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BLADE-LESS WINDMILL USING VORTEX SHEDDING

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Abstract: In our country vortex shedding is a new concept of windmill without Blade-less. In renewable wind turbine there have lots of capital cost, more space required, expensive material use and also it is harmful for birds. In this concept of Blade-less windmill which work for generate electricity using piezoelectric cell. This project is present a simple and effective working. This created in a such a way that we can placed it anywhere, where wind pressure is available, hence it is a new way to generate electricity which will use in small remote area.

Due to the scarcity of fossil fuel in the future and its detrimental effects on the environment, alternative. energy has to be discovered. Wind power is a clean and sustainable natural resource that has yet to be fully utilized in the automotive industry. One of the front runners in the area of renewable energy resources today is solar power.

Index Terms - Vortex shedding, Blade-less windmill, Piezoelectric cell, Oscillation.

I. INTRODUCTION

The main objective of this project is to develop a new concept of wind turbine without blades. Called Blade-less windmill. This design represents a new structure of electricity generation to reduce the many existing problem occurred in conventional rotary wind turbine generator. Due to this vital change in project concept, it having scope in future. The device is composed of single structure component and it gives simplicity in structure, its manufacturing, transport, storage and installation has clear advantage. Also, the windmill has no bearing and gears. So, the maintenance requirement is reduced and their life span is higher life span than the traditional windmill. It is clear that the proposed device is of prime interest, and that scientific investigation of the response of this wind energy generator under different operation scenarios is highly desirable. Project is to develop the needed tools to simulate Fluid-Structure Interaction (FSI) problems and to reproduce the experimental results for scaled models of the Vortex-Blade-less device.

A wind mill is a device which converts the kinetic energy of wind into electrical energy. There are two ways of generating the energy from windmill which is through rotational windmill and oscillation windmill. Rotational windmill is effectively used in commercial application because its effectiveness and efficiency at a large scale. Oscillational windmill is used to produce less amount of electrical energy so, the advantage is that it has less space required, light in weight and cost is also less it has no Blade-less and gear box also absent. In present time, India is stepping towards spiraling into international anticyclone in terms of energy. The non - renewable energy sources are declining there is a need to produce energy from renewable sources in order to meet the energy requirement. Wind turbine is the one existing equipment providing an alternative solution. Current wind turbines suffer many drawbacks Blade-less windmill are secure and easy it works on low speed. It generates electricity by using oscillation due to wind.

II. LITERATURE SURVEY

THE LITERATURE SURVEY OF THIS PROJECT THERE ARE SOME GROUPS THAT COMPLETED THIS TYPE OF WORK BUT IN DIFFERENT DESIGNS.

--ONKAR D KSHIRSAGAR, AMOL B GAIKWAD

In this paper they study of effective design of project. Analysis and experimental of vortex Blade-less windmill. The study focuses on maximize the deflection of Blade-less windmill which is used to produce electricity. This study shows to provide tools that ensure better designing option for Blade-less windmill with experimental result.

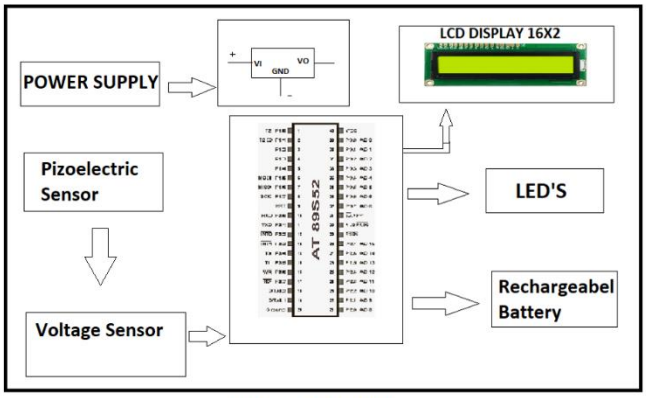
--NEETIN KUMAR, KHURSHED ALAM, SUDHANSHU KUMAR

This paper deals with the study of various method 1. By Piezoelectric Material 2. By Piezoelectric Effect 3. By Rack and Pinion Mechanism. The ability of certain material to generate and electric charge in response to applied mechanical stress. By linear generator when a magnet moves in relation to an electromagnetic coil, this change the magnetic flux flow of an electric current which can be used to do work.

--ONKAR D KSHIRSAGAR, AMOL B GAIKWAD

This concept is based on fluid dynamics. There various assembly drawing condition. The glass fiber is the most suitable material for manufacturing of vortex tube is nearly same. After experimentation, it found that the maximum deflection is more.

