V A WT. Madani, Cosic, Sadarangani, “A Permanent Magnet Synchronous Generator for a Small Scale Vertical Axis Wind Turbine”,[4], states that A design of surface mounted permanent magnet synchronous generator with concentrated windings. The design features low harmonic contents in the air gap flux density and in the induced voltage. Chongyang Zhao, “Experiment Validation of Vertical Axis Wind Turbine Control System based on Wind Energy Utilization Coefficient Characteristics”, [5], states that Wind generator external characteristics are measured. Speed ratio and wind turbine characteristics are analyzed.

2.3 Summary

First of all, This smart glass implemented for blind person who are unable to see any object and secondly, unable to hear any sound also so this two types of person can aware about accident. In future it can be implemented as an image recognition where sensor give information user about the object.

Chapter 3
Hardwire

3.1 Required Components

Table I: Component List

S/L	Components Name	Quantity
01	Arduino Nano	1
02	3.7V Battery	4
03	Display	1
04	Relay	1
06	1k Resistor	1
07	10-Wire	Needed
09	DC Motor	3
10	Buck Converter	1
11	Sun Board	Needed
12	Bearing	6
13	LDR	1
14	LED	10

3.1.1 Arduino Nano

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P released in 2008. It offers the same connectivity and specs of the Arduino Uno board in a smaller form factor. The Arduino Nano is equipped with 30 male I/O headers, in a DIP-30-like configuration, which can be programmed using the Arduino Software integrated development environment (IDE), which is common to all Arduino boards and running both online and offline. The board can be powered through a type-B mini-USB cable or from a 9 V battery. In 2019, Arduino released the Arduino Nano Every, a pin-equivalent evolution of the Nano. It features a more powerful ATmega4809 processor and twice the RAM.

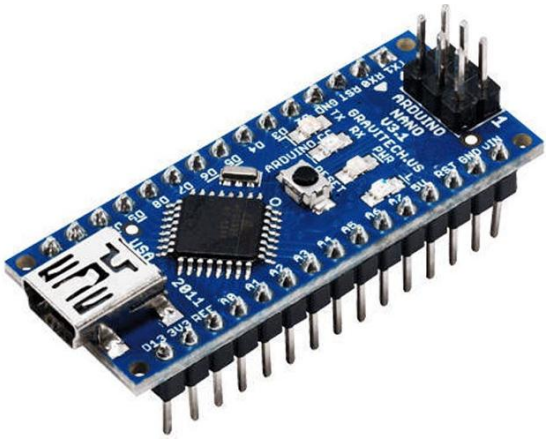


Figure 3.1: Aurdiuno Nano

Technical specifications

- Microcontroller: Microchip ATmega328P
- Operating voltage: 5 volts
- Input voltage: 5 to 20 volts
- Digital I/O pins: 14 (6 optional PWM outputs)
- Analog input pins: 8
- DC per I/O pin: 40 mA
- DC for 3.3 V pin: 50 mA
- Flash memory: 32 KB, of which 2 KB is used by boot loader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock speed: 16 MHz
- Length: 45 mm
- Width: 18 mm
- Mass: 7 g
- USB: Mini-USB Type-B
- ICSP Header: Yes
- DC Power Jack: No

Communication

The Arduino Nano has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provide UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An FTDI FT232RL on the board channels this serial communication over USB and the FTDI drivers (included with the Arduino software) provide a virtual com port to software on the computer. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the FTDI chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Nano's digital pins. The ATmega328 also support I2C and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus.

3.1.2 Battery 3.7V

The 3.7v lithium battery is a lithium cell having a 3.7v nominal voltage and 4.2v at full charge. It has a capacity between a few hundred and a few thousand mAh. It is typically utilized in a variety of devices, including meters, testing equipment, medical equipment, POS equipment, notebook computers, and other goods. Regarding the capacity of 3.7V lithium batteries, the capacity increases according to the volume of the battery, or, alternatively, the more parallel lithium batteries are connected, the bigger the capacity. A 3.7v lithium battery typically needs a "protection board" to prevent overcharging and discharge. Because a lithium battery's ideal full charge voltage is 4.2 volts, a battery without a protective board can only be charged up to 4.2 volts before it risks being harmed. When using a charging method, it's important to keep an eye on the battery's health at all times. The battery with a protection board, however, can be charged at voltages between 4.8 and 5.2 volts. As we all know, a 5V charger may typically be used with USB devices like laptops and cell phones. The 3.7V battery's charging cut-off value is 4.2V, and its discharge cut-off voltage is 3.0V. The battery should therefore be charged whenever its open-circuit voltage is below 3.6V. To avoid having to keep track of the charging time, it is preferable to select the 4.2V constant voltage charging option. Overcharging is simple to occur when 5V charging is used



Figure 3.2: Battery 3.7V

3.1.3 Display

This is a 20 character x 4 line blue background Super Twisted Nematic (STN) LCD with built-in HD44780 equivalent controller (also known as alphanumeric displays). Interfacing is simplified with 4 bit or 8 bit communications and programming code is widely available for many different controllers and systems.



Figure 3.3: LCD

Features:

- High contrast STN 20×4 character LCD
- White text on blue background
- Single +5.0V supply operation
- LED backlight
- 5x8 dot characters
- HD44780 equivalent controller
- 4 or 8 bit interface

3.1.4 DC Motor

A DC motor is an electrical motor that uses direct current (DC) to produce mechanical force. The most common types rely on magnetic forces produced by currents in the coils. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.



Figure 3.4: DC Motor

DC motors were the first form of motors widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor, a lightweight brushed motor used for portable power tools and appliances can operate on direct current and alternating current. Larger DC motors are currently used in propulsion of electric vehicles, elevator and hoists, and in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

3.1.5 Resistor 1k

In the beginning, Electronic parts called resistors prevent current from flowing. They are frequently utilized in circuits to regulate the circuit's current or voltage levels. How much a resistor restricts the flow of electrical current is determined by its resistance value. In the case of a 1k resistor, more current can flow through than with greater resistance components like 10k (10 kilohms) or 100k (100 kilohms) resistors. One kilohm of resistance is referred to as a "1k" resistor. The letter "k" stands for the 1,000-fold multiplier "kilo," which is the prefix for the metric system. A 1K resistor has a 1,000 Ohm resistance as a result.



Figure 3.5: Resistor 1k

3.1.6 10-Wire

Ribbon cables for circuit linking assemblies reduce time and space. When using standard wire connectors, jacks, and pins for clean terminations, the conductor ribbon cable readily separates. We will send out random orders because every product batch is unique and the color could differ. -55 to +105 degrees Celsius. It is simple to cleanly terminate the conductor ribbon cable with jacks, pins, and wire connections that are commonplace. Ribbon cables for circuit linking assemblies reduce time and space. Resists fungi, flame, moisture, oil, acids, and alkalis. Applying to LCD TVs, LCD monitors, computers, digital cameras, and camcorders, among other devices.



Figure 3.6: Wire – 10

3.1.7 Buck Converter

A chopper circuit known as a "buck converter" is made to step-down convert the supplied dc input signal.



Figure 3.7: Buck Converter

In the case of buck converters, the fixed dc input signal is converted into a different, lower value, dc signal at the output. This indicates that it is built to have an output dc signal with a smaller magnitude than the applied input.

3.1.8 Sun Board

In the case of buck converters, the fixed dc input signal is converted into a different, lower value, dc signal at the output. This indicates that it is built to have an output dc signal with a smaller magnitude than the applied input. Sun board is a common material used by hobbyists to create backgrounds for scale model displays, dioramas, and computer games. It is frequently helpful for photographers to use as a light reflector in their studios, and it is also used in the design business to display demonstrations of new goods. Aero-modelers can also use it to construct small radio-controlled aircraft. But today, solar board is frequently utilized for large-format printing and store branding both in India and elsewhere. Self-adhesive vinyl is first printed with images or other creative content before being attached to the solar board. Then, depending on the surface, this solar board can be nailed or double-sided adhesive taped to a wall, pillar, or other flat surface. The most cutting-edge approach involves employing a UV flatbed printing device to directly print the solar board. Sun board UV prints are free from peeling issues and remain longer.



