

# Design of a Small-Scale Wind Turbine to Charge a Battery Pack

Azzam Shaikh  
Mohammad Hajib Ali  
Brandon Nicholas  
Team 3-4

Department of Mechanical and  
Nuclear Engineering  
The Pennsylvania State  
University

April 24, 2018



**Our turbine was designed to meet the needs of the people in Chennai, India**



# This presentation will focus on our beta prototype of our team's wind turbine



Alpha 1

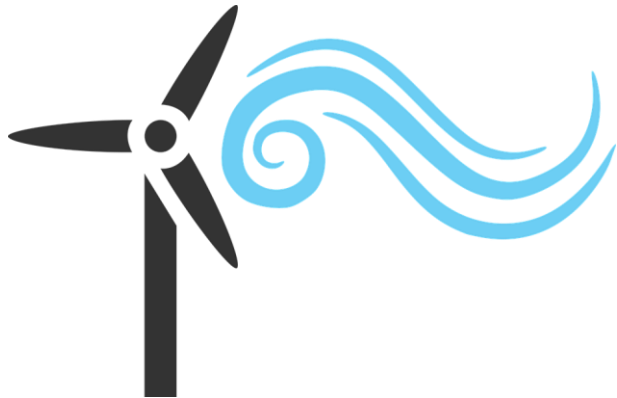


Alpha 2



Beta

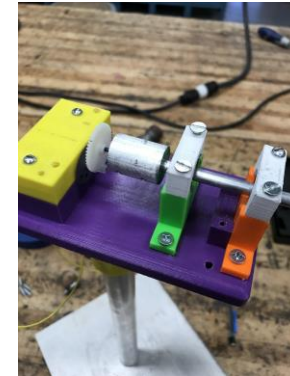
## Prototypes



## Demonstration

|                |                 | Metrics              |                           |                          |             |          |                    |                         |
|----------------|-----------------|----------------------|---------------------------|--------------------------|-------------|----------|--------------------|-------------------------|
|                |                 | Produces Electricity | Withstand High Wind Speed | Withstand Wind over Time | Lightweight | Size     | Roughness of Blade | Amount of Visible Bolts |
| Customer Needs | Produces Energy | x                    |                           |                          |             |          |                    |                         |
|                | Durable         |                      | x                         | x                        |             |          |                    |                         |
|                | Portable        |                      |                           |                          | x           | x        |                    |                         |
|                | Aesthetics      |                      |                           |                          |             |          | x                  | x                       |
|                | Minimum         | 0.2W                 | -                         | 13 s                     | 5 lb        | H >0.5ft | -                  | -                       |
|                | Maximum         | 1W                   | 15 mph                    | inf s                    | 20 lb       | H >2ft   | -                  | 2                       |
|                |                 | Target Values        |                           |                          |             |          |                    |                         |

