Vertical Axis Windmill with Shrinkage of Blades using Servomotor and IoT Applications

R.Manoj Kumar
N.Gokul Prasath
S.Kalaiprabhu
S.Ganeshkumar
Third Year Mechanical Engineering

Ramco Institute of Technology

January 13, 2020

Outline

Windmill Tower

Windmill Blades

Components

Airflow Direction Sensor

Raspberry Pi

Data Logger

Generator

Battery

Methodology

Modeling of

Windmill Tower

- Tower is made up of material known as “302 Stainless Steel”.

Specifications and Properties

- Low deflection value when compared to other metals
- Excellent corrosion resistance
- Ease of fabrication
- Good strength and toughness at cryogenic temperatures
- Excellent formability

Windmill Tower

Figure: Windmill Tower Sample

Windmill Blades

- Windmill Blades are made up of Sheet metal.

Specifications and Properties

- It has greater bending strength.
- Withstand under pressure without breaking.
- It is low weight, so the wind blade can rotate at low speed.
- It is non-corrosion material, weldable and machinable.

Windmill Blades

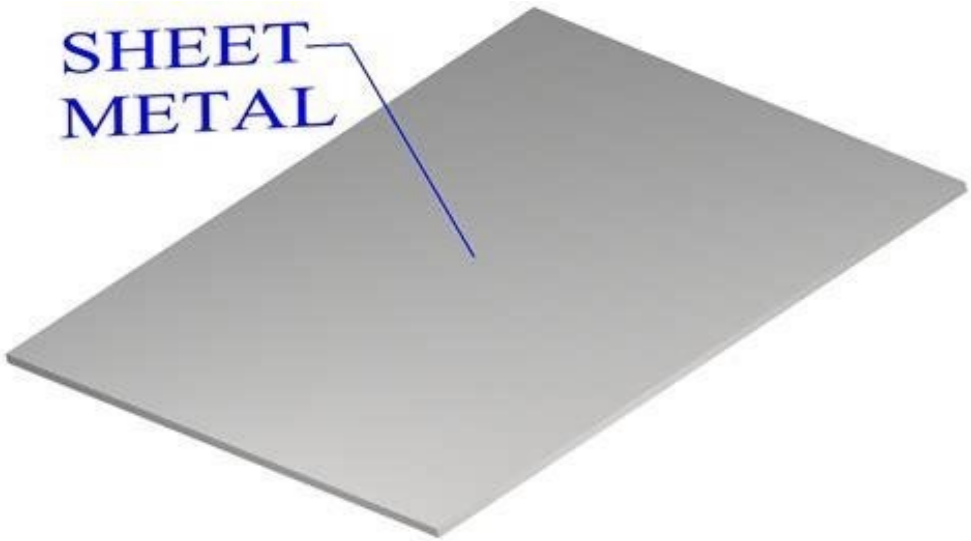


Figure: Windmill Blades Sample

Airflow Direction Sensor

- Air flow direction sensor is used to sense the wind direction and send the binary input to the servomotor which rotates according the wind direction consequently more power should be produced.

Figure: Airflow Direction Sensor

Raspberry Pi

- The Raspberry Pi 4 is a low cost modulator, which performs like a small size computer and uses a standard keyboard and mouse. The sensor output is given to the Raspberry pi which converts the electrical output into the binary output. The binary output is given to the servomotor.

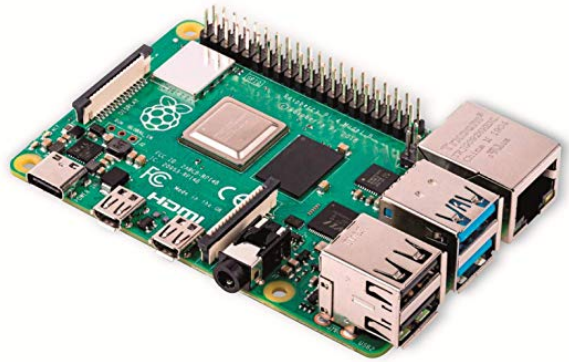


Figure: Raspberry Pi 4

Data Logger

- Data logger is electronic instrument which record the data over the set interval of time. Data logger is used to find the electricity usage of building and manage the peak demand and energy profile. Here the energy used by the building should be eventually monitored. If the energy amount used by the home is small when compared to peak demand, the system sends the message to the user for appreciation. If the energy amount used by the home is large when compared to peak demand, the system sends the message to the user for repression.