Figure 3.8: Sun Board

3.1.9 10mm LED

A light-emitting diode (LED) is a semiconductor device that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. 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

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, strip lights, automotive headlamps, advertising, general lighting, traffic signals, camera flashes, lighted wallpaper, horticultural grow lights, and medical devices.

3.1.10 LDR

A photoresist or (also known as a photocell, or light-dependent resistor, LDR, or photo-conductive cell) is a passive component that decreases resistance with respect to receiving luminosity (light) on the component's sensitive surface. The resistance of a photoresist or decreases with increase in incident light intensity; in other words, it exhibits photoconductivity. A photoresist or can be applied in light-sensitive detector circuits and light-activated and dark-activated switching circuits acting as a resistance semiconductor. In the dark, a photoresist or can have a resistance as high as several mega ohms (MΩ), while in the light, a photoresist or can have a resistance as low as a few hundred ohms. If incident light on a photoresist or exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their hole partners) conduct electricity, thereby lowering resistance. The resistance range and sensitivity

of a photoresistor can substantially differ among dissimilar devices. Moreover, unique photoresistors may react substantially differently to photons within certain wavelength bands.

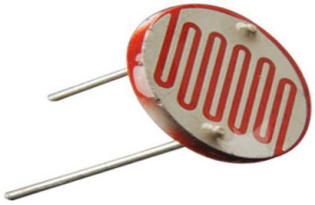


Figure 3.10: LDR

A photoelectric device can be either intrinsic or extrinsic. An intrinsic semiconductor has its own charge carriers and is not an efficient semiconductor (such as silicon is). In intrinsic devices, most of the available electrons are in the valence band, and hence the photon must have enough energy to excite the electron across the entire bandgap. Extrinsic devices have impurities, also called dopants, added whose ground state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons (that is, longer wavelengths and lower frequencies) are sufficient to trigger the device. If a sample of silicon has some of its atoms replaced by phosphorus atoms (impurities), there will be extra electrons available for conduction. This is an example of an extrinsic semiconductor.

3.1.11 Bearing

A bearing is a machine element that constrains relative motion to only the desired motion and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or the directions of the loads (forces) applied to the parts.



Figure 3.11: Bearing

The term "bearing" is derived from the verb "to bear"; a bearing being a machine element that allows one part to bear (i.e., to support) another. The simplest bearings are bearing surfaces, cut or formed into a part, with varying degrees of control over the form, size, roughness, and location of the surface. Other bearings are separate devices installed into a machine or machine part. The most sophisticated bearings for the most demanding applications are very precise components; their manufacture requires some of the highest standards of current technology.

3.1.12 Relay

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof. Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

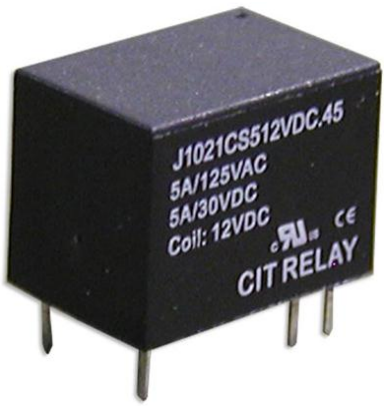


Figure 3.12: Relay

The traditional electromechanical form of a relay uses an electromagnet to close or open the contacts, but relays using other operating principles have also been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called protective relays or safety relays. Latching relays require only a single pulse of control power to operate the switch persistently. Another pulse applied to a second set of control terminals, or a pulse with opposite polarity, resets the switch, while repeated pulses of the same kind have no effects. Magnetic latching relays are useful in applications when interrupted power should not affect the circuits that the relay is controlling.

Chapter 4
Software

4.1 Arduino IDE

The open-source Arduino IDE program can be used to write code and upload it to Arduino boards. The IDE application is compatible with Windows, Mac OS X, and Linux, among other operating systems. It supports C and C++ as programming languages. It alludes to an Integrated Development Environment in this sentence.

Programming or creating a line of code in the Arduino IDE is frequently referred to as "sketching." To upload the sketch created in the Arduino IDE application, we must connect the Genuino and Arduino board with the IDE. The filename of the sketch ends with ".ino."

The Arduino IDE looks like:

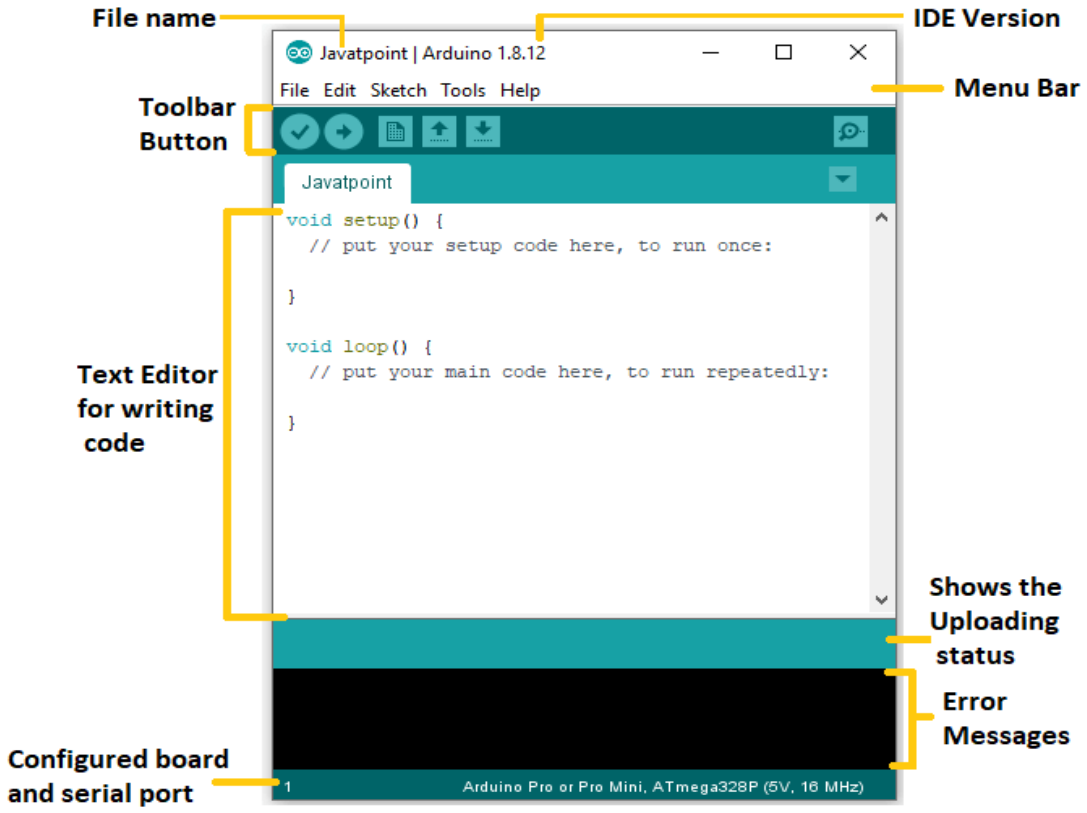


Figure 4.1: Javatpoint

Toolbar Button

The New, Open, Save, Upload, and Verify icons are all that are visible on the toolbar. It is displayed below:

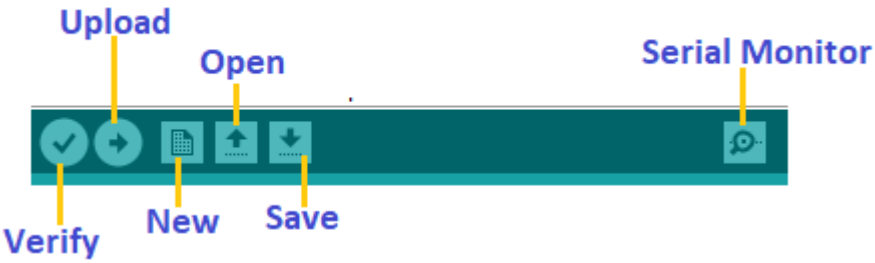


Figure 4.2: Toolbar Button

Upload

The compilation and execution of our on-screen code happens when you click the Upload button. The new code is then updated on the connected board. We must confirm that the appropriate board and ports have been chosen before submitting the drawing.