III. BLOCKDIAGRAM OF PROJECT



BLOCK DIAGRAM

IV. COMPONENT USED IN PROJECT-:

1. PVC Pipe and Iron structure
2. Foam Disk
3. Foam Type Material Mast
4. Spring

1. PVC Pipe and Iron structure -:

We used PVC pipe as a middle rod or support for the Foam disk. Actual work of this pipe is supporting the Foam mast and capture the humming of the air that is how the Shedding Effect can be created and we can generate the electricity. A PVC pipe is used specifically due to its light weight and flexible characteristics.

2. FOAM DISC- :

Foam disk is used for tapping on piezoelectric cell already placed on a metal ring. Diameter of foam disc is slide smaller than outer ring and allows the vertical beam to make oscillation while wind creates pressure on it. Hight of the disk is slide smaller at the outrmost side(on peremeter) than center of the disk. So the applied pressure on pizoelectrical is increses. Distance covered by disc edge in one oscillation is

Ds = (Diameter of Outer Metal Ring) – (Diameter of inner Disc)
Ds = (0.135) – (0.095)
Ds= 0.04 cm.

3. FOAM MATERIAL MAST-:

For the mast we used Foam type martial, we need to choose the material that can sustain the wind pressure in any areas and it will be need to be a lite in weight and rigid type material so we used Foam for making the mast. We designed it as square pulse type that can convert the wind pressure humming effect can called the shedding effect.

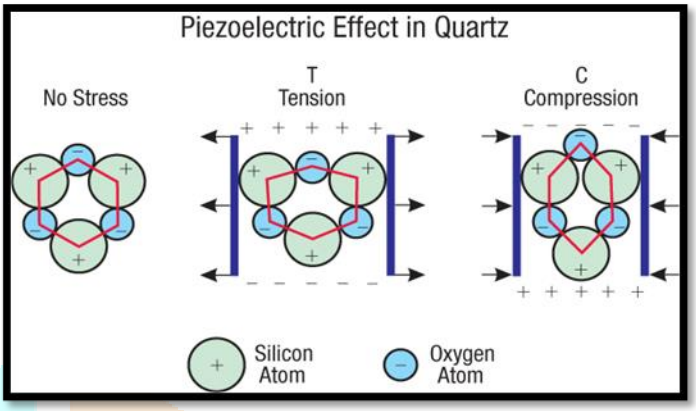
4. SPRING -:

The spring is used to provide support to a PVC pipe and to maintain the tension. Spring assembly is employed at the center of rectangular prism metal structure. Spring had a dense no of turns up to some distance above from the bottom terminal and sparse no turns toward top terminal as shown in picture. This ratio determines the equation of controlling force applied by spring.

V. Fabrication Material (Electrical and Electronic Components)

1. Piezoelectric cell
2. PCB
3. VOLTAGE REGULATOR
4. VOLTAGE SENSOR
5. MICROCONTROLLER 89s52
6. DISPLAY

1. PIEZOELECTRIC CALL -:

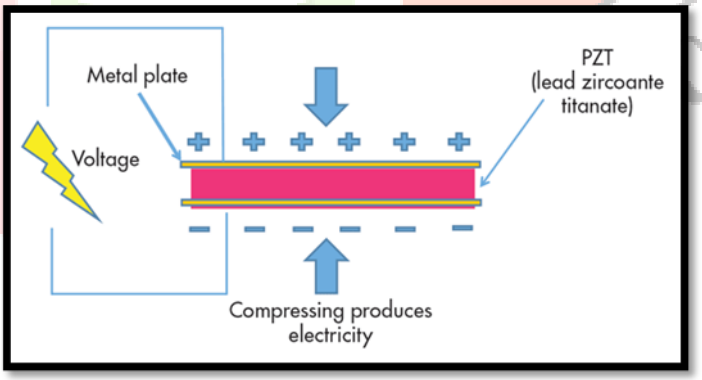


HOW PIEZOELECTRIC WORK

We have specific materials that are suited for piezoelectricity applications, but how exactly does the process work? With the Piezoelectric Effect. The most unique trait of this effect is that it works two ways. You can apply mechanical energy to the piezoelectric material and get result.

