PREDCITION OF WIND POWER BASED ON WIND CONDITIONS

CHAPTER-1
INTRODUCTION

1.1 OVERVIEW

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. Wind speed/power has received increasing attention around the earth due to its renewable nature as well as environmental friendliness. With the global installed wind power capacity rapidly increasing, the wind industry is growing into a large-scale business. Reliable short-term wind speed forecasts play a practical and crucial role in wind energy conversion systems, such as the dynamic control of wind turbines and power system scheduling. A precise forecast needs to overcome problems of variable energy production caused by fluctuating weather conditions. Power generated by wind is highly dependent on the wind speed. Though it is highly non-linear, wind speed follows a certain pattern over a certain period of time.

1.2 PURPOSE

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.

CHAPTER-2
LITERATURE SURVEY

2.1 EXISTING SOLUTION

Forecasting wind speed and power is highly important due to the increase in the penetration of wind energy in electricity generation. The wind power forecasting methods are majorly classified based on ‘Time-scales’ and ‘Overall Wind Power Forecasting’. They are further categorized as Ultra-short-term forecasting, Short-term forecasting, Medium-term forecasting, and Long-term forecasting on time-scales basis whereas Overall Wind Power Forecasting has categorized into six methods viz. persistence method, physical method, statistical method, spatial correlation method, artificial intelligence method, and hybrid approach.[1]

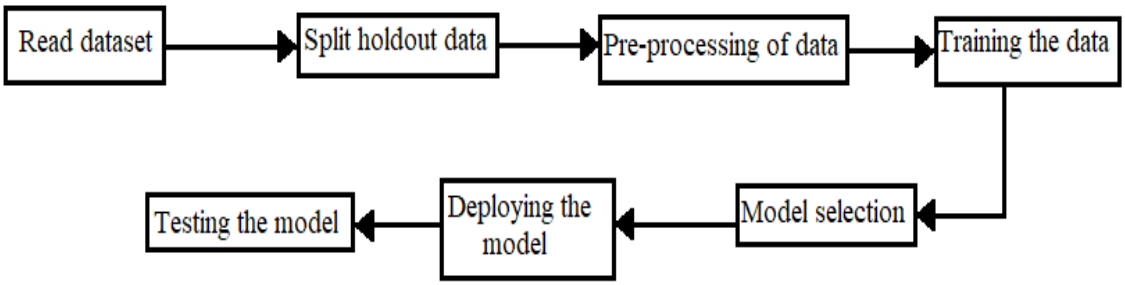
2.2 PROPOSED SOLUTION

Estimation: Given weather conditions like wind speed, wind direction is used for determining the energy power prediction.

CHAPTER-3
THEORETICAL ANALYSIS

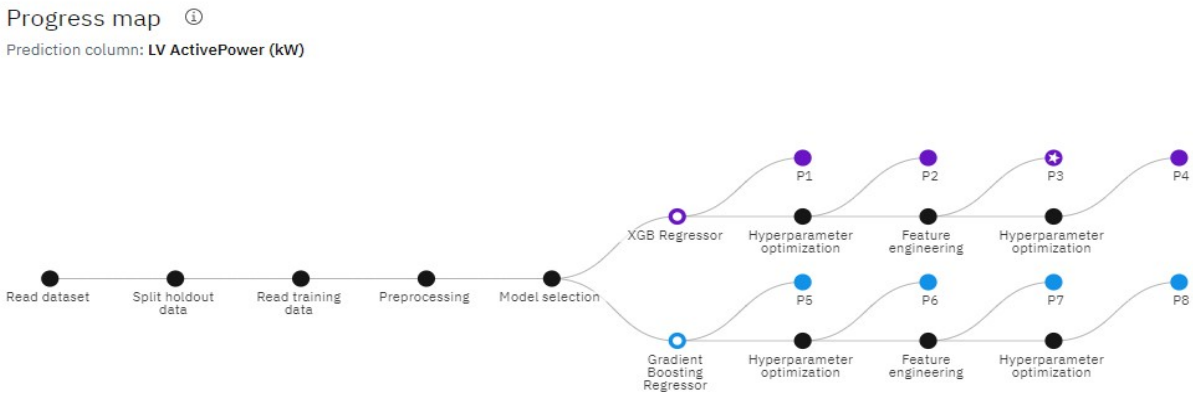
3.1 BLOCK DIAGRAM

The block diagram is given by



3.2 SOFTWARE DESIGNING

The software designing is done by Auto AI model using IBM Cloud and User Interface is created by NODE-RED using IBM Cloud.