In order to connect the board to the PC, we also need a USB connection. Select the Upload button from the toolbar once the aforementioned procedures are complete.

A feature on the most recent Arduino boards resets them automatically before an upload. There is a Reset button that needs to be pressed on the older boards. The Tx and Rx LEDs will begin to blink as soon as the uploading is complete.
If the uploading fails, the message will show up in the error window.

Without using any additional hardware, we may upload our application using the Arduino Boot loader. A small program that is loaded into the board's microcontroller is referred to as a boot loader. The LED will flicker as a result of PIN 13.
File
When we click on the File button on the Menu bar, a drop-down list will appear. It is shown below:

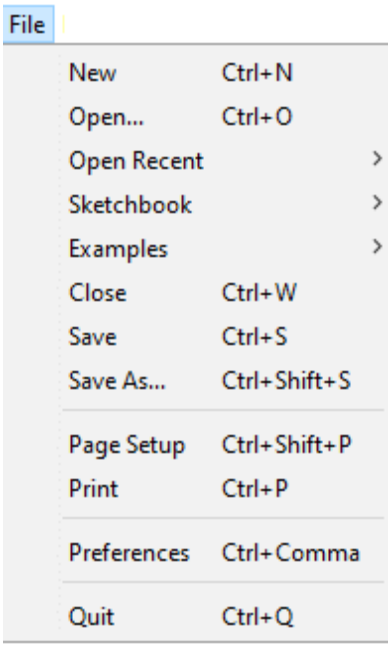


Figure 4.3: File

Let's discuss each option in detail.

New

When you click New, a new window is opened. The already existing sketch is left in place.

Open

It enables opening the sketch, which may be viewed in the computer drivers and folders.

Save

The current sketch can be saved by using the save button. Additionally, it saves any adjustments made to the current sketch. The "Save As..." window will open if the file name is not given.

Save As...

By pressing the "Save As..." button, we can save the sketch under a different name. The name can also be adjusted appropriately.

Page Setup

For printing, it enables specifying the page margins, orientation, and size. This is how the "Page Setup" window will look:

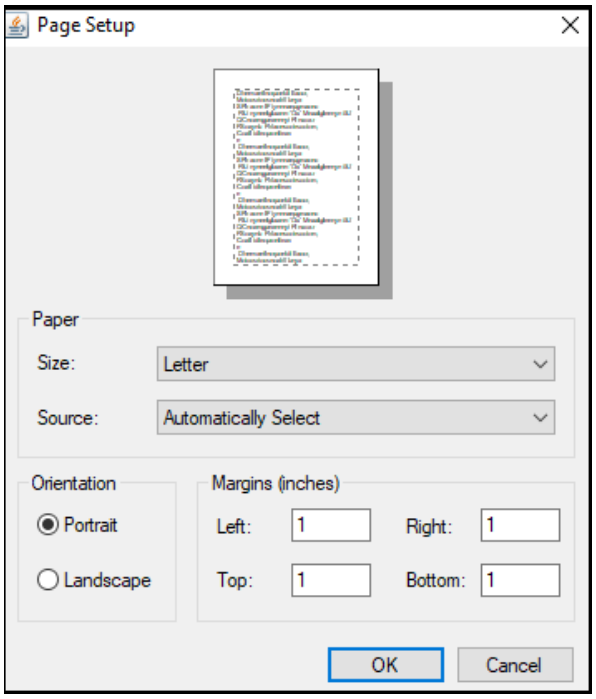


Figure 4.4: Page Setup

Print

It gets the current sketch ready for printing in accordance with the options put out in the 'Page Setup'.

Preferences

It enables the Arduino IDE's customisation options.

Quit

To close every IDE window, press the Quit button. When we launch the Arduino IDE, the same closed sketch will be reopened.

Edit

A drop-down list shows when we click the Edit button on the Menu bar. It is displayed below:

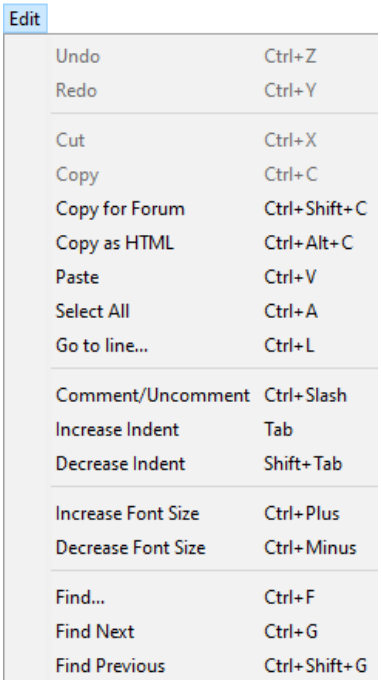


Figure 4.5: Edit

Let's discuss each option in detail.

Undo

The Undo button can be used to reverse the most recent modification made to the sketch while editing.

Redo

To undo the most recent change made to the sketch while editing, press the Redo button.

Cut

It enables us to take certain text out of the written code. Additionally, the text gets copied to the clipboard. Additionally, that text can be pasted anywhere in our sketch.

Copy

This technique involves duplicating the selected text. The text is additionally copied to the clipboard.

For the Forum

The "Copy for Forum" button copies the selected text to the clipboard, preparing it for forum posting.

Paste as HTML

By selecting the "Copy for Forum" button, the selected text can be copied as HTML to the clipboard. It is perfect for embedding in web pages.

Paste

The selected text from the clipboard is pasted at the designated cursor point using the Paste button.

Select All

It chooses all of the sketch's text.

Go to line...

The cursor is moved to the requested line's position.

The window will appear as:

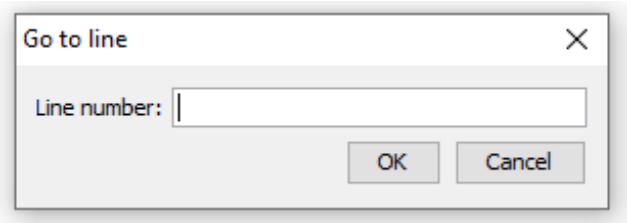


Figure 4.6: Go to line

Comment/Document

Using the Comment/ Document button, you may add or remove the comment mark (//) at the start of a line.

Heighten indent

It is used to add a space to the start of the specified line. The spacing moves the text to the right.

Reduce Indent

This command removes or removes the space at the beginning of the specified line. The spacing moves the text to the left.

Increase Font Size

The written text's font size is enlarged.

Decrease Font Size

The written text's font size is shrunk as a result.

Find...

It is utilized to locate the desired text. The text can also be changed. The text in the drawing is highlighted.

