PREDICTING THE ENERGY OUTPUT OF WIND TURBINE BASED ON WEATHER CONDITION

PROJECT REPORT

INDEX

INTRODUCTION

Wind energy plays an increasing role in the supply of energy world-wide. The energy output of a wind farm is highly dependent on the wind conditions present at its site. If the output can be predicted more accurately, energy suppliers can coordinate the collaborative production of different energy sources more efficiently to avoid costly overproduction.

PROPOSED SOLUTION

- As we have a considerable amount of data, we have used polynomial linear regression machine learning model to predict the output power and energy generated by the wind turbines, which is dependent on the wind speed.
- We have developed the machine learning model code in Python using Pycharm IDE.
- We have also created a UI using Flask and Python.
- Created a pickle file by importing the pickle library into the ML model code and then by running it.
- Created a procfile.
- Created a text file which consists of names and versions of all the libraries that we have used.
- Created a html file for the web page.

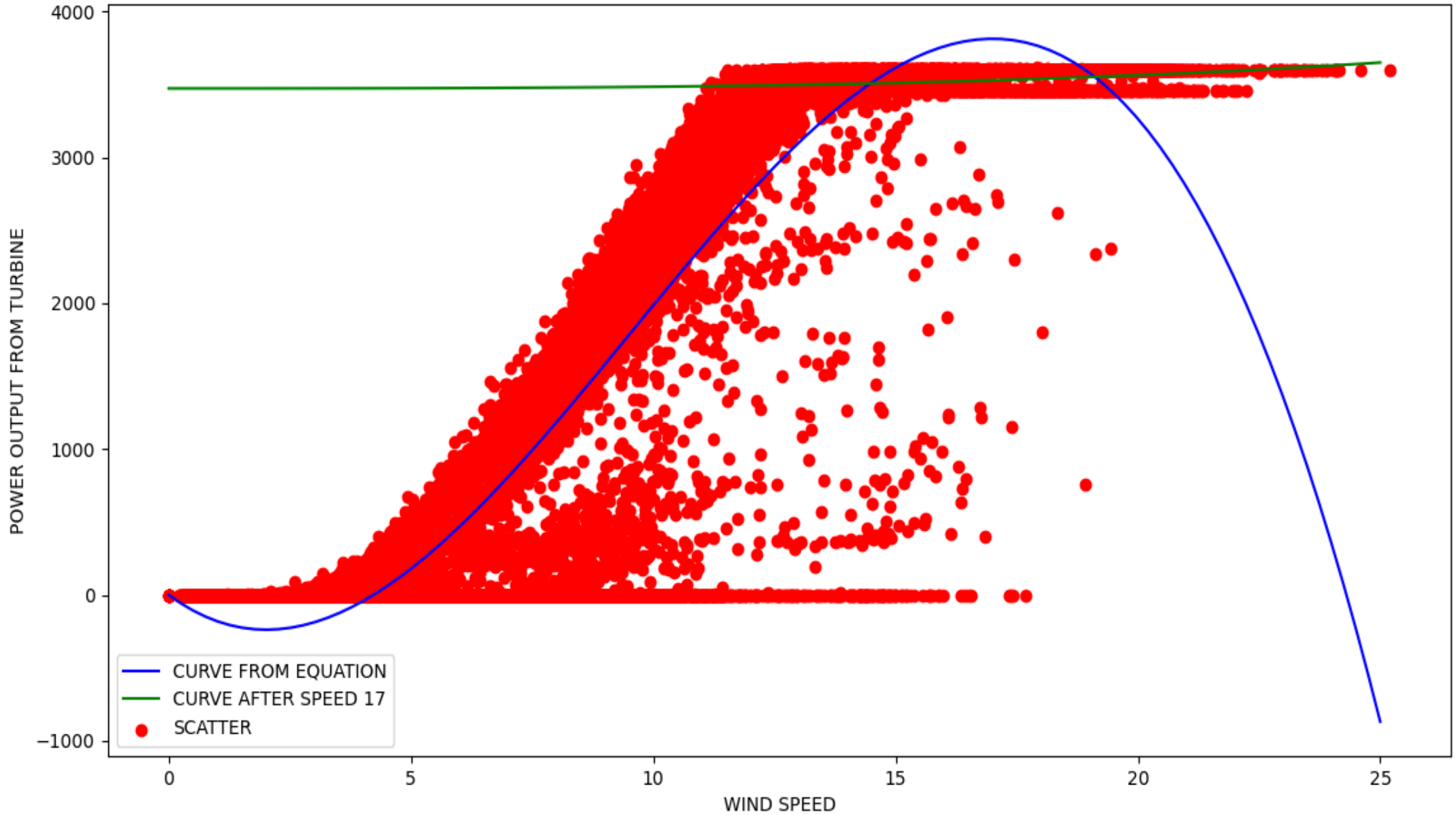
PROPOSED SOLUTION

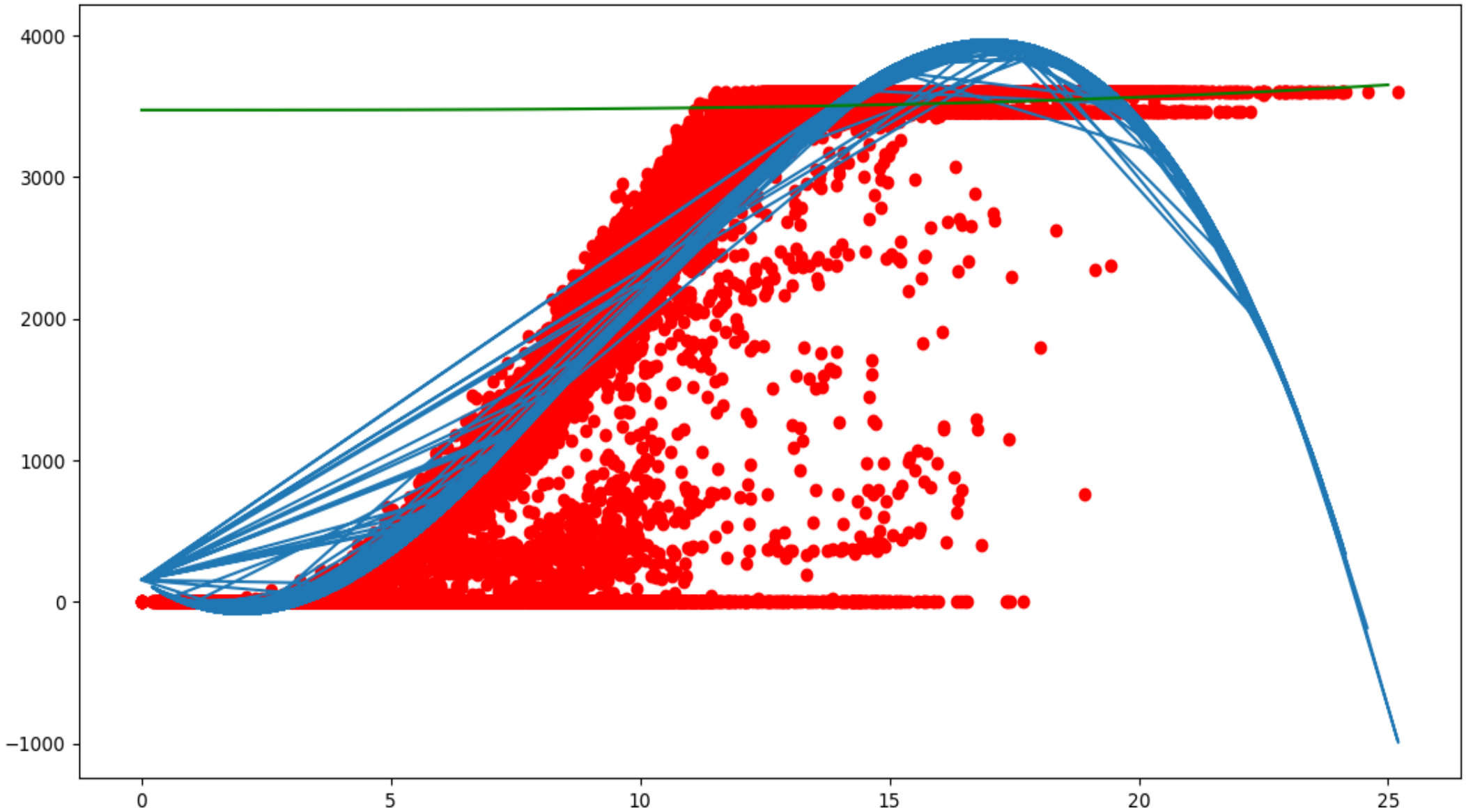
- All of these files have been uploaded to the GItHub Repository.
- We have connected the Heroku and GitHub to deploy the web application.
- After the deployment in Heroku we would get a URL that can be used by anyone, to predict the energy output of wind turbine using our model.

DATA ANALYSIS AND WORKING ON MODELS

- After doing analysis on given data set from KAGGLE . We found out that wind direction has less that 1% effect in predicting output-power compared to wind speed.
- After our research on wind speed and output power from wind-turbine , We concluded

  Output power is directly proportional to cube of wind speed.
- So, we used polynomial linear regression model to predict out put power from wind speed.
- But ,after at a certain wind speed , output power decreases and below 3 for wind speed we are getting negative power.
- So , we used if loop to get output power


4000
3000
2000
1000
0
−1000
POWER OUTPUT FROM TURBINE
0
5
10
15
20
25
WIND SPEED
CURVE FROM EQUATION
CURVE AFTER SPEED 17
SCATTER


4000
3000
2000
1000
0
−1000
0
5
10
15
20
25

- We used three speeds at intervals of 10 minutes to predict acceleration/deceleration
- We used above acceleration/deceleration to get wind speeds for 10 minutes of interval for next 2 hours and used these speeds to predict output power.
- Used these output powers to calculate energy .

