



## DESIGN AND ROBOTIC CONTROL OF MODERN WIND TURBINE.

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**ABSTRACT:** Mini wind turbines can be used in the remote areas. For a farmer who wants to water his crop or a utility company that wants to use distributed generation to help defer building new transmission lines and distribution facilities with use of smart mobile devices. That is, Farmers can control the dripping irrigation even by their absence in the fields. This paper covers the working of small wind turbine under automatic switching using an arduino uno. The program is been dumped in the arduino through which the whole energy path is controlled either to conduct load (Phone Charger) or to store energy for emergency purposes by charging the batteries. , along with a voltage booster. Mini wind turbines can be used for powering communities, businesses, homes, and miscellaneous equipment to support unattended operation.

**Keywords:** [ Arduino, Renewable energy, irrigation purpose, voltage booster, Distance controlling.]

### 1. INTRODUCTION

Renewable Energy Sources are those energy sources which are not destroyed when their energy is harnessed. Human use of renewable energy requires technologies that harness natural phenomena, such as sunlight, wind, waves, water flow, and biological processes such as anaerobic digestion, biological hydrogen production and geothermal heat. . Amongst the above mentioned sources of energy there has been a lot of development in the technology for harnessing energy from the wind. Wind is the motion of air masses produced by the irregular heating of the earth's surface by sun. These differences consequently create forces that push air masses around for balancing the global

temperature or, on a much smaller scale, the temperature between land and sea or between mountains.

Wind energy is not a constant source of energy. It varies continuously and gives energy in sudden bursts. About 50% of the entire energy is given out in just 15% of the operating time. Wind strengths vary and thus cannot guarantee continuous power.

The power extracted from the wind can be calculated by the given formula:

$$P = \frac{1}{2} \rho A V^3$$

$\rho$  = effect of air density

$A$  = effect of swept area and

$V$  = effect of wind speed

Swept Area  $A = r^2$ .

## 2. PROPOSED METHODOLOGY.

In rural areas for the purpose of irrigation there is always need a physical presence of the farmer. This may not be possible all the time. Therefore, Mini wind turbine module would be a solution for such situation. Farmers can control the water pumping to crops even in their absence.

Mini wind turbine technology especially designed for the irrigation purposes. For analysis, we used the load as 5volt phone charger, in actual implementation the energy is used to power water source in the field and when the supply is off the energy is stored in the batteries for back up. Implementing this project in the rural areas will help them find more renewable and affordable way of involving technology into their day to day work rather than depending on expensive energy sources.

## 3. TECHNICAL SPECIFICATIONS

Dynamo; rated voltage DC 12V; rated speed 1000RPM, Shaft size: 12\*4mm(L\*D);Speed Reducing Rate:9.45

Voltage Booster; output current: 1.5A (minimum), 2.2(typ); Input and output voltage difference range-40vdc; The adjustable output voltage range: 1.2-37V; operating temperature -55 degree to + 150 degree.

Arduino UNO Bluetooth model: HC-05 Wireless Bluetooth Host Transceiver module Slave and Master RS232 for Arduino.

Relay Switch: Dimensions: 50.6mm (long)\*38.8mm (wide)\*19.3mm (high); 5V relay, plug jumper cap, Max Output: DC 30/10A, AC 250V/10A. VCC: system power supply cathode, GND: system power source cathode, IN1-IN2-relay control port.

### A. Dynamo

Including the electric motor, the alternating-current alternator, and the rotary converter, a dynamo of 1000rpm is been placed perpendicularly to the wind turbine blades. As the increases produces more voltage and gives accurate output.



**Figure 1 dynamo**

### B. Wind turbines blades

Wind turbine blades for use e.g. in generating electricity. Wind turbines use wind to make electricity. The terms wind energy or wind power describe the process by which the wind is used to generate mechanical power or electricity. This mechanical power can be used for specific tasks (such as grinding grain or pumping water) or a generator can convert this mechanical power into electricity.

