R. V. COLLEGE OF ENGINEERING, BANGALORE-560059

(Autonomous Institution Affiliated to VTU, Belgaum)

A Project Report On

"MULTIVARIATE PREDICTIVE MODEL FOR WIND POWER USING ANN"

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CERTIFICATE

Certified that the project work titled "**MULTIVARIATE PREDICTIVE MODEL FOR WIND POWER USING ANN**" is a work carried out by **Tejasvi C M (1RV10EE015), Dhinesh Kumar (1RV10EE017), Rajananda Kishore G (1RV10EE040), Sohan Rai Udupi (1RV10EE049),** who are the bonafide students of R.V. College of Engineering, Bengaluru, in partial fulfillment for the award of degree of **Bachelor of Engineering** in **Electrical and Electronics Engineering** of Visvesvaraya Technological University, Belgaum during the year **2013-2014.** It is certified that all corrections/ suggestions indicated for the internal assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of project work prescribed by the institution for the said degree.

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DECLARATION

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ABSTRACT

The energy demand of the world is rising exponentially. As fossil fuels, the principal sources of energy are fast depleting, researchers are focusing their attention to renewable energy sources. The primary consideration in this subject viz. wind energy sources poses their own challenges to researchers, an essential component being their stochastic nature.

Considering the fact that wind generation shows typical behavioral patterns, with time varying, seasonal and trend pattern in its generation, predictive models would be effective in forecasting the possible generation. This would help the operators to be prepared for the load demand, without over or under estimating the generation capabilities of the generation sources. Accurate short term wind speed prediction for wind power farms is crucial if wind power is to be a stable source of power. For typical wind turbines, power output varies as a cube of wind speed over a significant portion of the power curve. Therefore small improvements in the wind speed will contribute much larger improvements in the wind power forecast. The purpose of this thesis is to show the different prediction possibilities in wind speed by using the artificial neural network for the time shift wind speed prediction. A methodology to forecast wind speed and wind power for every 10 minutes of the next 24 hours is developed. Information regarding wind speed, humidity, temperature and wind direction is obtained from Bagalkot wind farm. The collected data was then normalized so as to include a larger data set.

An error calculation was also carried out in order to evaluate the performance of the suggested ANN prediction tool and to show the improvement of errors with the different approaches. The error calculations are encouraging with a best root mean square error of 2.09 m/s for a 24 hour ahead forecast.

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LIST OF SYMBOLS, ACRONYMS AND NOMENCLATURE

WPP :Wind Power Prediction

NWP :Numerical Weather Prediction

ANN :Artificial Neural Network

LMS :Least Mean Square

NAR :Nonlinear Auto Regressive

NARX :Nonlinear Auto Regressive with Exogenous input

BPA :Back Propagation Algorithm

MSE :Mean Square Error

RMSE :Root Mean Square Error

MAPE :Mean Absolute Percentage Error

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