(Using formulae : energy=power*(time intervals of 10 minutes)

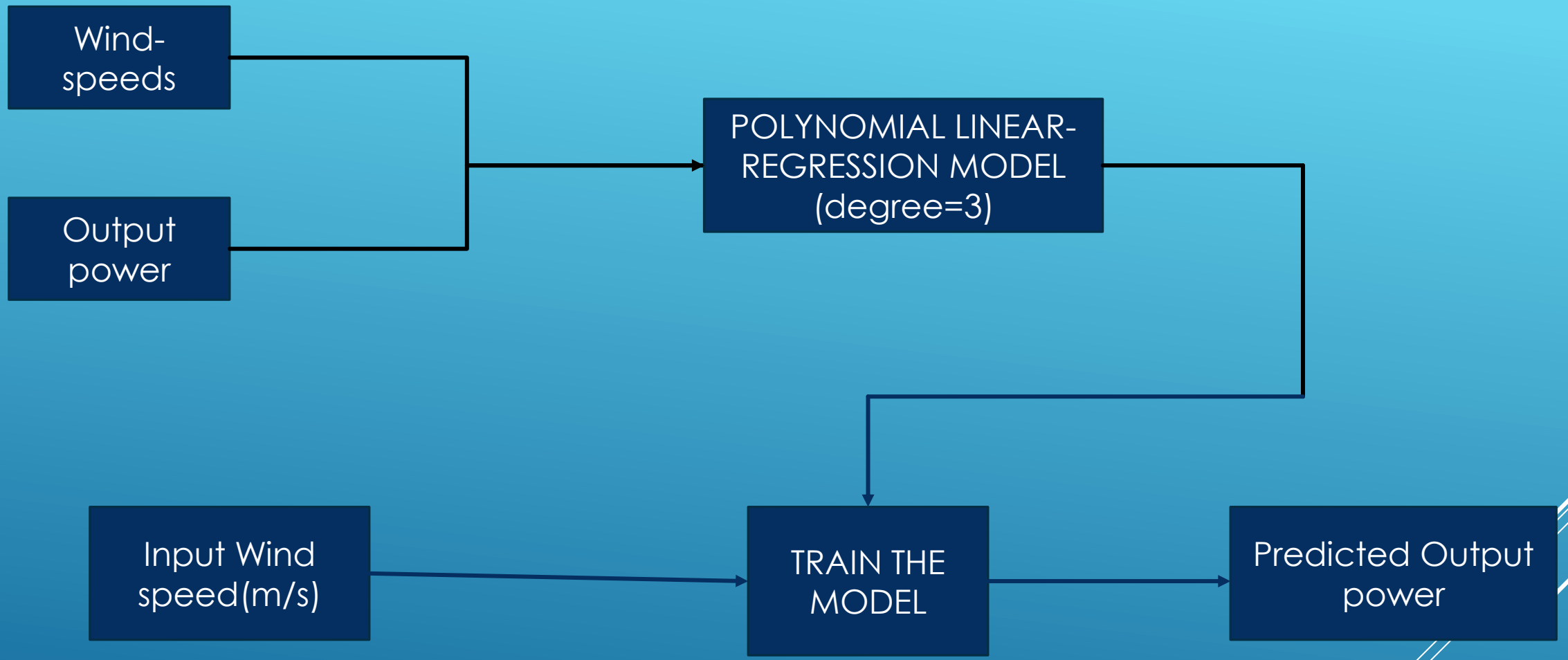
APPLICATIONS

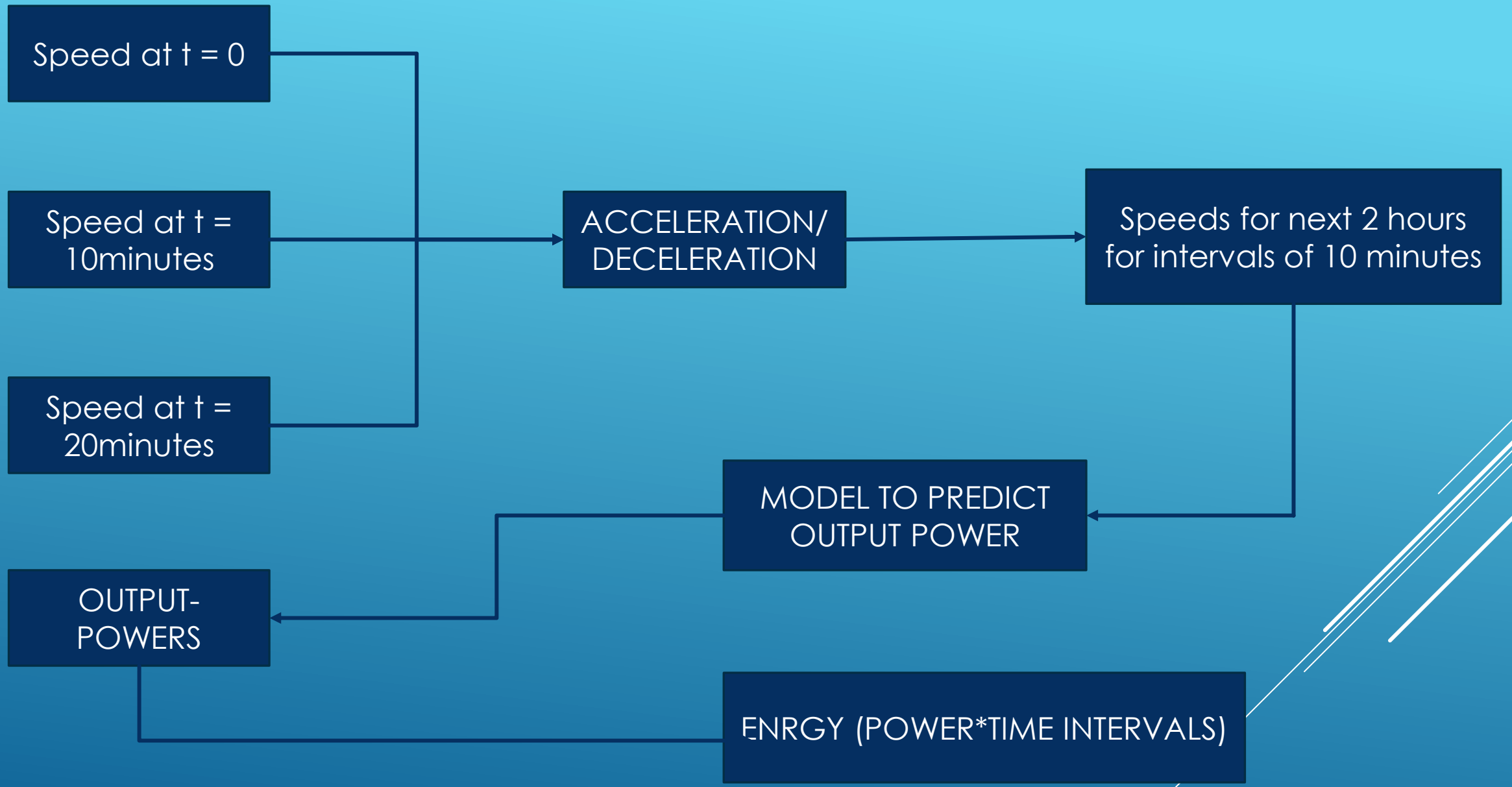
- As we are all aware of the Global Warming, it's time we find the alternate methods to generate power from renewable energy resources like wind.
- The wind energy industry has a lot of potential to develop, but the drawbacks that are setting it backwards is improper estimation of where the plants should be setup and even the unpredictive nature of the wind.
- With proper amount of data that has been collected from some time it is possible to predict the unpredictable.
- Our model can help you predict the estimated amount of energy that could be generated by the wind given the dataset with very high accuracy
- Accuracy is everything when it comes to wind energy industry, this accuracy can attract the investors to setup power plants without any second thoughts.
- As the only investment that we have to put into this industry is infrastructure and maintenance the cost of power would considerably less than others.
- Thereby helping the people, as it is a renewable energy resources there are no green house gases released, thereby helping the world.