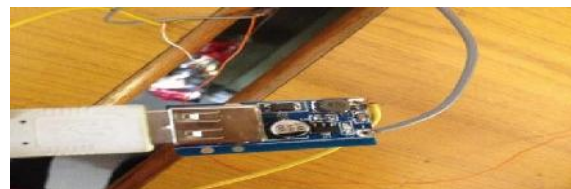


**Figure 2. Wind blades**

### C.2 to 5v Voltage booster.

A **boost** converter (step-up converter) is a DC to-DC power converter that steps up **voltage** (while stepping down current) from its input (supply) to its output (load).

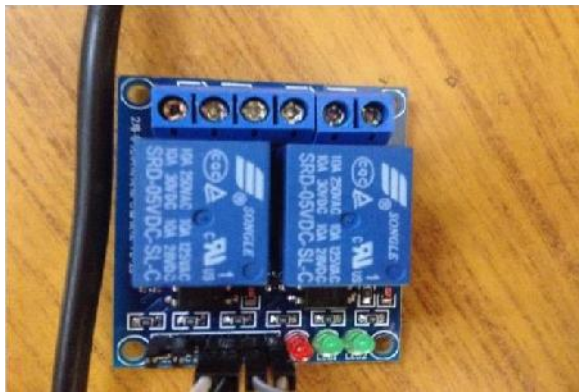
The DC input to a boost converter can be from many sources as well as batteries, such as rectified AC from the mains supply, or DC from solar panels, fuel cells, dynamos and DC generators.



**Figure.3 Voltage Booster**

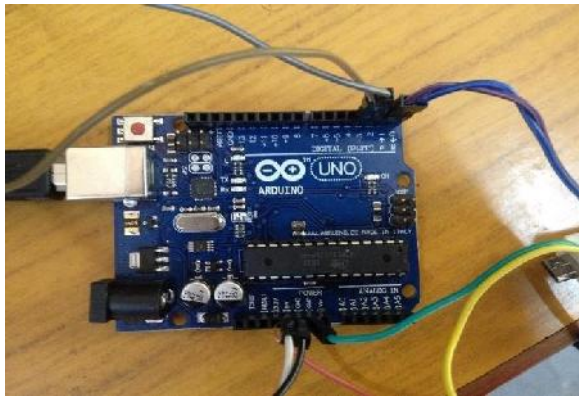
**Relay switch**

A relay is an electromagnetic switch operated by a relatively small electric current that can turn on or off a much larger electric-current.



**E. Arduino UNO.**

It acts as Microcontroller in this project for deviating the path either to load or to storage element. Its model number is ATmega328P (datasheet).



**Figure. 4 Arduino UNO.**

**G. Arduino Pin Diagram**

**ARef:** Provides reference to the analog inputs It resets the microcontroller when low.



**Figure 5. Arduino Pin Diagram**

A typical example of Arduino board is Arduino Uno. It consists of ATmega328- a 28 pin microcontroller.

**Power Jack:** Arduino can be power either from the pc through a USB or through external source like adaptor or a battery. It can operate on a external supply of 7 to 12V. Power can be applied internally through the pin Vin or by giving voltage reference through the IOREf pin.

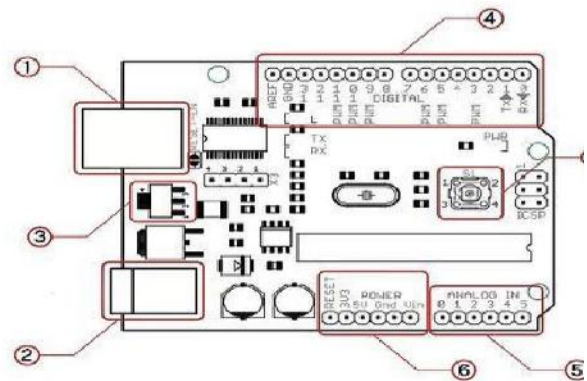
**Digital Inputs:** It consists of 14 digital inputs/output pins, each of which provide or take up 40mA current. Some of them have special functions like pins 0 and 1, which act as Rx and Tx respectively , for serial communication, pins 2 and 3-which are external interrupts, pins 3,5,6,9,11 which provides pwm output and pin 13 where LED is connected.