Applying mechanical energy to a crystal is called a direct piezoelectric effect and works like this:

1. A piezoelectric crystal is placed between two metal plates. At this point the material is in perfect balance and does not conduct an electric current.
2. Mechanical pressure is then applied to the material by the metal plates, which forces the electric charges within the crystal out of balance. Excess negative and positive charges appear on opposite sides of the crystal face.
3. The metal plate collects these charges, which can be used to produce a voltage and send an electrical current through a circuit That's it, a simple application of mechanical pressure, the squeezing of a crystal and suddenly you have an electric current.

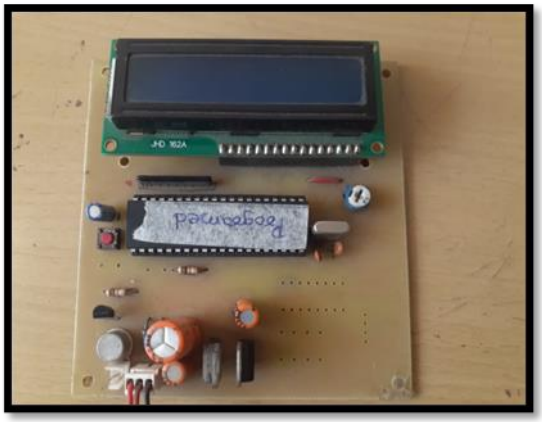


2. PCB

A printed circuit board (PCB) is a laminated sandwich structure of conductive and insulating layers. PCBs have two complementary functions. The first is to affix electronic components in designated locations on the outer layers by means of soldering. The second is to provide reliable electrical connections between the component's terminals in a controlled manner often referred to as PCB design.

The etching is usually done using photoresist which is coated onto the PCB, then exposed to light projected in the pattern of the artwork. The resist material protects the copper from dissolution into the etching solution. The etching board is then cleaned. Design and printing on PCB plate is created through Portus design software.

ELECTRONIC CIRCUIT OF PCB DESINING - :



The figure is made up of two following sub circuit

a) POWER CIRCUIT

b) REGULATOR CIRCUIT

** POWER CIRCUIT

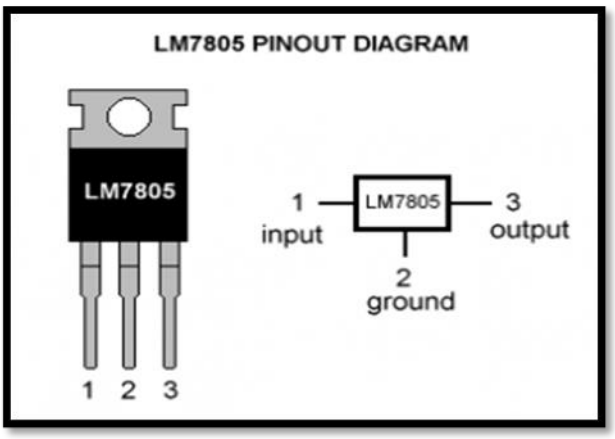
It is a primary circuit used to maintain power supply which is required for the function of electronic components such as microcontroller, display, voltage sensor etc. In this circuit external DC 5-volt supply is taken and spread it. This spread power supply is carried where it is required. A capacitor is used to sustain power in it to serve good quality of supply.

This circuit is used to convert energy produced by our project module into a stable form. The output of piezoelectric cell has much un- regularity so to fix it at a constant value we use this circuit.

Firstly, output of piezoelectric is make stable by using filters, here only 'c type' filter is used, then voltage regulator is used to further rectification and its work is described below.

3. VOLTAGE REGULATOR -:

Voltage sources in a circuit may have fluctuations resulting in not providing fixed voltage outputs. A voltage regulator IC maintains the output voltage at a constant value. 7805 Voltage Regulator, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC). The xx in 78xx indicates the output voltage it provides. 7805 IC provides +5 volts regulated power supply with provisions to add a heat sink.



PIN FUNCTION

1. INPUT - In this pin of the IC positive unregulated voltage is given in regulation.
2. GROUND - This pin is neutral for equally the Input and output.
3. OUTPUT - The output of the regulated 5V volt is taken out at this pin of the IC Regulator

4. Voltage Sensor-:

The out power generated from piezoelectric is transfer to either load circuit or store in batteries. This Output power we have to measure and display in digital format.

In this circuit a output of the voltage regulator is given to voltage sensor which compare it with predefined quantities and send it to microcontroller to make logical operation.

5. MICROCONTROLLER 89s52 -:

The 89s52 was an enhanced version of the original 8051 that featured 256 bytes of internal RAM instead of 128 bytes, 8 KB of ROM instead of 4 KB, and a third 16-bit timer. Most modern 8051- compatible microcontrollers include these features.