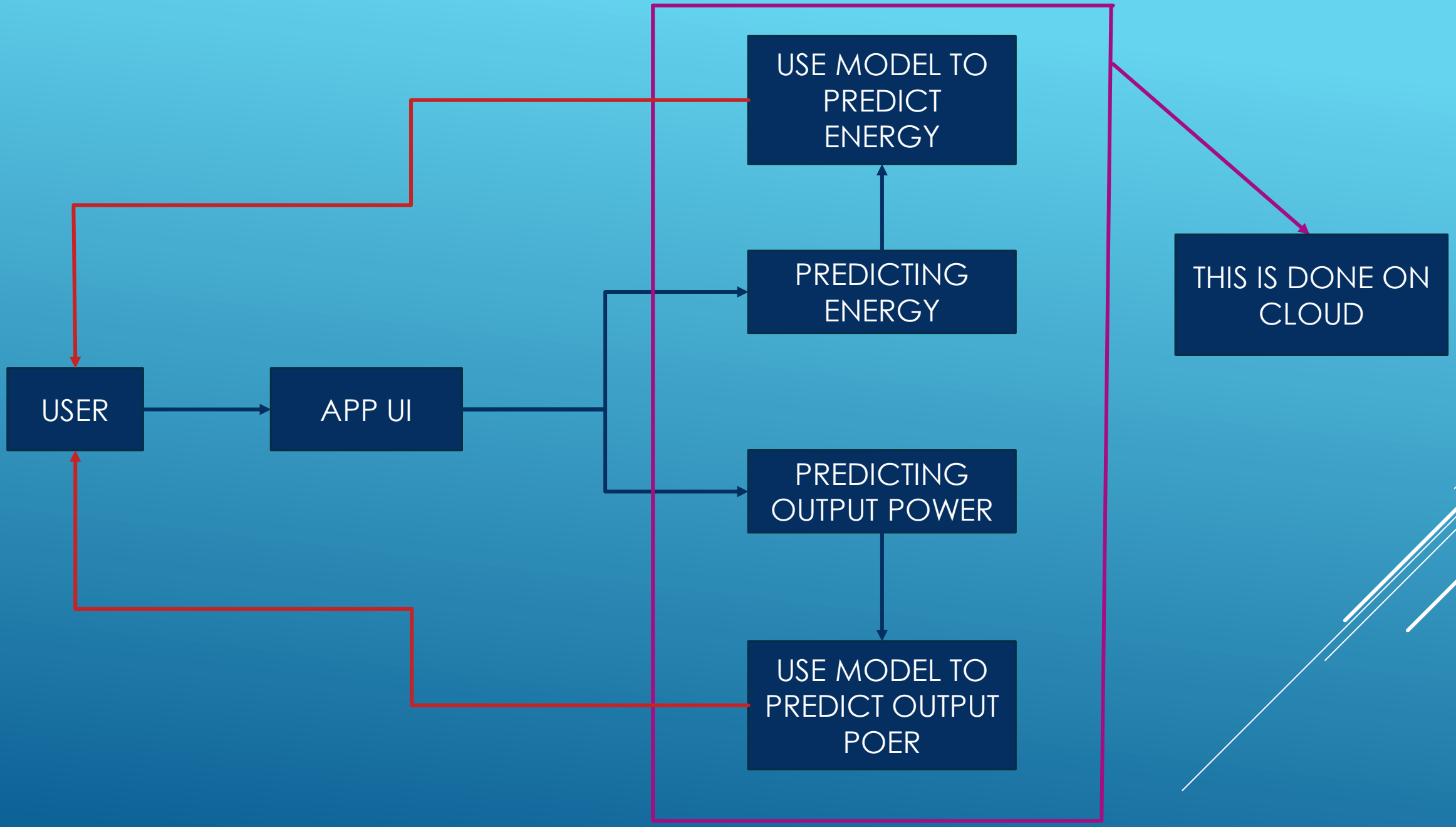
FLOW CHARTS

- MACHINE LEARNING MODELS.
  1.MODEL TO PREDICT OUTPUT POWER.
  2.MODEL To PREDICT ENERGY GENERATED FOR 2 HOURS.

- USER INTERFACE


Wind-speeds
Output power
POLYNOMIAL LINEAR-REGRESSION MODEL (degree=3)
Input Wind speed(m/s)
TRAIN THE MODEL
Predicted Output power


Speed at t = 0
Speed at t = 10minutes
Speed at t = 20minutes
ACCELERATION/ DECELERATION
Speeds for next 2 hours for intervals of 10 minutes
MODEL TO PREDICT OUTPUT POWER
OUTPUT-POWERS
ENRGY (POWER*TIME INTERVALS)