CHAPTER-4

EXPERIMENTAL INVESTIGATIONS

EXPERIMENTAL OBSERVATIONS ON LOSS OF MODEL

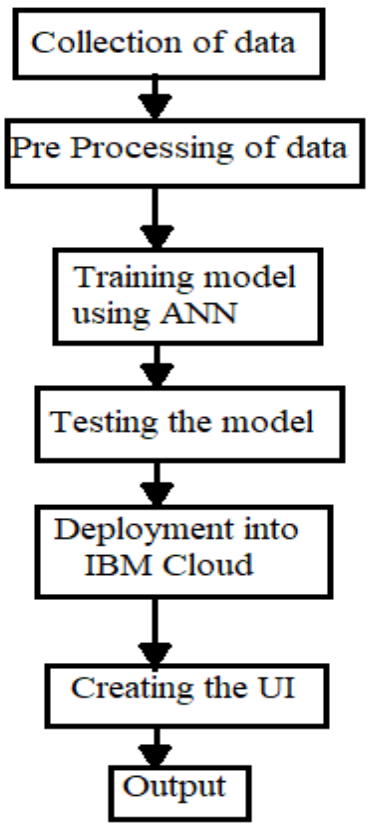
The XGB Regressor pipeline which has the least loss is 376.846(RMSE)

Experiment summary | Pipeline comparison | Rank by: Root mean squared err... | Score: Cross validation | Holdout

Rank	Name	Algorithm	RMSE (Optimized)	Enhancements	Build time
★ 1	Pipeline 3	XGB Regressor	376.846	HPO-1 FE	00:29:42
2	Pipeline 4	XGB Regressor	376.846	HPO-1 FE HPO-2	01:01:22
3	Pipeline 2	XGB Regressor	377.313	HPO-1	00:16:53
4	Pipeline 7	Gradient Boosting Regressor	378.474	HPO-1 FE	00:06:34
5	Pipeline 8	Gradient Boosting Regressor	378.474	HPO-1 FE HPO-2	00:02:28
6	Pipeline 1	XGB Regressor	378.545	*None*	00:00:03
7	Pipeline 5	Gradient Boosting Regressor	379.300	*None*	00:00:05
8	Pipeline 6	Gradient Boosting Regressor	379.300	HPO-1	00:00:35