Data Logger

Figure: Battery Powered Data Logger

Generator-Specifications

- Rated Power : 200W
- Rated voltage : 12V
- Rated Speed : 4500rpm

Battery-Specifications

- 12v 26Ah
- Battery Cell Composition is Lead-Acid, AGM
- AGM is maintenance free, provides good electrical reliability.

Figure: Battery Sample

Methodology

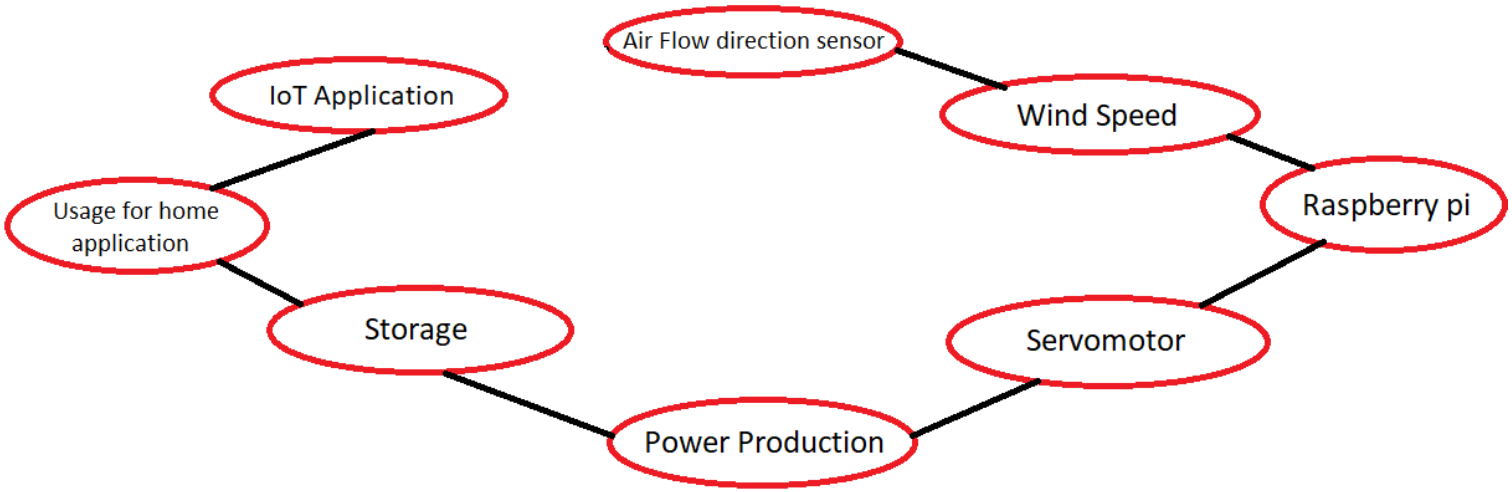
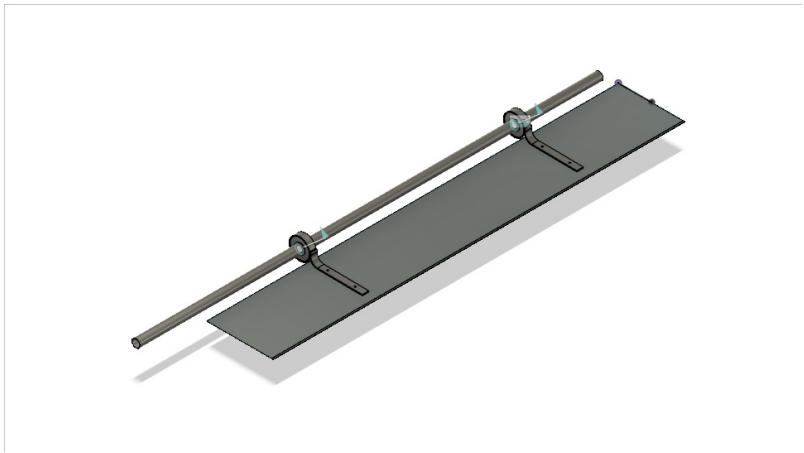
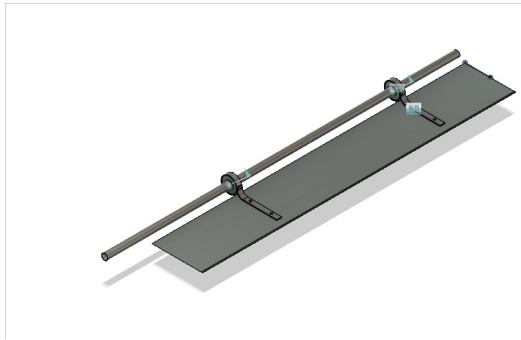


