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# Roadside Retractable Wind Turbines

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***Abstract:*** ***The utilization of wind energy as a sustainable and clean energy source is growing rapidly, but its effectiveness is limited due to the variable nature of natural wind. However, highways offer a unique opportunity to generate significant wind energy from the high volume of vehicle traffic. In order to determine the average velocity of wind created by passing vehicles, extensive research on wind patterns is required. Wind turbines will be strategically placed on the medians of highways, with careful consideration given to fluid flow from both sides of the road. By capturing wind energy through the installation of wind turbines onto existing streetlights, an endless source of electricity for lamps and other devices can be supplied. The ultimate goal of this project is to create a sustainable and efficient wind turbine that can harness wind energy from moving cars on highways.***
***Keywords: Wind Turbines, Wind Energy, Highways, Traffic, Hydraulics.***

## I. INTRODUCTION

The world's fastest-growing source of clean energy is wind energy, but its volatility poses a challenge for its widespread adoption. One possible solution is to harness the wind energy generated by moving cars on highways, which could provide a steady source of power. This initiative aims to contribute to the global trend towards renewable energy by utilizing wind energy, which is cost-effective, environmentally friendly, and can create jobs. The increasing support for wind power reflects its economic and competitive advantages among renewable energy sources.

## II. LITERATURE REVIEW

There are two processes involved in generating electricity. The first process is to convert the kinetic energy of the wind into mechanical energy using a wind turbine. Whereas the second process is to convert the mechanical energy from the first process into electricity via the generator. The conversion of wind energy to mechanical energy is based on basis of mass conservation, energy and momentum. With this, a small wind turbine can be installed and used to generate electricity along the highway by catching the induced wind turbine induced by the moving vehicle. This wind flows through the wind turbine to make electricity. Electricity will be used as a free power to turn on streetlights or be used for other services near the highway. This idea is not entirely new but still needs more effort and research to apply it along the highway. There are several attempts to get the energy from the wind caused by highway speeds on the highways have been carried out by individuals and research groups. However, there is still no complete process that has been successfully produced to implement the idea. The idea of using a small wind turbine on the highway is found in the literature. Some studies reported that the possible implementation of this idea and its advantages of wind energy is when the implementation of this idea is achieved to obtain clean energy for various applications of unused wind energy along the road. But the situation will be different when the wind turbine will be reused with the wind in the environment. Works on conducting experiments and numerically determining optimum positioning for wind turbine placement to adjacent to the highway to ensure the production of wind energy is in the maximum level of existing airflow due to the vehicle.

The roadside wind turbine project is an innovative approach to generating electricity from renewable sources. The project involves the installation of small wind turbines on the side of the road, which are designed to capture the wind energy passing by. The turbines are installed on poles or masts, which are secured to the ground using concrete or steel anchors. The project is designed to be flexible and scalable, meaning that it can be adapted to suit different locations and requirements. The turbines can be installed along highways, rural roads, and other areas with high wind speeds. They are also designed to be easy to maintain and repair, ensuring that they can continue to generate electricity for many years.

## III. METHODOLOGY/EXPERIMENTAL

### *A. Components*

#### *1) Arduino UNO*

The Arduino Uno microcontroller controls the flow of energy.

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It provides voltage to the motor and the circuit made in the breadboard. It takes input signals from the wind turbines and LDR and produces the output for the battery. The output of the program is that how the energy is stored inside the battery..



*2) Rechargeable Battery*

A rechargeable battery, store battery, or secondary cell can be charged, discharged into a load, and recharged several times in contrast to a disposable or main battery, which is provided fully charged and thrown away after use.



*3) LED Lights*

Electrical equipment frequently uses light-emitting diodes (LEDs) as a conventional source of illumination. It can be used for a variety of things, including mobile phones and huge billboards for advertising. They are typically used in gadgets that display various forms of data and display time. In this project, the LEDs are used to display the results of the project's execution.