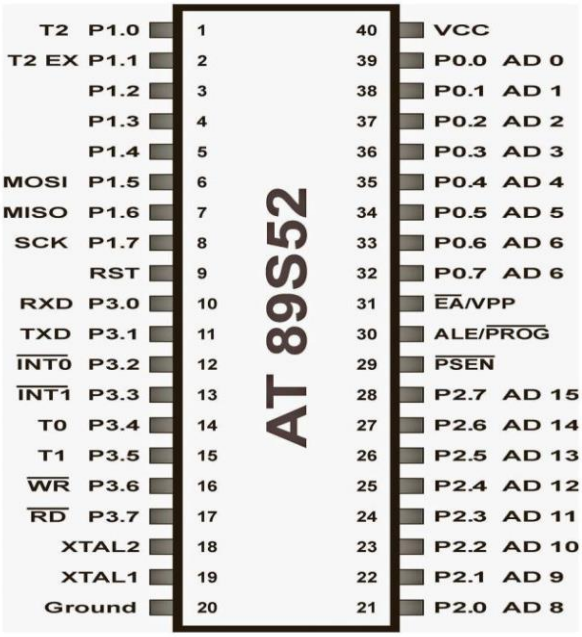
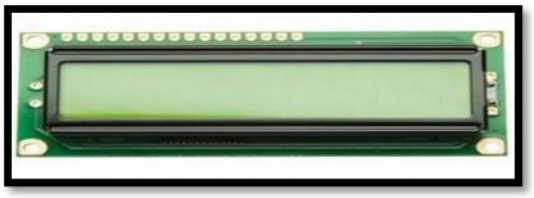


Fig- Pin Diagram of microcontroller 8052

Microcontroller Reset Circuit

A power-on reset (PoR) is a circuit that provides a predictable, regulated voltage to a microprocessor or microcontroller with the initial application of power. The PoR system ensures that the microprocessor or microcontroller will start in the same condition every time that it is powered up.

6. DISPLAY -:



LCDs (Liquid Crystal Displays) are used in embedded system applications for displaying various parameters and status of the system.

It has 8 data lines and 3 control lines that can be used for control purposes. For more information about LCD 16x2 and how to use it, refer the topic LCD 16x2 module in the sensors and modules section.

VI. CALCULATION -:

Let's consider a wind flow at a particular velocity act force on of vertical rod.
Wind Flow Velocity = U m/s.
ν= density of fuel (air),
Area of Vance of vertical Rod
A p = height * length ------- (rectangular structured)
$A_p = (0.25) *(0.05)$
$A_p = 0.0125\ m^2$
Wind Flow act force on 2 Vance at a time
So,
Force Act on Vertical Rod is,
$F_v = U\ 2* A_p$
$F_v = 2* 0.0125\ U$ Newton Meter
Vertex is composition of Vertical rod and a disc
So,
Mass of Vertex = (Mass of vertical rod) + (Mass of Disc)
$M_v = (172/9.81) + 23/9.81)$
$M_v = 19.79\ g$
When vertex starts to make a movement, its oscillations impact on Output of system.
So,
Fs =Oscillation Frequency
Distance covered by disc edge in one oscillation is
Ds = (Diameter of Outer Metal Ring) – (Diameter of inner Disc)
Ds = (0.135) – (0.095)
Ds= 0.04 cm.
Kinetic energy converted by vortex is,
E_k = Vortex Mass * (Velocity of Vortex)^2
$E_k = (M_v * (\text{Force on Vance} * \text{Distance covered in one oscillation})^2) / 2$
$E_k = M_v *(F_v * Ds)^2 /2$
$E_k = 19.79 *(2* 0.0125\ U * 0.04)^2 /2$

VII.ADVANTAGES

Advantages:

- Simple and low cost.
- Compact size and light weight.
- Pollution free.
- Corrosion and cavitation are less.
- Vortex Blade-less wind-driven generator prototype produces electricity with very few moving parts.
- Many opponents of spinning wind turbines point totheir supposed danger to birds and other flying animals.
- particularly in commercial installations – their enormous size which is not present in this vortex turbine.

VIII. FUTURE SCOPE-:

- Cutting edge research and development the future of wind technology is more exciting than ever
  So, we can create this structure in urban area also.
- In many villages of India there is no electricity available so, by developing this type of electric plant it helps for many people.

IX. RFERENCES -:

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