The window will appear as:

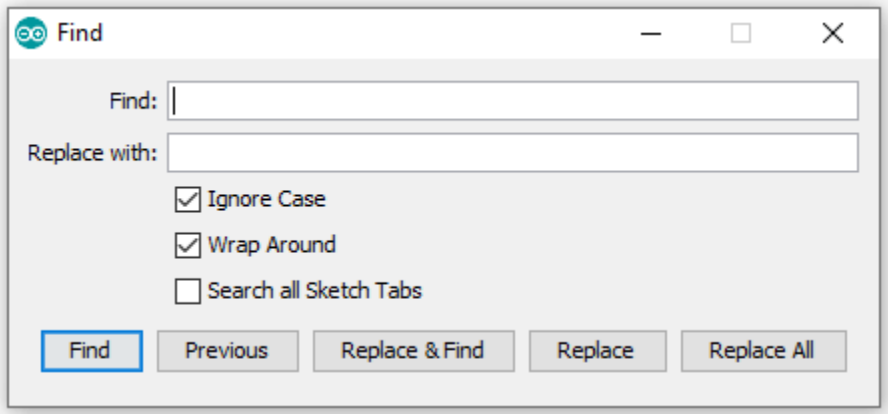


Figure 4.7: Find

Locate Next

It is highlighted the term that was typed into the "Find..." field. If the word is absent, no highlighted text will show.

Locate Previous

It highlights the term that was previously typed in the "Find..." window. If the word is absent, no highlighted text will show.

Sketch

A drop-down menu shows when we click the Sketch button on the Menu bar. It is displayed below:

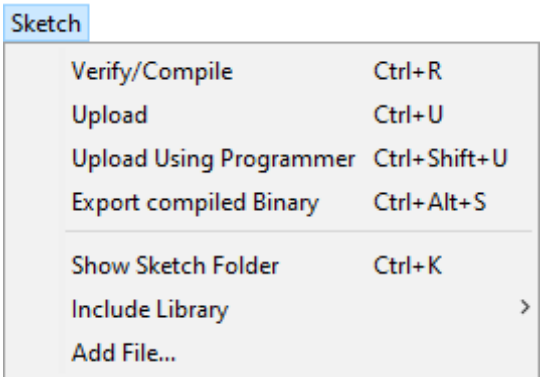


Figure 4.8: Sketch

Let's discuss each option in detail.

Verify/Compile

It will check for errors in the code as it compiles. Additionally, the RAM in the terminal area is reported by the IDE.

Upload

The Upload button is used to configure the code to the selected board through the port.

Upload Through a Programmer

It serves as a replacement for the board's inbuilt boot loader. We can utilize the entire storage capacity of the Flash memory by choosing the "Upload Using Programmer" option. Using the Tools->Burn Boot loader option, we must restore the Boot loader and transfer it to the USB serial port to accomplish this.

Export binary code

.hex files can also be uploaded to the board using other tools, and it has the capability to save and archive.hex files.

Display Sketches Folder

The most recent sketch or line of code is displayed once it opens the folder containing them.

The Arduino libraries in Include Library are all included in Include Library. The libraries are first introduced to our code after the hash symbol (#). Libraries from.zip files can also be imported.

Add File...

The Add File. button is used to add the created file in a new tab on the existing file. For example, let's add 'Blink' file to the 'Java point' file. The tab will now appear as:

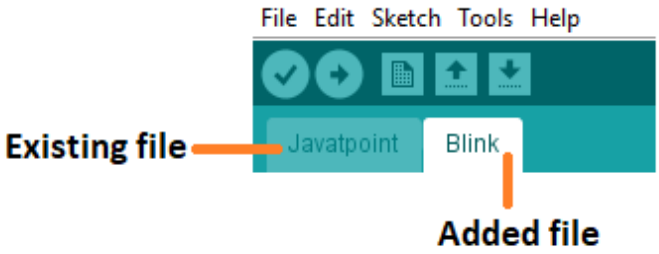


Figure 4.9: Added file

Alternately, we can choose the Delete option from the little triangle to remove the associated file from the tab.

Tools

A drop-down menu shows when we click the Tools button on the Menu bar. It is displayed below:

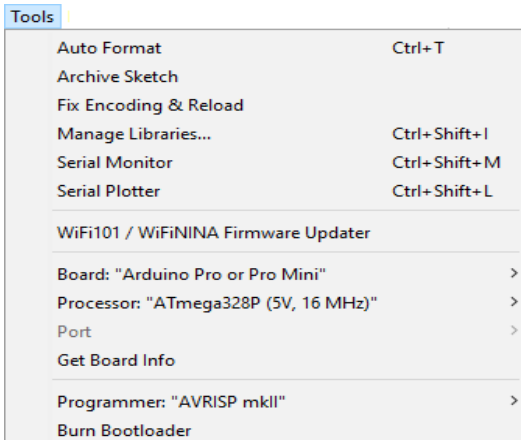


Figure 4.10: Tools

Let's discuss each option in detail.

In Auto Format

The written code is formatted by using the Auto Format button. employing open and closed curly brackets, for instance, in the code.

Retro Sketch

A.zip files are used to save the most recent sketch or piece of code. The organizational structure of the sketch and the stored directory is the same.

Enhance Coding, then Reload

This button can be used to correct the discrepancy between the editor's char map encoding and the operating system's char maps.

Organize libraries...

It shows the most recent list of all the libraries that are installed. By selecting this choice, a new library can also be added to the Arduino IDE.

Serial Monitor
With the attached board on the port, it enables data exchange.

Regular Plotter

A plot of the serial data is shown when you click the Serial Plotter button. It is preconfigured in the Arduino IDE.

Firmware Updater for WiFi NINA/WiFi 101

On the linked board, it is used to check and update the Wi-Fi firmware.

Board

The board must be chosen from the collection of boards. It's crucial that the chosen board seem similar to the board that's connected to the computer.

Processor

According to the chosen board, the processor is displayed. After each choice, the board is refreshed.

Port

The actual and virtual serial devices on our machine make up this component.

Information about the Board

On the chosen board, it provides details. Before gathering information about the board, the proper port must be chosen.

Programmer

We must select the hardware programmer before programming the board. It is required when we don't use the onboard USB serial connection. Additionally, burning the Boot loader requires it.

Burn Boot loader

A boot loader for the microcontroller is present on the board. The option was advantageous when we purchased the microcontroller without the boot loader. Before burning the boot loader, we must make sure the selected board and port are legitimate.

Help

The menu bar's Help button will display a drop-down list when we click it. It is displayed below:

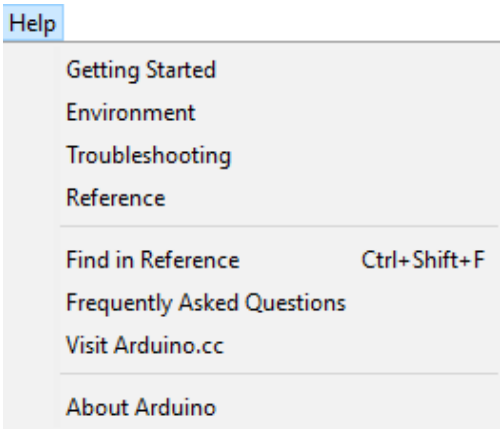


Figure 4.11: Help

Several easily accessible publications are supplied with the Arduino IDE and can be found in the Help section. It has a variety of options, such as Getting Started, Environment, Troubleshooting, Reference, etc. We can also consider the top image, which shows all of the choices available in the Help section. Some articles, including "Getting started" and "Reference," are also available without an online connection. It will send us to the official Arduino website.

4.2 Proteus 8 Professional

This provides a brief summary of the Proteus application. The special features and advantages of this application are listed below. We anticipate that this article will give you the most in-depth and useful breakdown on how to use Proteus 8 Professional.

You're interested in looking at the circuit diagram. Viewing the circuit layout would seem like a good idea, but large circuit boards make this challenging. As an alternative, you may try printing a circuit schematic (PCB) and testing it, but this would involve numerous laborious procedures. It appears that using Proteus 8 Professional is the best choice. Proteus 8 Professional is a program that plots, draws PCBs, and simulates schematics.

