Generation of Electricity from Exhaust Fan

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Abstract— From home, offices, to industries there is great demand for a variety of exhaust fans. Exhaust fans are available at various specification such as RPM, watts, current, speed. etc. Most industrial units vary huge and high-speed exhaust fan are required which runs continuously. Such exhaust fans consume a large amount of electric current and energy, an attempt is made in our project to utilize the exhaust fan air flow (exhaust wind) to rotate the blades of a turbine which is coupled to an electric generator. It is like a wind energy generator. When the exhaust fan turned ON, the exhaust high speedair flow (exhaust wind) turns the blades of the turbine, which ultimately rotates the generator. The generator converts mechanical power into electric energy. This project may be applicable to small scale energy generation. The electrical energy may be stored in rechargeable batteries, a super capacitor or any other mode of storage mechanism. The stored energy can be used for inverts etc. For greater efficiency of this system exhaust air flow can be focused directly through the pipes at the turbine blade.

I. INTRODUCTION

The wind energy cannot be utilized fully to produce electricity. This limitation can be surmounted with idea of using the wind from exhaust fan of big industries as a source of power. 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.

1.1 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.

1.2 Overview of Project Report

The main aim of the project is to prove that the wind from an exhaust air system can be utilized into useful forms of energy.

Moreover, the utilization of this man- made wind energy by the energy recovery wind turbine generator is aimed to give no negative effect on the performance of the exhaust air system.

II. LITERATURE SURVEY

- Wind Energy

Wind is a natural phenomenon that is caused by then even 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).

- Literature Review

Nowadays the utilization of wind energy for electricity generation has to propel 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 ("Global Wind Energy Report: Annual Market Update 2014," 2015). Wind energy is one of the earliest sources of energy when it was utilized 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.

- Exhaust air system

Exhaust Fan: Exhaust Fan are heat removal devices used to transfer waste heat tothe 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.

- Objectives

The objectives of this research are as listed below:

1. Determination of exhaust air energy recovery turbine generator configuration by experimental analysis on wind turbine and exhaust air system performance.
2. Experimental analysis of the diffuser as a power augmentation device for the exhaust air energy recovery turbine generator.
3. Energy estimation of exhaust air energy recovery turbine generator.

III. RESEARCH METHODOLOGY

- Team selection

In previous semester our teachers told us to make a group for capstone project. So we discussed with our guide and team members to being a team then they all are accepted and teachers were allotted groups for capstone project. Then we performed a seminar

- Finding problem in society

As we can see, natural resources are about to end, there have only few coals are present to generate electricity. So we think about generate electricity from Exhaustfan because air is natural resource and if we generate electricity from this it's also environment friendly.

- Discussion on project title

Our guide gave instructions to us to find any five titles on any domain to we do work on. So we discussed with team members to make a use of wind energy which gives more amount of energy without human effort.
Finalization of title

We take the title on "Generation of electricity from exhaust fan" and we consult this to our guide and we all performed a title finalization seminar and our title get final.

- Collect related information

It is an energy recovery system which may reduce the energy demand by generating energy from waste. This system enables the low wind speed countries especially in urban areas to harness wind energy from exhaust air resources which are consistent and predictable

- Make project proposal

We decided to work on Generation of electricity from exhaust fan and also we get permission from our HOD sir and also our guardian teacher.

IV. EXPERIMENTATION/ IMPLEMENTATION/ SIMULATION

- Experimentation

The unnatural wind resources can be from Exhaust fan of industries or Restaurants, cooling towers, air ventilation systems, humidification plants or any system that produce strong and consistent winds. However, the integration of the exhaust air energy recovery wind turbine generator is not identical for all the unnatural wind resources. A specific configuration has to be designed in order to recover the maximum

amount of energy from the exhaust air system without any significant negative effect to the original system. In this study, the exhaust air energy recovery wind turbine generator is specifically designed.

Procedure for generating Electricity from Exhaust air: -

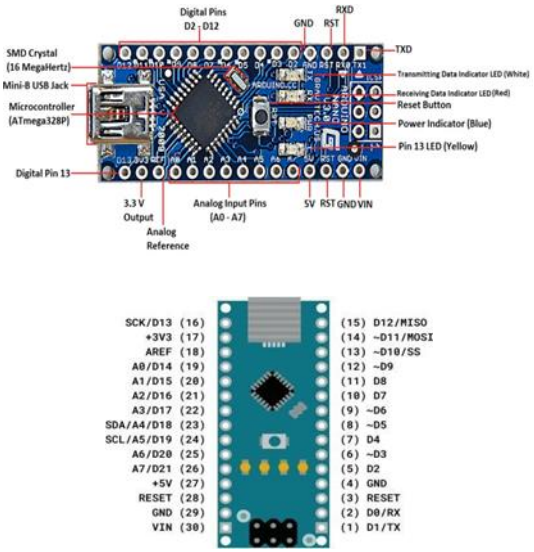
1) While switch on the supply first check the inverter is in off position.
2) Then Switch on the supply for exhaust fan.
3) Exhaust fan will run and dynamo will start run and produced electricity is Connected to charge flow converter and connected to battery.
4) Battery will store the electricity.
5) Then switch off the exhaust fan supply.
6) Now switch on the inverter switch.
7) AC Load has given.