CHAPTER-5

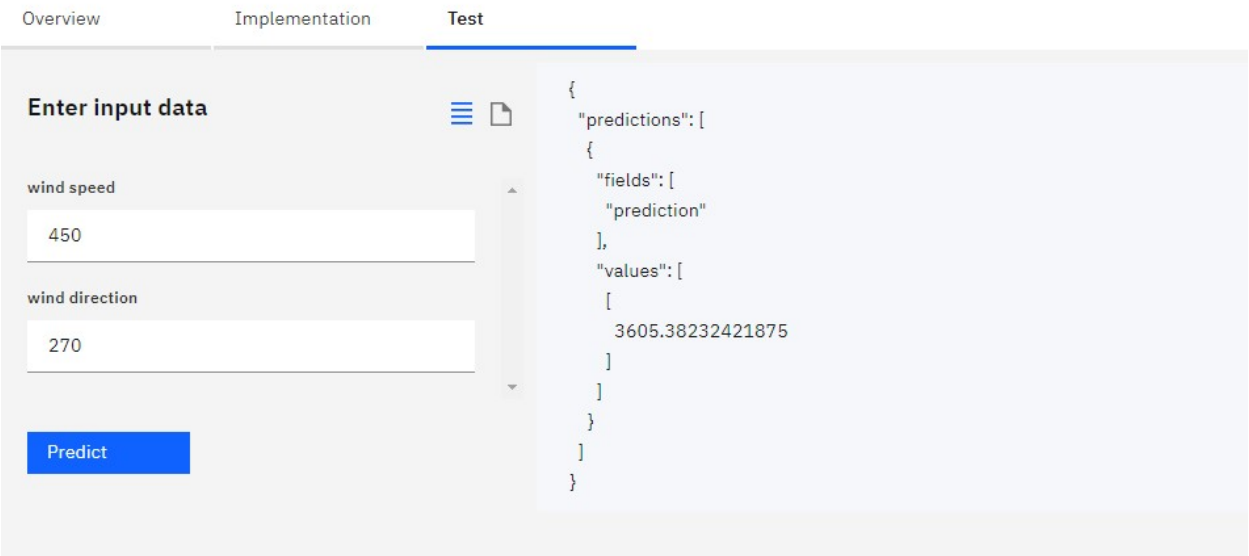
FLOWCHART



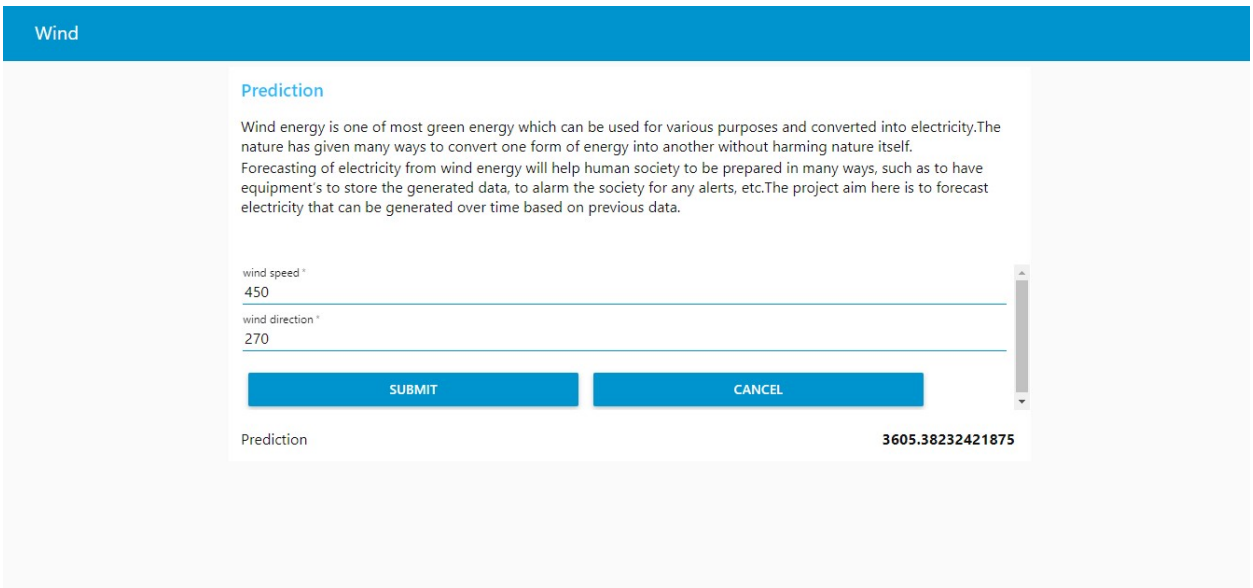
CHAPTER-6

RESULTS

DEPLOYMENT OUTPUT



USER INTERFACE OUTPUT



CHAPTER-7
ADVANTAGES & DISADVANTAGES

1. Saving on costs
2. Reduced imbalance charges and penalties.
3. Competitive knowledge advantage in real time and 'day ahead' energy market trading.
4. More efficient project construction, operations, and maintenance planning.
5. Accurate wind power forecasts are also important in reducing the occurrence or length of curtailments (which translate to cost savings), improved worker safety, and mitigating the physical impacts of extreme weather on wind power systems.

CHAPTER-8
APPLICATIONS

1. In parallel to be used for market participation, wind power forecasts may be used for the optimal combined operation of wind and conventional generation, wind and hydro-power generation, or wind in combination with some energy storage devices.

2. They also serve as a basis for quantifying the reserve needs for compensating the eventual lacks of wind production.

CHAPTER-9
CONCLUSION

This project is built for prediction of the wind power based on weather conditions like wind speed and wind direction. The estimation model can be done using Artificial Neural Networks(ANN) . For predicting of power using time series can be done based on only two parameters which is power and time. By giving the past inputs to time series model it will predict the future power required. The time series model can be built using Recurrent Neural Networks(RNN).

CHAPTER-10
FUTURE SCOPE

1. Improving ramp event predictions.
2. Incorporating climate change impacts on wind projects.
3. Integrating and automating regional forecasts with electricity scheduling systems.
4. Improving icing forecasts.
5. Improving probabilistic forecast product development using NWP ensembles.

BIBILOGRAPHY

[1] Chang, W.-Y., “A Literature Review of Wind Forecasting Methods”. Journal of Power and Energy Engineering, 2, 161-168., 2014.
[2] http://www.renewableenergyfocus.com/view/1379/the-importance-of-wind-forecasting/
[3] https://en.wikipedia.org/wiki/Wind_power_forecasting

WORK DISTRIBUTION

Data collection and half of preprocessing part is done by MANASA A
The remaining preprocessing part is done by NAVEEN REDDY C S
The Auto AI model for estiamtion model and time series model is done by LOKESH S
The web Application part is done by MANJUNATH B KANAVALLI