**Analog inputs:** It has 6 analog input/output pins, each providing a resolution of 10 bits.

**H. Bluetooth/wifi module**

Technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices, and building personal area networks (PANs).

**Wifi-Description:** The ESP8266 **WiFi Module** is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your **WiFi** network. The ESP8266 is capable of either hosting an application or offloading all **Wi-Fi** networking functions from another application processor.



**Figure 6.Wi-Fi Module.**



### J.Arduino cables and connectors

Cables made to connect to these pin headers are usually one of two types: individual wires with **crimp** connectors on them or ribbon cables with **insulation displacement** connectors.



**Figure.7 Cables**

### K. PC with Arduino software

Arduino software, here we execute codes in embedded C, in an IDE called ARDUINO, based on the sensors data/users need we can write the code. Bluetooth/Wifi Control is an application that allows you to control your arduino's board (and similar boards) via These can simply be clamped onto the end of a ribbon cable, which creates a connection to each one of the conductors in the ribbon cable. Generally, cables are only available as female gender and expect a male pin to mate with. - position crimp-type cable.



**Figure 8 USB cable.**

This is a standard issue USB 2.0 **cable**. This is the most common A to B Male/Male type peripheral **cable**, the kind that's usually used for printers. Compatible with most SFE designed USB boards as well as USB **Arduino** boards like the Uno.

Bluetooth. once if we are paired with device's bluetooth module and mobile bluetooth connection, we now start giving commands to device for the deviation of path either to battery or load depending on the application we use, provided for bluetooth module data transfer, they have to be within the range of bluetooth distance,

whereas in case of wifi, distance doesn't come into picture, both mobile and device should have wifi/net connectivity.

The application also smartly remembers your bluetooth module and will always try to connect automatically to the latest one you have used, so you won't have to select it every time you use it

### WORKING

The whole concept is based on the basic principles Bernoulli Principle and the lesser known

Coanda Effect that states that air tends to follow a curved surface as long as the curvature isn't too exaggerated or the "angle of attack" (the steepness of the blade edge as it is presented to the moving wind) too great. If either happens, the laminar (smooth) airflow is disturbed and turbulence is created that can lead to a stall.

Propeller blades exhibit the same lifting and stalling characteristics as fixed aircraft wings. Helicopters are a prime example of propeller blades that are really rotating wings where blade shape and pitch control the motions of the machine. However, in our case we are using the moving wind to spin the blades instead of powering the blades themselves; the effect, however, is still the same.

This basic principles are used to obtain the ultimate aim that is **Conversion of Mechanical energy to Electrical energy** that can later be used to operate any electrical device. The blades rotate due to wind force causing the dynamo to rotate. Once a uniform magnetic field is created the commutator helps convert it to electrical energy which is followed by the voltage booster, which is used to step-up to the required voltage that can be

used instantly or can be store for later use. The microcontroller does this work very well at deviating the current paths according to the requirement needed,in a specific code is damped in it, and for its controlling purposes a wifi or Bluetooth connectivity is required for the communication with Arduino,with the help of mobile application,so they can be controlled from distant places away from the home for irrigation purposes.

This tool is just a classic terminal that receives and sends data to the board, displayed with the timestamp corresponding to each action.

Software code used in Arduino

## CONNECTIONS

The +ve terminal of the dynamo/generator is connected to the second pin from left of relay i.e source pin. The negative terminal is grounded (i.e. to ground pin in relay switch on right side). In relay switch there are 1-2 sets of three pins on left side of switch, simultaneously one set is used at a time. Load pin (i.e. left pin), source pin(i.e. middle pin), battery connection pin(i.e. right pin). The load pin is connected to the booster terminal through which the voltage is stepped up from 2 volts to 5 volts. Then the booster is connected to load (i.e. mobile charger). The third pin is connected to battery positive terminal, the negative terminal is grounded.