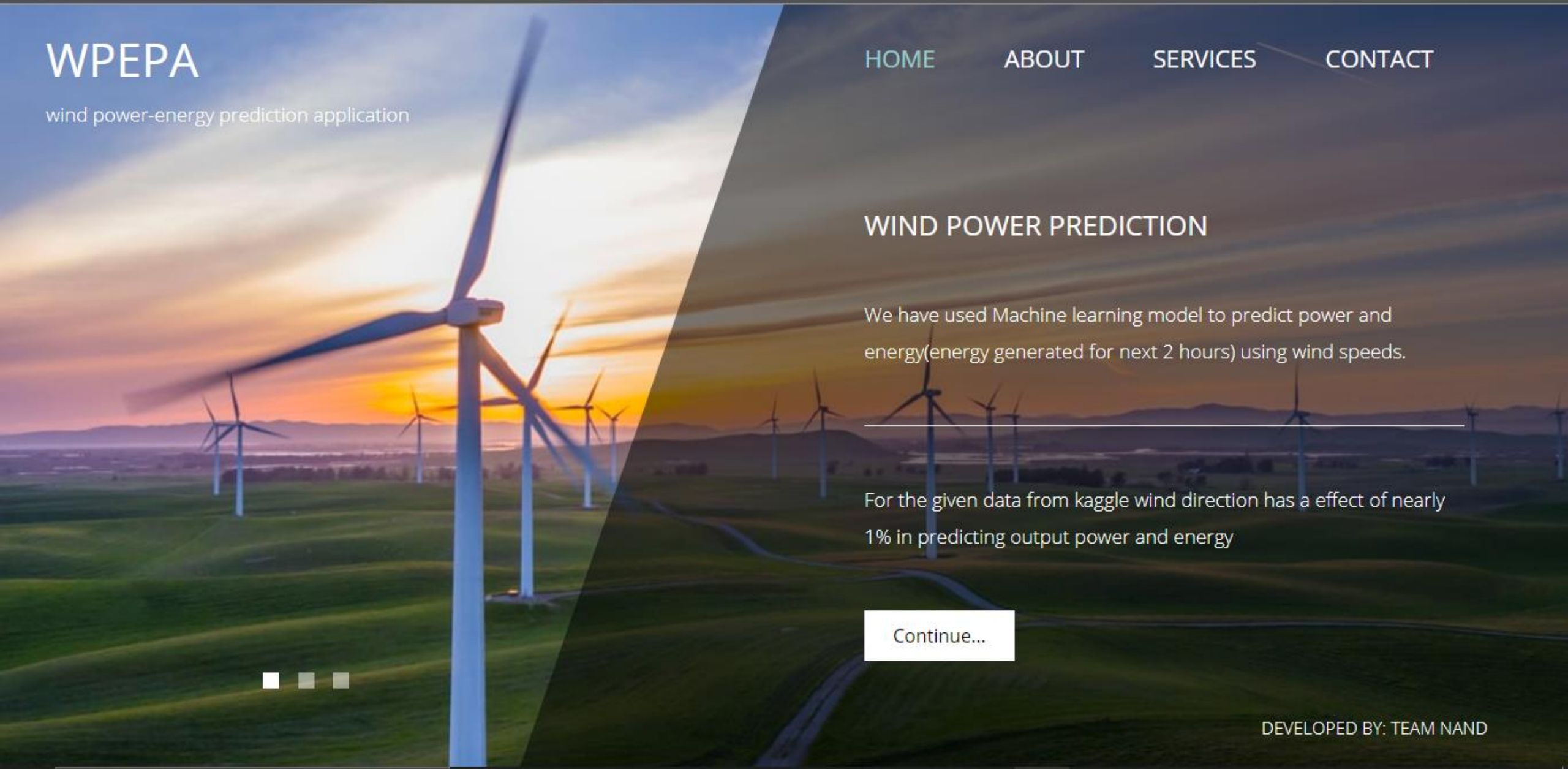

USE MODEL TO PREDICT ENERGY
PREDICTING ENERGY
THIS IS DONE ON CLOUD
USER
APP UI
PREDICTING OUTPUT POWER
USE MODEL TO PREDICT OUTPUT POER