Implementation

Component Dynamo Generator:

12V, DC, 0.9Amper Generator is a machine that converts mechanical energy into electrical energy. It works based on principle of faraday law of electromagneticinduction. The faradays law states that whenever a conductor is placed in a varying magnetic field, EMF is induced and this induced EMF is equal to the rate of change offlux linkages. This EMF can be generated when there is either relative space orrelative time variation between the conductor and magnetic field.

Arduino nano:

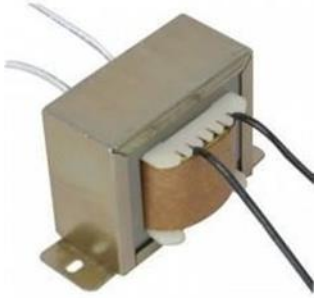


The classic Nano is the oldest member of the Arduino Nano family boards. It is similar to the Arduino but made for the use of a breadboard and has no dedicated power jack. Successors of the classic Nano are for example the Nano 33 IoT featuring a WiFi module or the Nano 33 BLE Sense featuring Bluetooth Low Energy and several environment sensors. The ATMega328 CPU runs with 16 MHz and features 32 KB of Flash Memory (of which 2 KB used by bootloader).

Technical specifications

- Microcontroller: Microchip ATmega328P
- Operating voltage: 5 volts
- Input voltage: 6 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 0.5 KB is used by bootloader
- 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

Step Down Transformer:



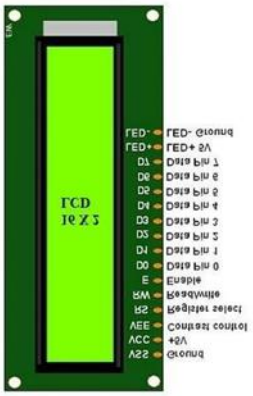
0-12 500mA Step Down Transformer is a general-purpose chassis mounting mains transformer. Transformer has 230V primary winding and non-center tapped secondarywinding. The transformer has flying colored insulated connecting leads (Approx. 100 mm long). The Transformer act as step down transformer reducing AC - 230V to AC
- 12V.

The Transformer gives outputs of 12V and 0V. The Transformer's construction is written below with details of Solid Core and Winding.

The transformer is a static electrical device that transfers energy by inductive coupling between its winding circuits. A varying current in the primary winding creates a varying magnetic flux in the transformer's core and thus a varying magnetic flux through the secondary winding. This varying magnetic flux induces a varying electromotive force (E.M.F) or voltage in the secondary winding. The transformer has cores made of high permeability silicon steel. The steel has a permeability many times that of free space and the core thus serves to greatly reduce the magnetizing currentand confine the flux to a path which closely couples the winding.

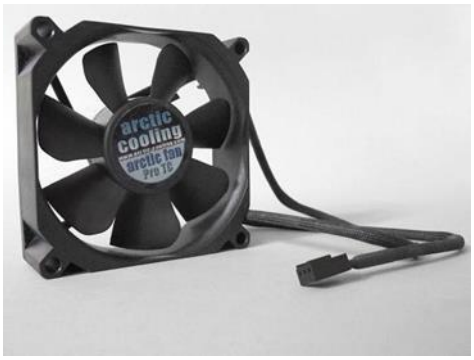
- LCD Display:

The 16×2 LCD pin out is shown below.



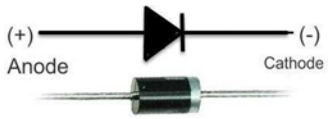
- Pin1 (Ground/Source Pin): This is a GND pin of display, used to connect the GND terminal of the microcontroller unit or power source.
- Pin2 (VCC/Source Pin): This is the voltage supply pin of the display, used to connect the supply pin of the power source.
- Pin3 (V0/VEE/Control Pin): This pin regulates the difference of the display, usedto connect a changeable POT that can supply 0 to 5V.
- Pin4 (Register Select/Control Pin): This pin toggles among command or dataregister, used to connect a microcontroller unit pin and obtains either 0 or 1(0 = data mode, and 1 = command mode).
- Pin5 (Read/Write/Control Pin): This pin toggles the display among the read or writes operation, and it is connected to a microcontroller unit pin to get either 0 or1 (0 = Write Operation, and 1 = Read Operation).
- Pin 6 (Enable/Control Pin): This pin should be held high to execute Read/Write process, and it is connected to the microcontroller unit & constantly held high.
- Pins 7-14 (Data Pins): These pins are used to send data to the display. These pins are connected in two-wire modes like 4-wire mode and 8-wire mode. In 4-wire mode, only four pins are connected to the microcontroller unit like 0 to 3, whereas in 8-wire mode, 8-pins are connected to microcontroller unit like 0 to 7.
- Pin15 (+ve pin of the LED): This pin is connected to +5V
- Pin 16 (-ve pin of the LED): This pin is connected to GND.