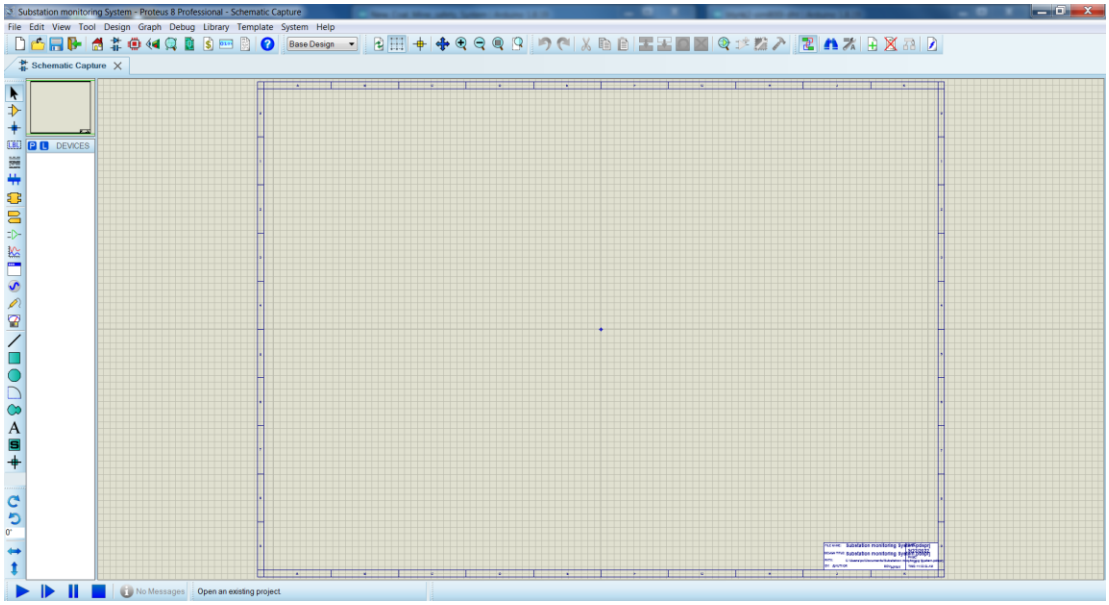


Figure 4.12: Diagram drawing

4.3 Features of Proteus 8 Professional

Diagram drawing:

On Proteus 8 Professional, diagramming is quite simple. Select the desired information by clicking "select device," then draw the wire by clicking on the electrical output or Vcc, Ground, etc.

On Proteus 8 Professional, diagramming is quite simple. Select the desired information by clicking "select device," then draw the wire by clicking on the electrical output or Vcc, Ground, etc.

Simulation

Was the circuit completed? The simulation tool in Proteus 8 Professional might display the circuit in all of its minute, detailed detail. The two choices for this feature are to run the simulation or to run each table. If the circuit is not too complex, the circuit board is displayed in "Running Simulation" at an average speed. Every circuit board will be run every time you select "Running each table". This change can help with digital circuit repair. It is feasible to simulate microcontrollers. Each microcontroller, such as the PIC24, dsPIC33, 8051, Arduino, or ARM7, will be described in accordance with its unique architecture. A hex file can be dumped into the Proteus microcontroller using the compiler.

PCB design

is a straightforward Proteus function. Using Proteus or creating your own designs are both options. It's easy to create your own design; all you have to do is include the relevant details in the diagram before building the electrical circuit. Don't worry about breaking any design rules; it will catch errors automatically. If you want Proteus to execute the information when it is in the proper place automatically. It will demonstrate circuit configuration and optimal choice selection. In order to choose the board size, a new custom "Auto placer" requires you to create the board's shape and size. After that, the details are automatically added into the mold.

Chapter 5

Working Principle

5.1 System Block Diagram

In this part, we try to discuss about the block diagram of our proposed system. Here we included three wind turbine and this three turbines will be rotate when it will get air pressure from the movement of vehicle beside of each turbine. This rotation will be sifted to DC motor using rubber belt. DC motor will generate DC voltage when it will rotate continuously.

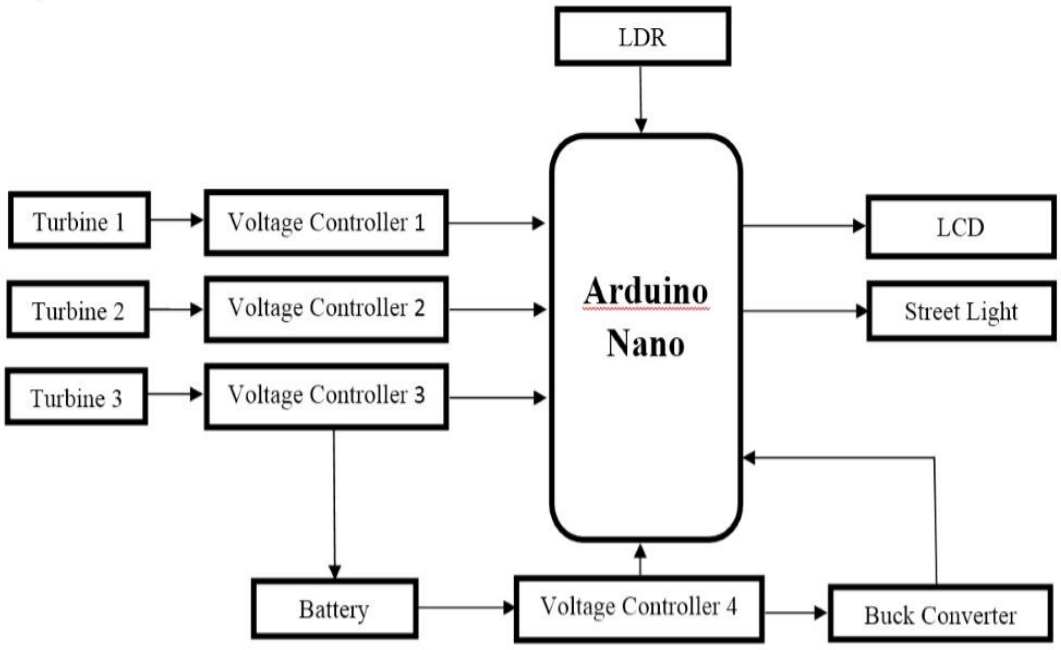


Figure 5.1: Block diagram of proposed system

This generated voltage will be stored to DC Battery that we will use here to store our generated power from this plant. Here we use Arduino Nano to read the generated voltage value from our wind turbine. Every turbine will send data to arduino and value will be calculate by arduino and then value will be show in our LCD display. We use here LDR to read the sun ray value and when it will be lower light from sun at that moment street light will be turn ON automatically and when it will get high value at that moment street light will be turn OFF automatically by using relay switching.

We included here a buck converter to reduce the supply voltage as per requirement of our Arduino Nano. We supply here 5V DC to operate our all components.

5.2 Complete Circuit Diagram

In this part, we try to discuss about the Circuit diagram of our proposed system. Here we included three wind turbine and this three turbines will be rotate when it will get air pressure from the movement of vehicle beside of each turbine. This rotation will be sifted to DC motor using rubber belt. DC motor will generate DC voltage when it will rotate continuously.