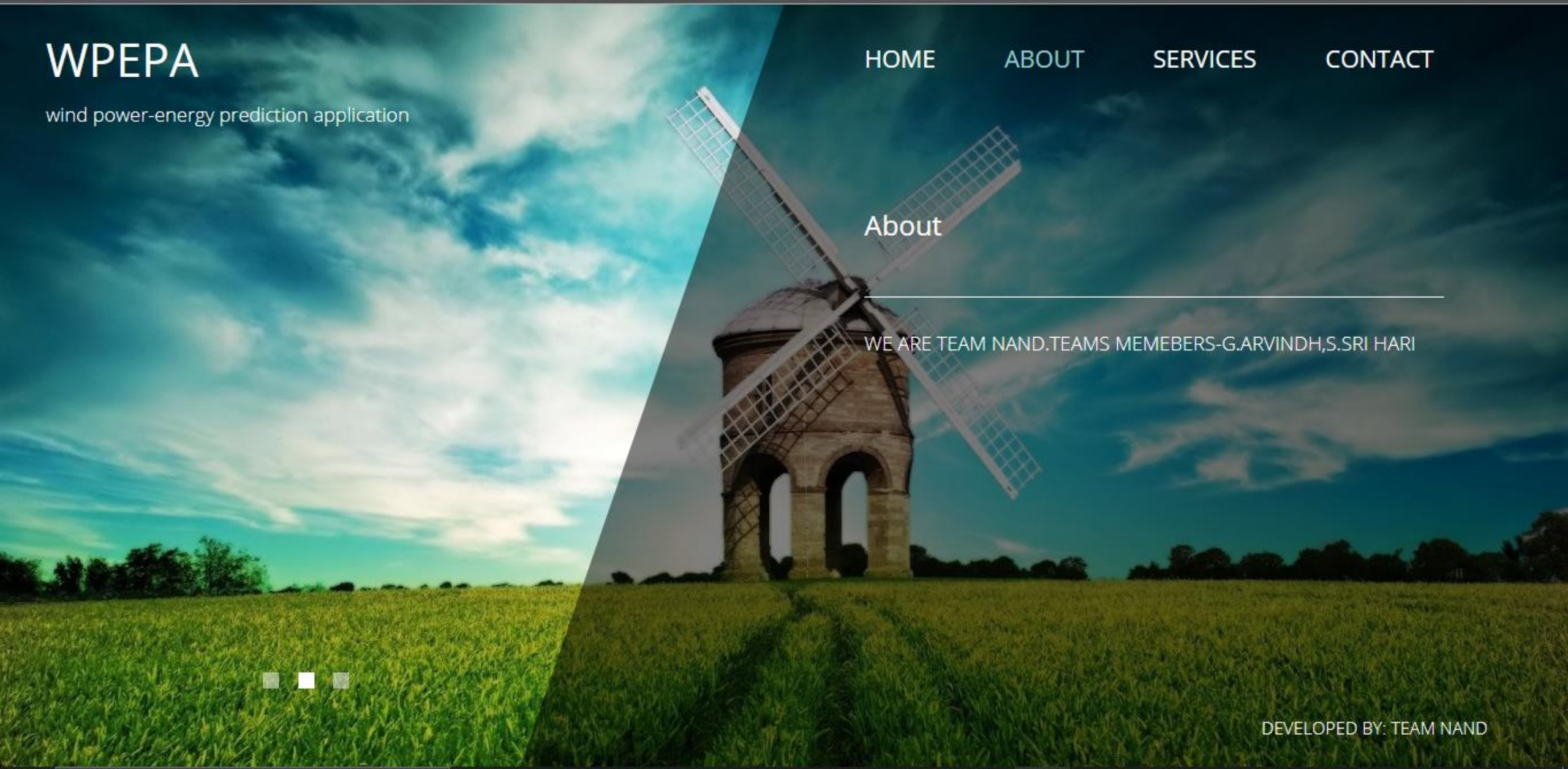
RESULT

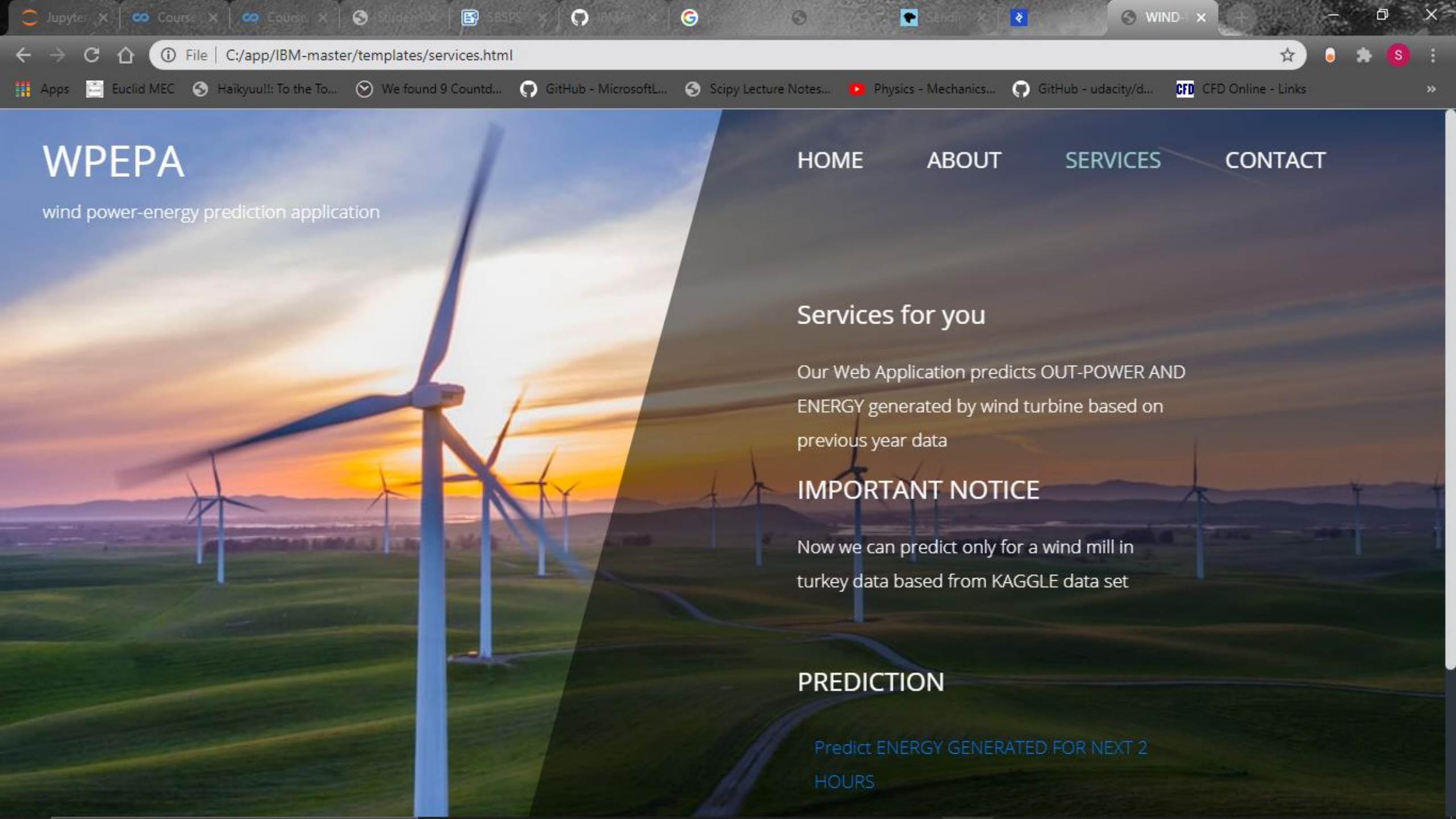
A web application with simple and clear UI that can be used by anyone from anywhere in the world, given the URL has been created that takes the data to be processed as inputs and outputs the prediction after being processed by the previously trained machine learning model. (https://nandwindprediction.herokuapp.com)