CPU Fan:



Voltage Regulator IC 7905:

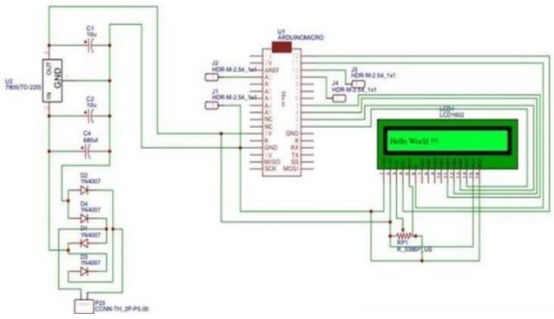
Diode



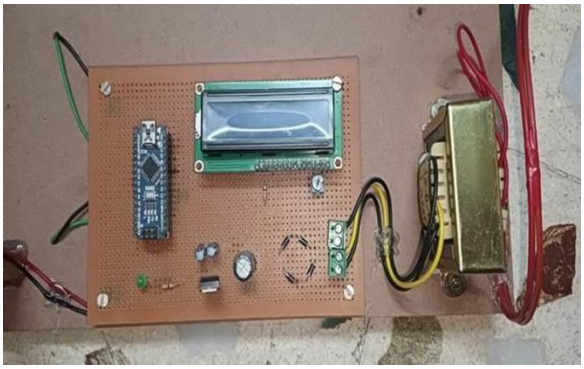
Light-emitting diode (LED)

Capacitor

Circuit Diagram



Photography of Project



Simulation

As we can see, natural resources are about to end, there have only few coals are present to generate electricity. So we think about generate electricity from Exhaustfan because air is natural resource and if we generate electricity from this it's also environment friendly. We take the title on "Generation of electricity from exhaust fan" and we consult this to our guide and we all performed a title finalization seminar and our title get final. It is an energy recovery system which may reduce the energy demand by generating energy from waste. This system enables the low wind speed countries especially in urban areas to harness wind energy from exhaust air resources which are consistent and predictable We decided to work on Generation of electricity from exhaust fan and also we get permission from our HOD sir and also our guardian teacher

4.3.1 Coding

Project Code:-

#include <LiquidCrystal.h>float LDR = A0;
int led1 = 7; int led2 = 13;
const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2;LiquidCrystal lcd(rs, en, d4, d5, d6, d7);

```
void setup() { Serial.begin(9600);lcd.begin(16, 2);
}
void loop() {
LDR = analogRead(LDR); Serial.print("\n Voltage =
"); Serial.print(LDR/100); delay(1000);
lcd.setCursor(0, 0); lcd.print("Voltage = ");
lcd.print(LDR/100); lcd.setCursor(0, 1);
lcd.print("Current = "); lcd.print(LDR/1000); if(LDR
> 150)
{
digitalWrite( led1 , HIGH);digitalWrite( led2 , HIGH);
}
else
{
digitalWrite( led1 , LOW);
}
digitalWrite (led2 , LOW);
}
```

V. RESULTS AND DISCUSSIONS

- Result

Output is coming in 12v and us successfully done the project. When fan is rotating weget output near about 10v. We will change the output by change in program code of Arduino nano.

- Discussion

Our guide gave instructions to us to find any five titles on any domain to we do work on. So we discussed with team members to make a use of wind energy which gives more amount of energy without human effort.

- Application

This circuit is use in further company to regenerate electricity by exhausted FAN. We can also use in the end of exhaust of vehicle it use in bike, car, and heavy vehicles

CONCLUSION

Thus, we get the knowledge about how to generate electricity from exhausted air. We able to make the project of generation of electricity from exhausted air. We generate electricity. 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 andhence 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. The wasted wind from exhaust fan can be efficaciously utilized to generate power if proper implementations are done.

REFERENCES

[1] Anon (2010). "What is wind?". Renewable UK: Education and careers. Renewable UK. Retrieved 9April 2012.

[2] Er. R.K. Rajput. Non-conventional energy sources and utilization.2013 Edition.

[3] Kira Grogg (2005). Harvesting the Wind: The Physics of Wind Turbines. Physics and Astronomy Comps Papers.

[4] http://raeng.org.uk/education/diploma/maths/pdf /ex emplars_advanced/23_Wind_Turbine.pdf

[5] http://houstonrenewableenergy.org/renewableenergy/windenergy/

[6] http://en.wikipedia.org/wiki/Wind_power_in_India

[7] B.H. Khan (2013). Non-conventional Energy resources. 2nd Edition.

[8] Exhaust air energy recovery (Ahmad Fazlizan Bin Abdullah)