## Meeting Customer Needs



## Improvements

# Our wind turbine had progressed through three prototypes before reaching our beta prototype



**Alpha 1**



**Alpha 2**



**Beta**

# Our wind turbine had progressed through three prototypes before reaching our beta prototype



**Alpha 1**



**Alpha 2**



**Beta**

# Our wind turbine had progressed through three prototypes before reaching our beta prototype



**Alpha 1**



**Alpha 2**



**Beta**

# The beta prototype was measured against our customer needs and metrics we had identified

Produces energy



Generates at least 0.2 Watts

Withstands high speed winds



Withstands wind over time



Lightweight



Size



Visible bolts



# The beta prototype was measured against our customer needs and metrics we had identified

Produces energy



Generates at least 0.2  
Watts

Withstands high  
speed winds



Withstood leaf blower

Withstands wind  
over time



Lightweight



Size



Visible bolts





# The beta prototype was measured against our customer needs and metrics we had identified

Produces energy



Generates at least 0.2 Watts

Withstands high speed winds



Withstood leaf blower

Withstands wind over time



>13+ seconds

Lightweight



Size



Visible bolts



# The beta prototype was measured against our customer needs and metrics we had identified

Produces energy



Generates at least 0.2 Watts

Withstands high speed winds



Withstood leaf blower

Withstands wind over time



>13+ seconds

Lightweight



< 20 lbs

Size



Visible bolts



# The beta prototype was measured against our customer needs and metrics we had identified

Produces energy



Generates at least 0.2 Watts

Withstands high speed winds



Withstood leaf blower

Withstands wind over time



>13+ seconds

Lightweight



< 20 lbs

Size



< 2 ft

Visible bolts



# The beta prototype was measured against our customer needs and metrics we had identified

Produces energy



Generates at least 0.2 Watts

Withstands high speed winds



Withstood leaf blower

Withstands wind over time



>13+ seconds

Lightweight



< 20 lbs

Size



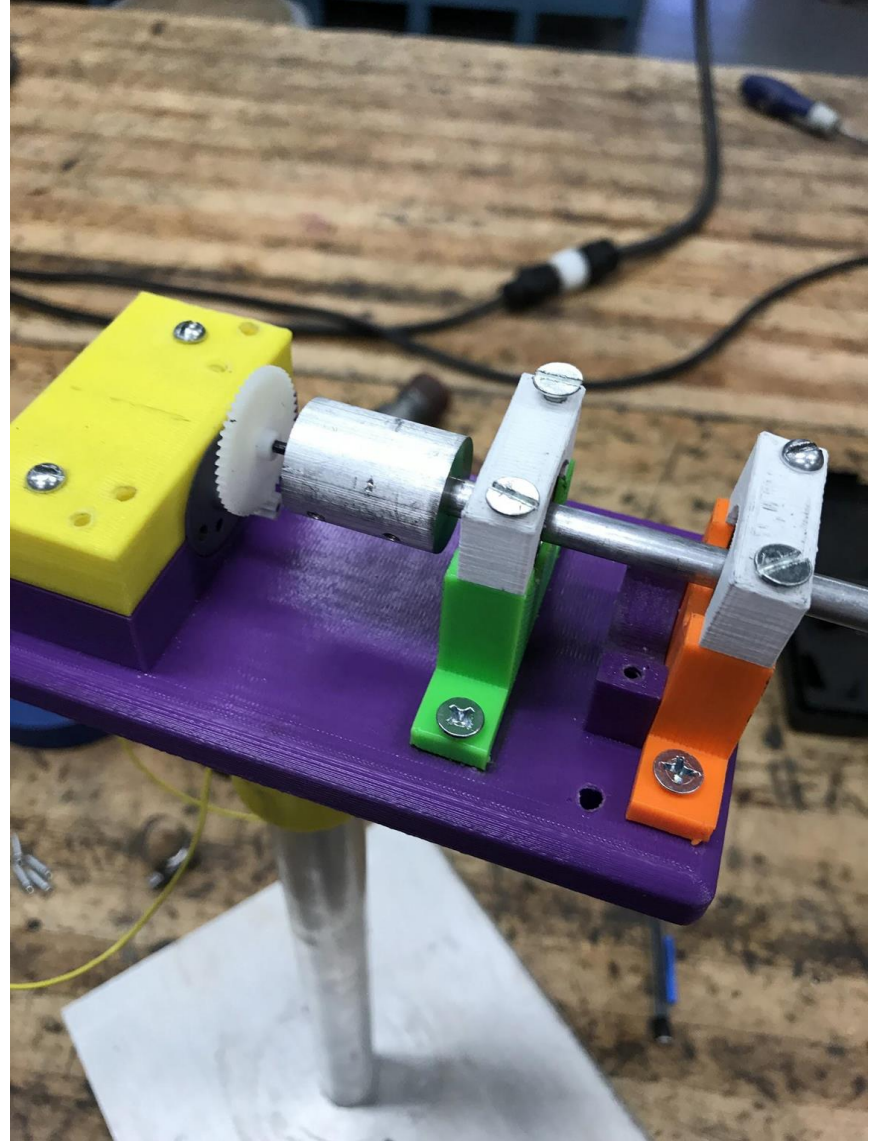
< 2 ft

Visible bolts



0 visible bolts

**Future modifications will be made to the blade to rotor connection and power transmission**



**In summary, our turbine will be effective to provide electricity to people in Chennai, India**