This is the link to code on git-hub of our main code

https://github.com/SmartPracticeschool/SBSPS-Challenge-3409-Predicting-the-energy-output-of-wind-turbine-based-on-weather-condition/blob/master/ENERGY-POWER-PREDICTION.ipynb


WPEPA
wind power-energy prediction application
HOME
ABOUT
SERVICES
CONTACT
WIND POWER PREDICTION
We have used Machine learning model to predict power and energy(energy generated for next 2 hours) using wind speeds.
For the given data from kaggle wind direction has a effect of nearly 1% in predicting output power and energy
Continue...
DEVELOPED BY: TEAM NAND


WPEPA
wind power-energy prediction application
HOME
ABOUT
SERVICES
CONTACT
About
WE ARE TEAM NAND.TEAMS MEMEBERS-G.ARVINDH,S.SRI HARI
DEVELOPED BY: TEAM NAND


WIND
File | C:/app/IBM-master/templates/services.html
Apps
Euclid MEC
Haikyuu!!: To the To...
We found 9 Countd...
GitHub - MicrosoftL...
Scipy Lecture Notes...
Physics - Mechanics...
GitHub - udacity/d...
CFD Online - Links
WPEPA
wind power-energy prediction application
HOME
ABOUT
SERVICES
CONTACT
Services for you
Our Web Application predicts OUT-POWER AND ENERGY generated by wind turbine based on previous year data
IMPORTANT NOTICE
Now we can predict only for a wind mill in turkey data based from KAGGLE data set
PREDICTION
Predict ENERGY GENERATED FOR NEXT 2 HOURS

IMPORTANT NOTICE

MAKE SURE YOUR WIND SPEED IS NOT SPEED

OF WIND GUST

Predicting Output power from wind speed

Velocity

Predict

{{prediction_power}}

ADVANTAGES AND DISADVANTAGES

- As all the resources that have been used in the development are open source, we don't have to pay anything.
- Coming to the disadvantages if there is wind gust present the accuracy of the model decreases.
- Some uncertainty in predicting wind speed .

CONCLUSION

This project gives you a basic idea on how to create a machine learning model and how to deploy it on the web using tferoku and Github services along with Flask.

BIBILOGRAPTFY

Names: S. SRI HARI College Name: Mahindra Ecole Centrale, Hyderabad,

Names: G. ARVIND College Name: Gitam Deemed To Be University, Vizag.

References:

Heroku.com

Github.com

jupyterlabs

Flask Documentation: https://flask.palletsprojects.com/en/1.1.x/

Requirements Text: https://www.jetbrains.com/help/pycharm/managing-dependencies.html

Youtube videos:

https://www.youtube.com/watch?v=mrExsjcvF4o&list=LLjRS2z7JlxfERxDBnWLCUA&index=3&t=0s

https://www.youtube.com/watch?v=p_tpQSY1aTs&list=LLjRS2-z7JlxfERxDBnWLCUA&index=2&t=0s