Diameter: 3 mm
Glow Colour: Red
Forward voltage: 2.2 V to 2.4 V
Peak Reverse Voltage: 5 volts
Lens Colour: Red
Wavelength: 630-635nm



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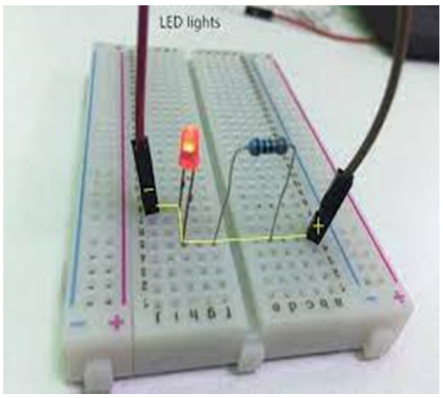
*4) Breadboard And Cables*

An electronic circuit's semi-permanent prototype is built on a breadboard, solderless breadboard, or protoboard. With the aid of several Jumper cables and wires, the circuit for capturing the energy and delivering the electricity generated to the LEDs as the output will be built upon this breadboard. Jumper wires are employed to link various objects..–

DC motor and Arduino Uno.

Arduino Uno and breadboard.

Components of Wind Turbines.




*5) DC Motor*

An electrical device known as a DC motor, also known as a direct current motor, converts electrical energy into mechanical energy and vice versa. The ability of DC motors to precisely manage speed is one of the reasons they are favored over other types of motors.

Operating voltage:7 volt~14 volt

Nominal Voltage:12 Volt

No Load Current:0.2A

Maximum Current:1.2 A

No Load Speed:4000 RPM



*6) Hydraulics*

Hydraulics are used considerably in the automotive assiduity for everything from retarding systems to power steering. still, they're also used in construction outfit, manufacturing ministry and aircraft. Hydraulics is so ubiquitous that you presumably interact with hydraulics- grounded systems numerous times throughout the day without indeed realizing it.

Model JF - 0630B DC 24V 6N Push Pull Solenoid Electromagnet

Rated Operating Voltage( VDC) - 24

Operation Mode - Push- Pull( typically Closed)

Rated Current( mama ) : 300

Holding Force(N) : 6

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*7) Vertical Fan Blades with Cylindrical Shapes*

A perpendicular- axis wind turbine( VAWT) is a type of wind turbine where the main rotor shaft is set transverse to the wind while the main factors are located at the base of the turbine. This arrangement allows the creator and gearbox to be located near to the ground, easing service and form. VAWTs don't need to be refocused into the wind,( 1)( 2) which removes the need for wind-seeing and exposure mechanisms.

*8) Capacitors*

A capacitor is a device that stores electrical energy in an electric field by virtue of accumulating electric charges on two close shells isolated from each other. It's a unresistant electronic element with two outstations

Capacitance: 10uF
Voltage: 50V
Capacitor Type: Electrolytic




*B. Method*

To build our prototype, we started by researching and selecting the necessary components, such as a turbine, a generator, and a tower. We then designed the turbine blades and structure using computer-aided design (CAD) software. Once we had our design finalized, we built the turbine and structure using materials such as PVC piping, and aluminum. To test our prototype, we installed it on the side of a busy road with high wind speeds. We connected the generator to a battery and a set of LED streetlights to see if the turbine could generate enough electricity to power them. We also measured the wind speed and direction to see how these factors affected the turbine's performance.

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## IV. RESULTS AND DISCUSSIONS

The roadside wind turbine project resulted in several benefits, including:

Clean energy generation: The turbines generated electricity from a renewable source, reducing our dependence on fossil fuels and reducing greenhouse gas emissions.

Cost savings: The project resulted in significant cost savings compared to traditional power generation methods. The turbines generated electricity at a lower cost than purchasing electricity from the grid.

Environmental benefits: The project helped reduce carbon emissions and other pollutants, resulting in improved air quality.

Public awareness: The installation of the turbines increased public awareness of the importance of renewable energy sources and helped promote sustainable living

## V. FUTURE SCOPE

Wind dynamism is a great source to fulfill dynamism conditions as well as develop the economy. future and evolution hinge upon multitudinous procurators one of them is being tone- dependent for its dynamism demands. Of all the major renewable sources they are primarily fastening on wind dynamism generation and division. Cost of wind turbines is also less consequently that they can be easily planted in farther areas. multitudinous disquisition and evolution centers should be opened for the further enhancement and process of wind authority. motive descrying to wind authority technology and other renewable dynamism technologies must be acquainted in communities and seminaries which may boost its compass in unborn considerably. Lighter wind turbines can be instated at blots of the highways consequently without important spare investment wind dynamism can be generated.