On right side of switch, there will be 4 pins, 2 signal pins, 1 ground pin,1 voltage pin (+5v). Only one signal pin can be used in the switch, this signal pin is connected to 2nd or 3rd pin of arduino uno.

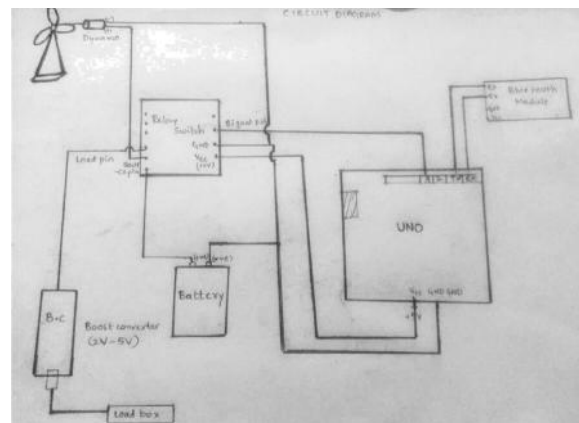
Ground pin is connected to ground pin of arduino uno. Voltage pin is connected to voltage pin of arduino Uno (+5volts) Now from Bluetooth module, there are two pins we will be using,(Rx read signal) and (Tx write signal).

This Rx pin is connected to Tx pin of arduino uno, and Tx pin of Bluetooth module is connected to Rx pin of arduino Uno. All negatives are connected together to a ground pin of arduino uno.It is operated through an

android application (arduino Bluetooth control.)

after the connections, the Bluetooth module is detected and connected through the app.

When the Bluetooth is turned on, it receives the signal and sends to arduino, where the signal is controlled. This arduino controls the signal through relay switch. Now the relay switch short-circuits the load pin and the current flows to the load (i.e. mobile is charged) via booster which step ups the voltage. Now, when the Bluetooth is turned off, it receives the signal sends to relay switch through arduino. The relay switch short-circuits the battery connected pin and stores the charge (energy).



The blades rotate due to wind force causing the dynamo to rotate. Once a uniform magnetic field is created and the commutator helps convert it to electrical energy and the flow of this energy is controlled by bluetooth module. This operation is done by using a pre existing arduino application that helps control the circuit functionality. This energy is stored and utilized as per requirement of the use

### Software used Arduino(microcontroller)

```
int relay1 = 2;
String readString;
void setup(){
  Serial.begin(9600);
  pinMode(relay1, OUTPUT);
}
void loop() {
  while (Serial.available()) {
    delay(3);
```

```

char c = Serial.read();
readString += c;
}
if (readString.length() >0) {
Serial.println(readString);
if (readString == "ON")
{
digitalWrite(relay1, HIGH);
}
if (readString == "OFF")
{
digitalWrite(relay1, LOW);
}
}
//next
readString="";
}
}

```

## CONCLUSION

The whole ideology is to create such a device that is compatible with commodities that we use in our day to day life that can help convert the wind energy into electrical energy, which is efficiently done using the present technology called ARDUINO, which controls the operation from distance places. Hence, this energy can be stored and later applied to either charge or use any electronic device.

## RESULT AND DISCUSSION

The wind input given is converted into electrical energy, producing an output voltage upto 5v.

This is used by load that is to charge mobile phones or to charge battery, which is controlled by Bluetooth module /wifi module via arduino uno from longer distances through mobile phones.

## FUTURE SCOPE

Industries will start using renewable products and contribute to the ecological balance.

Our project would become even more efficient with continuous supply of wind by placing sensors to the turbine blades and moving accordingly.

For large scale implementation, we will be using high rated Generator, relays.

## STRUCTURE

Wind turbine is installed near to the field and a Wi-Fi connection in the field and at farmer's home. We can use Google balloons for internet access at the field.

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