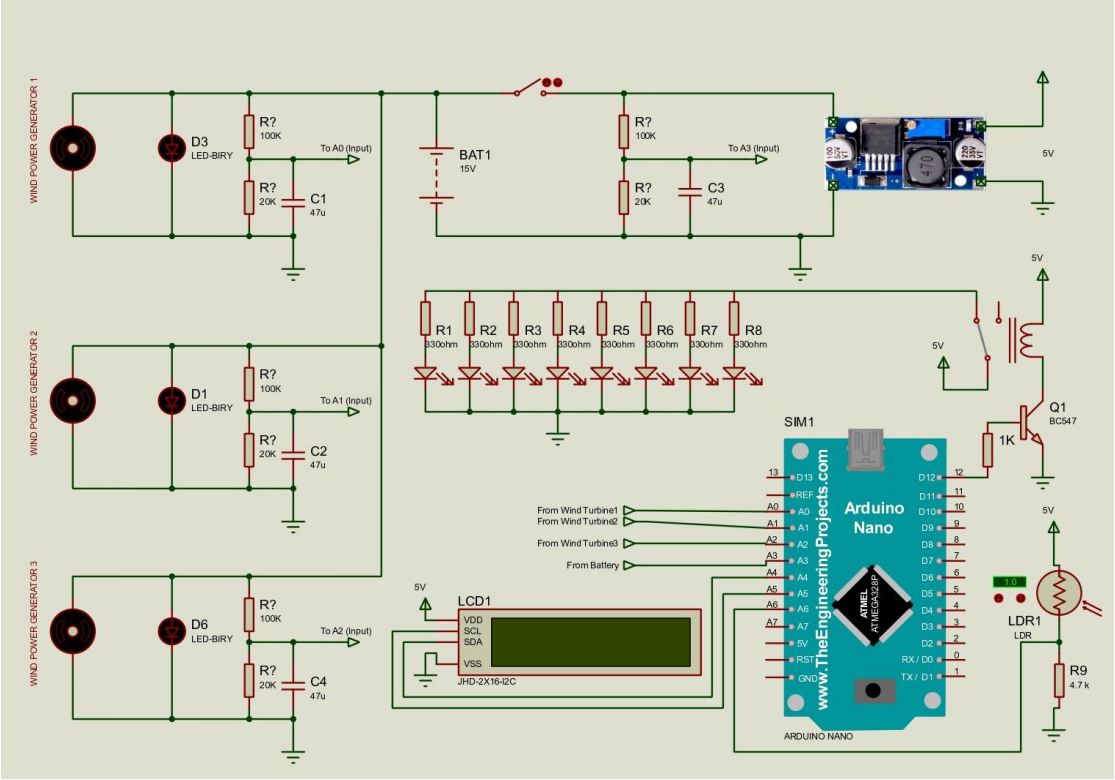


Figure 5.2: Complete circuit diagram of proposed system

This generated voltage will be stored to DC Battery that we will use here to store our generated power from this plant. Here we use Arduino Nano to read the generated voltage value from our wind turbine. Every turbine will send data to arduino and value will be calculate by arduino and then value will be show in our LCD display. We use here LDR to read the sun ray value and when it will be lower light from sun at that moment street light will be turn ON automatically and when it will get high value at that moment street light will be turn OFF automatically by using relay switching.

We included here a buck converter to reduce the supply voltage as per requirement of our Arduino Nano. We supply here 5V DC to operate our all components.

5.3 Hardware Implementation

We used here three 3.

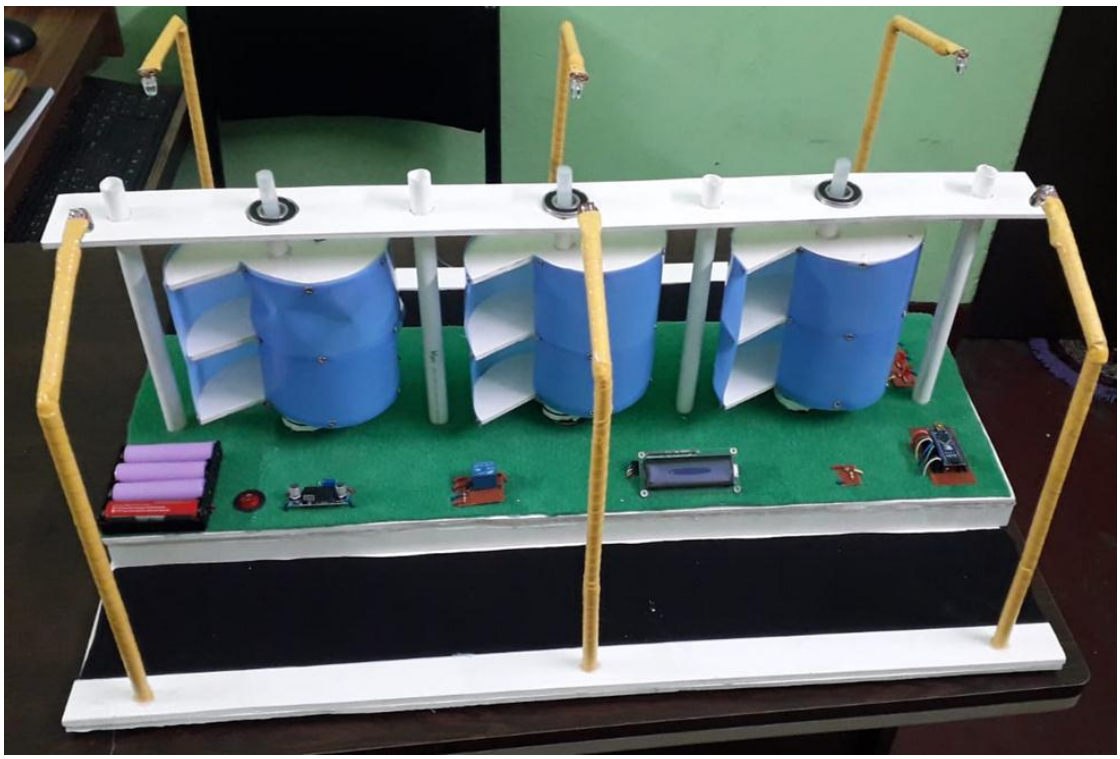


Figure 5.3: Full overview of our Project.

Chapter 6
Resultant Analysis

6.1 Results

Now in this chapter we will discuss about our project results with different side view and with operational outcome. Here we included a side view of our complete project.



Figure 6.1: Side view of proposed system

Now we will make sure proper air flow to our first wind turbine and then we will check the output to our used LED and LCD.

Here you see that we provide proper air flow and our first wind turbine is rotating. By using this rotation our system will generate DC voltage.

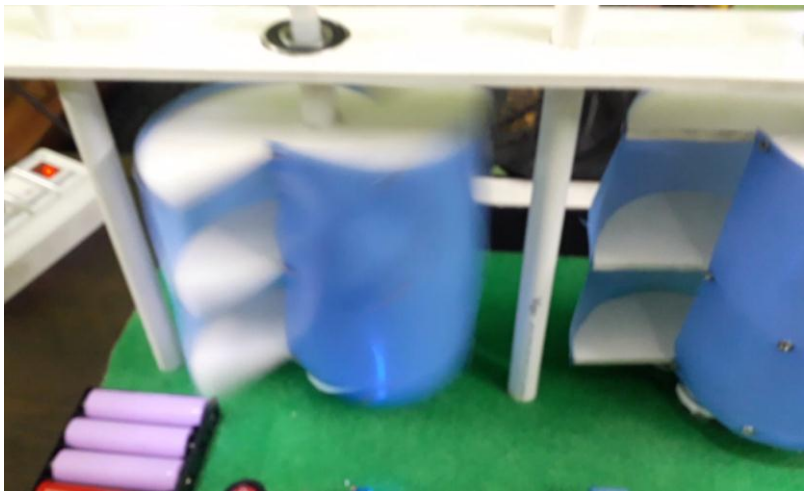


Figure 6.2: Wind Turbine -1 is rotating.