Figure: Flow Diagram

Modeling



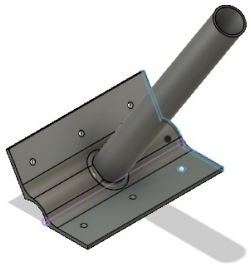
(a) upper plate-Blade(Sheet metal) v1



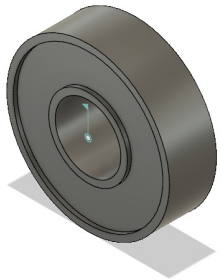
(b) lower plate-Blade(Sheet metal) v9

Figure: Plate Blade

Modeling



(a) Clamp v9

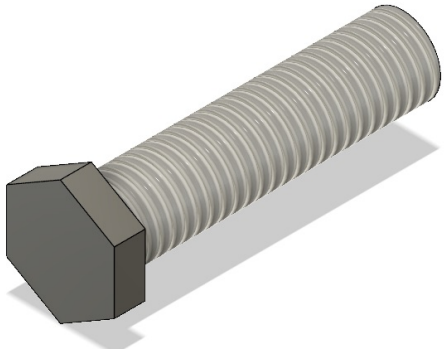


(b) bearing v2

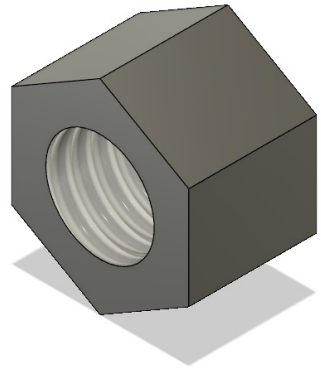
(c) Blade clamp-1 v2

Figure: Clamp and Bearing

Modeling



(a) Bolt v2

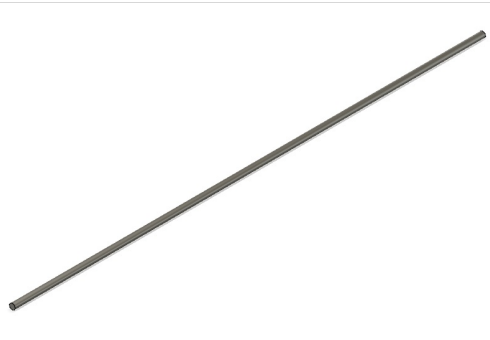


(b) Nut v3

Figure: Bolt and Nut

Modeling

(a) plat rod v2



(b) Shaft v1

(c) Tower v3

Figure: Shaft, Plate rod and Tower

Assembly

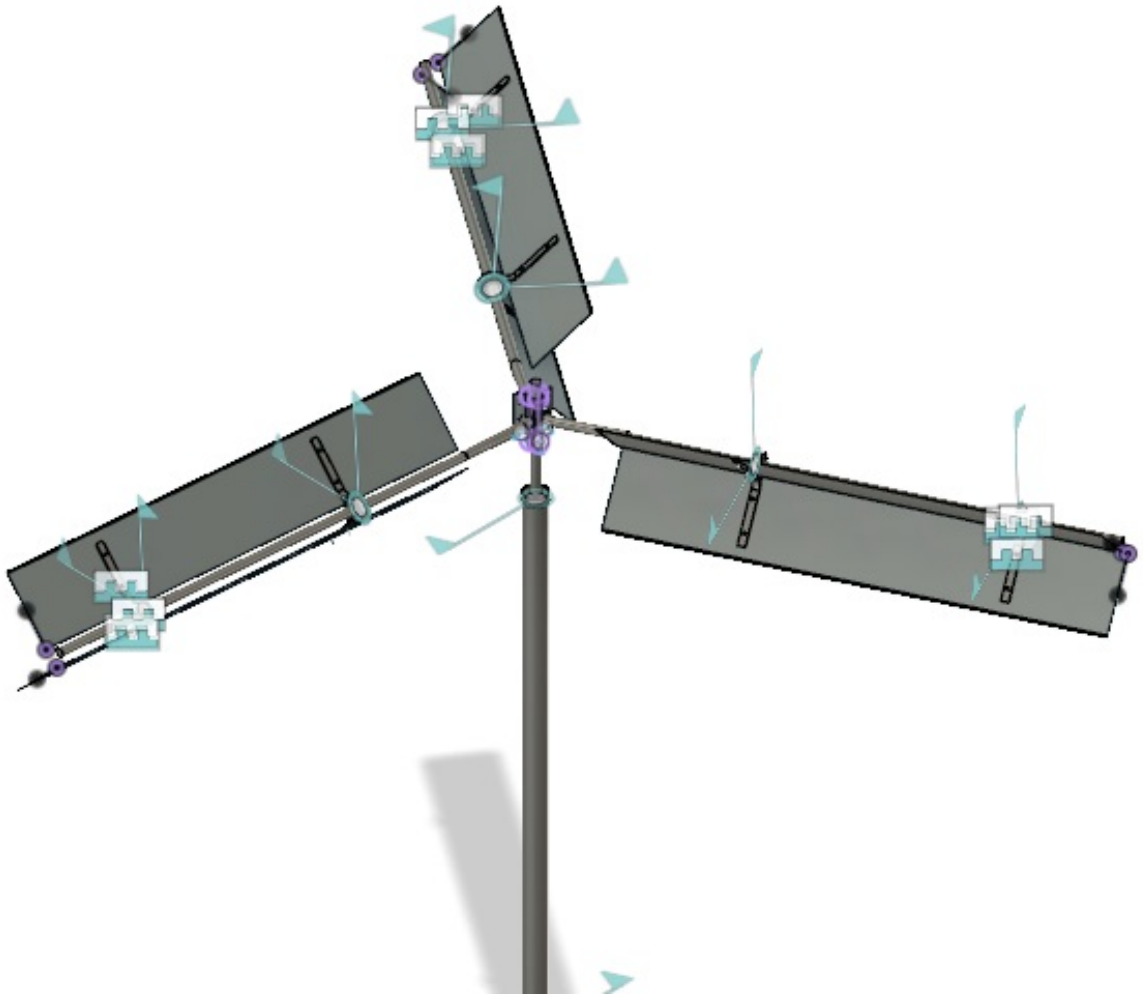


Figure: Windmill v11

Cost Estimation

Sl.No.	Particulars	Quantity	Cost in Rs.
1	Windmill Turbine Blades	12	2500
2	Windmill Turbine Tower	1	500
3	Inner shaft	1	200
4	Ball Bearing	2	200
5	Spur Gear	1	100
6	Bevel Gear	1	200
7	Generator	1	1800
8	Stand set up material	3	600
9	M Seal	3	30
10	Blade Rod	3	600

to be continued...

Cost Estimation

Sl.No.	Particulars	Quantity	Cost in Rs.
11	SS Door Clamp	6	300
12	Raspberry pi	1	Nil
13	Servomotor	6	1200
14	Battery	1	200
15	Data Logger	1	3100
16	Main Battery	1	4400
17	Anemometer	1	Nil
18	Voltmeter	1	Nil
19	Tachometer	1	Nil
20	Fabrication Cost	—	500
Total			16430

Table: Cost Estimation

Work to be done

- Procurement of air direction sensor
- Programming of Servo motors with Pi based board