## VI. CONCLUSION

Conclusively, extensive data is collected on wind patterns produced by instruments on both sides of the trace. utilizing the collected data, a electrical compass along with turbine is aimed to be placed on the middles of the trace. Although one turbine may not give respectable authority generation, a philanthropy of turbines on a long strip of trace has implicit to produce a voluminous amount of dynamism that can be exercised to power streetlights, other public amenities or indeed produce earnings by dealing the authority ago to the grid. This project generality is meant to be sustainable and environmentally friendly.

Theoretically any moving agent can power the turbine analogous as an recreation demesne assist. The trace wind turbine can be exercised to give authority in any municipality around the sphere where there is high agent business.

## VII. ACKNOWLEDGMENT

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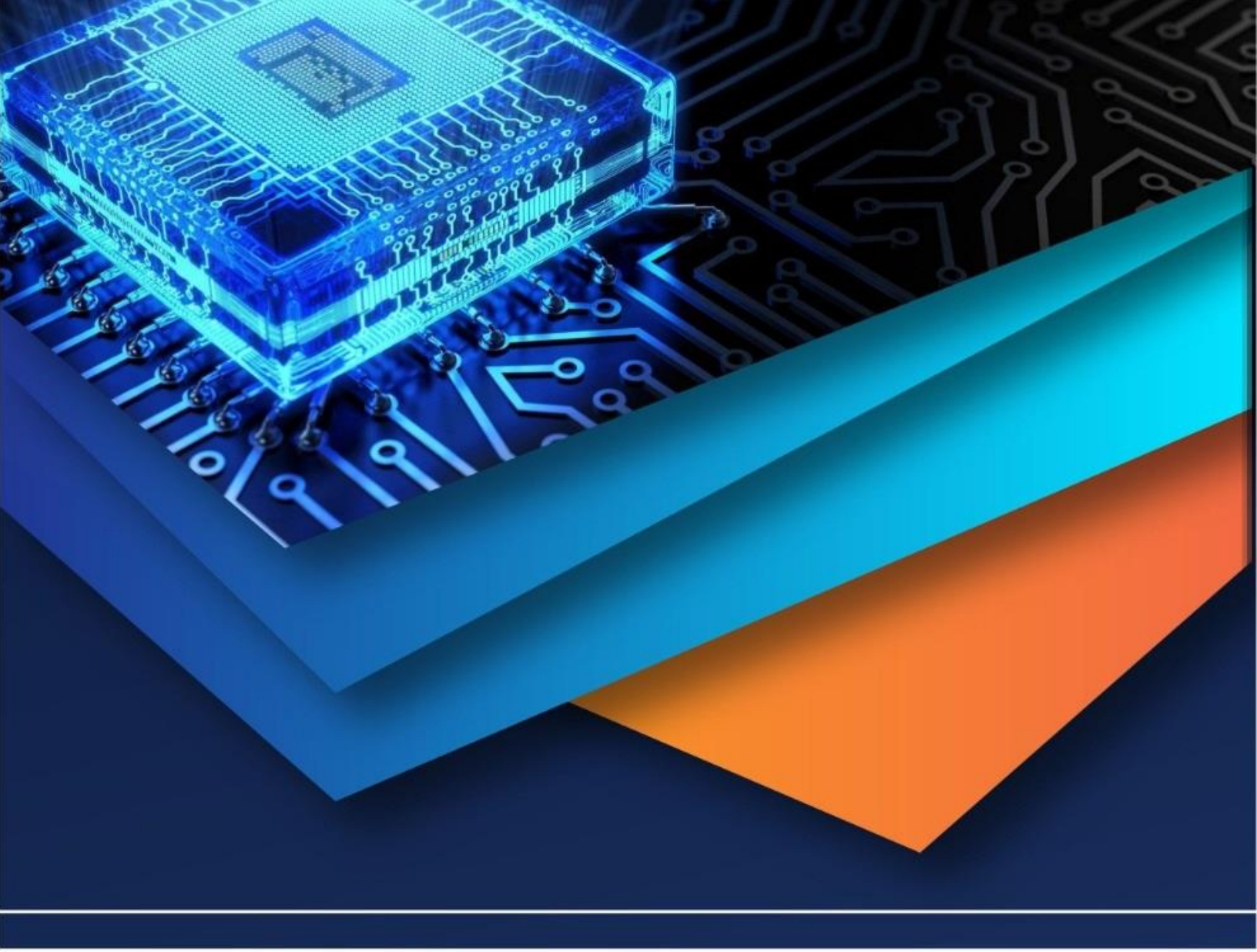
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