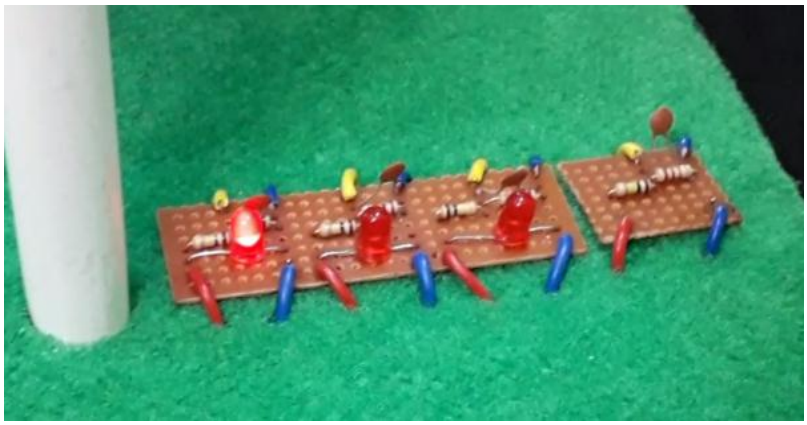


Figure 6.3: Wind Turbine -1 Geneated Voltage output



Figure 6.4: Wind Turbine -1 generated voltage output in LCD

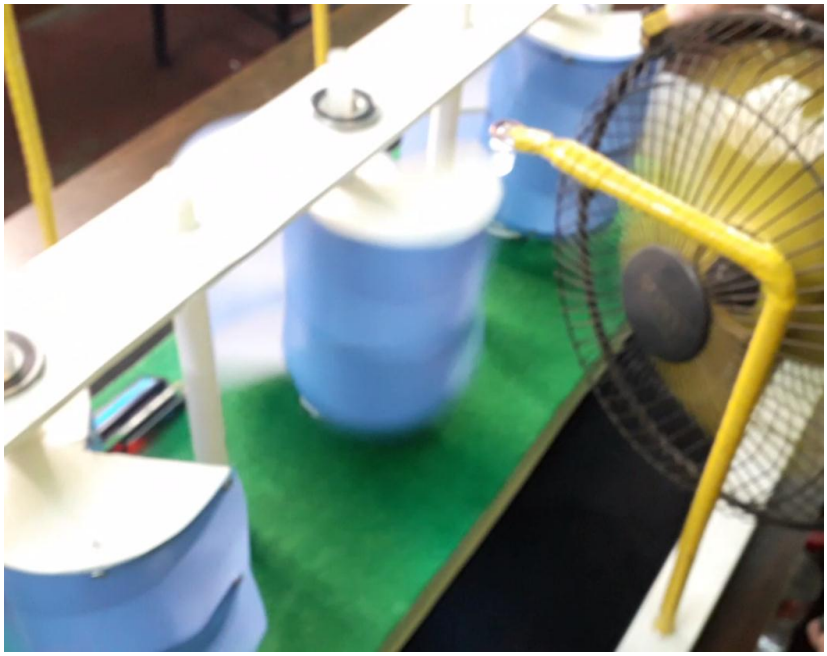


Figure 6.5: Wind Turbine -2 is rotating.

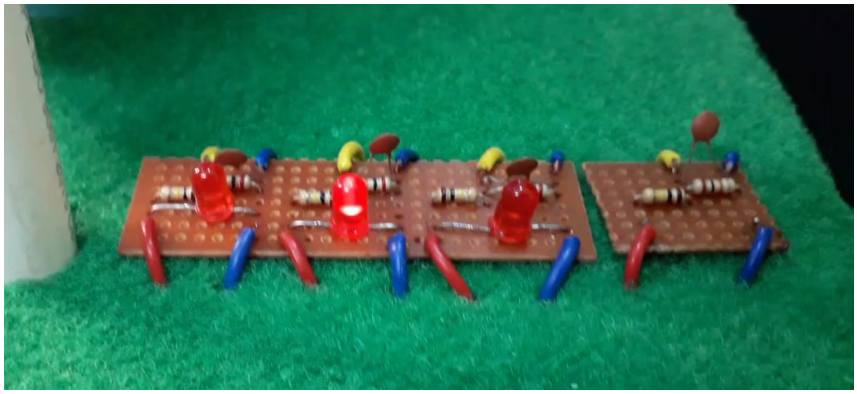


Figure 6.6: Wind Turbine -2 Geneated Voltage output

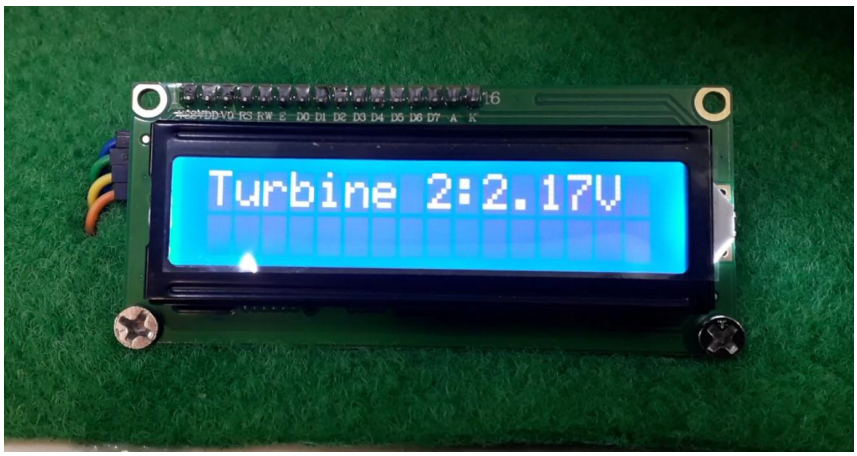


Figure 6.7: Wind Turbine -2 generated voltage output in LCD

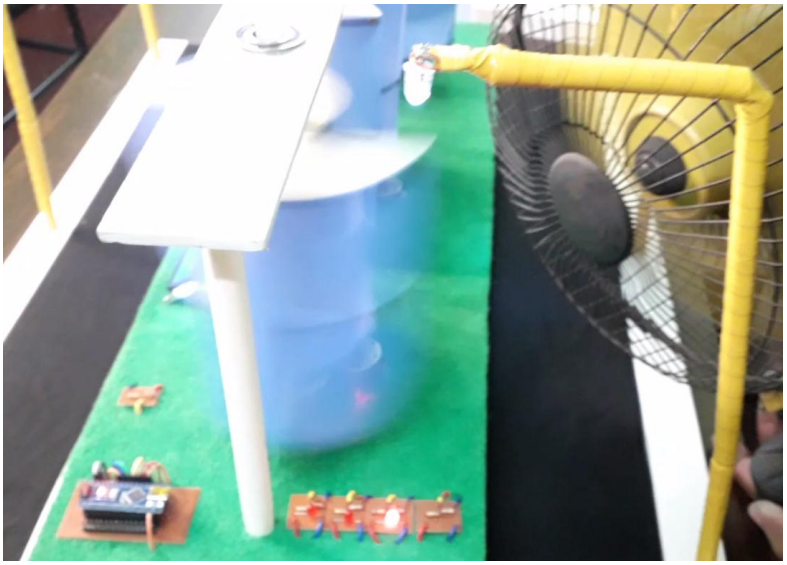


Figure 6.8: Wind Turbine -3 is rotating.

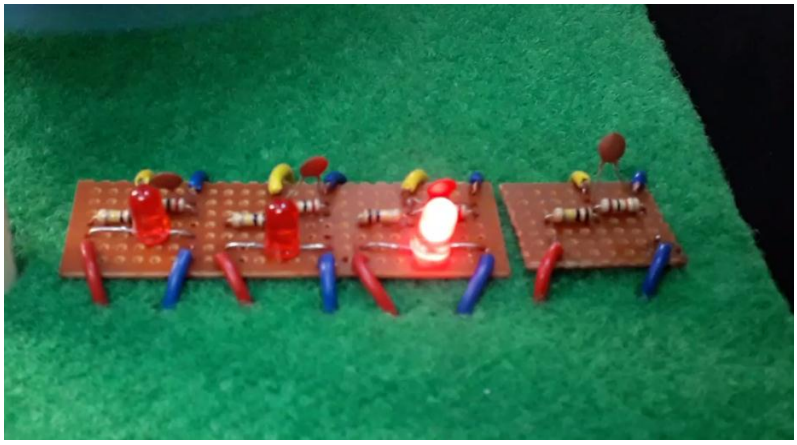


Figure 6.9: Wind Turbine -3 Geneated Voltage output



Figure 6.10: Wind Turbine -3 generated voltage output in LCD



Figure 6.11: Road Light ON, its Night Time

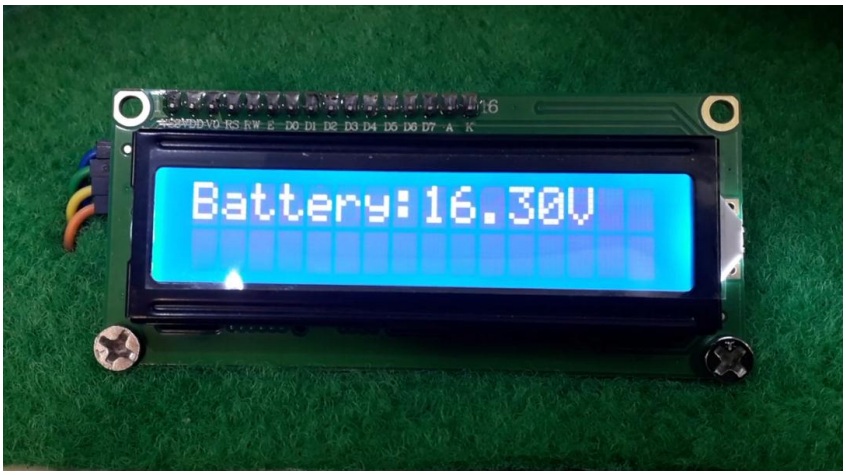


Figure 6.12: Battery Voltage showing in LCD

Chapter 7
Discussion and Conclusion

7.1 Discussion

By using this technology all the highways can be lightened without use of non-renewable energy resources. Also, if this method is implemented in all national highways it can able to produce large amount of power. And it can also provide job for many educated fellowship. By increasing numbers it can develop more energy & light up the highways so that the percentage of accidents gets minimized. The project "Highway Wind Mill" was designed such that to deliver power to switch on the emergency head lamp. The dynamo uses electromagnetic principles to convert mechanical rotation into direct current (DC) using wind energy. The system generates electrical power as nonconventional method by wind energy power using wind turbine set up. A careful selection has to be made for the blade profile so that the losses will be minimum and the power generation can be enhanced. Since the wind energy is not constant at all the time so the operation of the wind machine will be intermittent and the power production rate will also vary; the component should be design in such a manner so that the losses should be at minimum.

7.2 Advantages

- The major advantage of this design is that the rotor blades can accept the wind from any compass.
- Another added advantage is that the machine can be mounted on the ground eliminating tower structures and lifting of huge weight of machine assembly, i.e. it can be operated close to the ground level.
- Since this machine has vertical axis symmetry, it eliminates yaw control requirement for its rotor to capture wind energy. A dual purpose and relatively simple shaft axis support is anticipated as well as ground level power output delivery due to presence of vertical shaft. This may in turn, allow easier access and serviceability.

- Airfoil rotor fabrication costs are expected to be reduced over conventional rotor blade costs.
- The absence of pitch control requirements for synchronous operation may yield additional cost savings.

7.3 Disadvantages

- Rotor power output efficiency of a Darrius wind energy conversion system is also somewhat lower than that of a conventional horizontal rotor.
- Because a Darrius rotor is generally situated near ground proximity, it may also experience lower velocity wind compared to a tower mounted conventional wind energy conversion system of comparable projected rotor disc area. This may yield less energy output.
- Properly the biggest disadvantage with vertical axis machines is that far less is known about them than horizontal axis ones. This handicap is rapidly being removed.
- Although a Darrius machine has much directional symmetry for wind energy capture, it requires external mechanical aid for startup. Tests indicate that, with small machines, the problem can be solved by attaching Sorter's at the top and bo of the vertical (rotational) axis. This approach does not appear to be feasible with larger machines, but if the wind power system connected to a utility grid, the generator can serve as a motor to start the turbine. The (alternating-current) load can also provide a means for controlling the speed of the rotor regardless of the wind speed, so that variable-pitch blades are not required. At very high speeds, stalling occurs and the rotation stops automatically.
- The disadvantages are that producing efficient energy from winds takes twice as much time. The turbines have to be installed on flat land and some models require guide wires, which add more stress to the bottom of the tower; and they have a low starting torque. A consumer has to look at a design that is suitable for them by deciding on the best one for their needs.

7.4 Future Scopes

- By fixing solar panel in this vertical axis wind turbine will increase the efficiency.
- Fixing more in series or in parallel manner will give more efficiency.
- The wind energy can be tapped to a full extend when the force acting on the blade of the turbine which is coming in the opposite direction of the wind is minimized. This can be achieved when there are some holes on the blade which are closed when the wind is pushing the turbine and the holes are opened when the blade of the turbine is coming in the opposite direction of wind.
- The experiment set up is placed at the base level and the same setup may be tested at a different height. It has tested with one profile of blade and the profile of the blade may be changed for better efficiency.

7.5 Conclusion

Wind power is the most popular sources of alternative energy because it is a clean, emissions-free power generation technology and it is based on capturing the energy from natural forces and has none of the polluting effects associated with fossil fuels. Wind turbine is a machine for converting the kinetic energy available in the wind into mechanical energy. Modern wind turbines are divided into two main types based on their rotational axis: the HAWTs and the VAWTs. The efficiency of the VAWTs highly depends on the aerodynamics of the blades.

The propeller type wind turbine with blades has higher efficiency compared with flat vanes. This is caused the wind turbine has the high drag factor enables to capture wind energy. This type wind turbine has good technical properties and can be used for generating a power more efficiently for the low speed of the wind. The new turbine presents simple construction and for manufacturing can use simple technology and produce from cheap materials [10, 13]. Combining the rotor is generally one of the many ways to optimize and overcome the problem of low starting torque on Darrieus wind turbine.

References

[1] R. Devi, and J. Singh, “Design and development of prototype highway lighting with road side wind energy harvester”, International journal of science and research, 3rd ed., vol. 9, pp.2319-7064, 2014.

[2] H.Moghbelli, Hassan, H. Toliyat, and H. Abu-Rub, "A Green Hybrid Power Plant using Photovoltaic and Wind energy with Power Quality Improvement in Qatar" , Proceedings of the ASEE Annual Conference and Exposition, Vancouver, BC, Canada, 2011.

[3] S.Y.Sayais, G.P.Salunkhe, P.G.Patil, and M.F. Khatik, ”Power Generation on Highway by using Vertical Axis Wind Turbine & Solar System”, International Research Journal of Engineering and Technology (IRJET), 5th ed., vol.3, 2018.

[4] M.K.Sharma, “Assesment of wind energy potential from highway”. International Journal Of Engineering
Research and Technology (IJERT), vol.1, pp.1-8

[5] S.Bharath, G. Balaji, V.A.Saravanan, and S. Suresh, “ A Method for Generating Electricity by Fast Moving Vehicles”, In Applied Mechanics and Materials, vol. 110, pp. 2177-2182, Trans Tech Publications Ltd, 2012.

[6] D.Kalyanraj, S.L.Prakash, and S.Sabareswar, “ November. Wind turbine monitoring and control systems using Internet of Things”, In 2016 21st Century Energy Needs-Materials, Systems and Applications (ICTFCEN) , pp. 1-4), 2016

[7] L.Alhmoud, and H. Al-Zoubi, “IoT Applications in Wind Energy Conversion Systems. Open Engineering”, 9th ed. , vol.1, pp.490-499.

APPENDIX

A. Programming Codes for Proposed Project