MOWER 14-10 University of Maryland Eastern Shore

1. **The Title and the Names of the PI(s)**
   Dr. Joseph O. Arumala (PI), Professor
   Dr. Ibibia K. Dabipi (Co-PI), Professor
   Dr. Kenny M. Fotouhi (Co-PI), Professor
   Dr, Gurdeep S. Hura, (Co-PI), Professor
   Dr. Aaron R. Rababaah (Co-PI), Associate Professor
2. **Summary of the finding or expected findings if the project is still ongoing**
   The research investigation of MOWER 14-10 is mainly focused on developing and implementing a comprehensive Intelligent Health Monitoring Software System (IHMSS) that will be used as a training and information gathering tool to provide a comprehensive status of the components of an offshore wind farm. We have developed a multi-stage process including: signal acquisition, pre-processing, model training, testing, defect pattern detection and results verification. There were two main stages investigated for design-choice. These are: signal characterization (feature selection and extraction) and defect classification. For the characterization stage, two techniques were investigated, discrete cosine transform (DCT) and fast Fourier transform (FFT). A pre-examination of the similarity measure among the resulting vectors of the two techniques aforementioned was conducted and found that Euclidian-based was superior to correlation-based similarity measure of the signal vectors by a significant factor. We chose FFT over DCT since FFT naturally relates to the frequency domain of a signal and signifies direct interpretation of primary harmonics of the original signal. For the classification stage, we compared two implementations of the process: one that does not utilize an intelligent agent and another that utilizes a neural network model to classify signal vectors into healthy and damaged classes. The difference between the two implementations was very significant as the intelligent agent demonstrated a very reliable classification accuracy > 90% were the other showed an accuracy of 53%. Among future work tasks, we are interested in conducting a significant number of experiments with current configuration of the Artificial Neural Network (ANN) classifier and measure True Positive (TP)/False Positive (FP) rates for each trial. Finally, this study targeted one single wind turbine, whereas, in real world deployments, there are several turbines in each farm. Therefore, it is of high interest that we pursue a simulation of at least one wind farm that contains 50-100 turbines and investigate how our proposed model can be scaled up to handle several turbines simultaneously and how data can be collected and processed and interfaced with final human consumer and integrated with the rest of the system components.
3. **Any interface of value in project finding reported by any businesses including any developers such as Baltimore based US Wind**
   None. However, we have made presentations in several conferences and have a journal paper being reviewed for publication.
4. **If there has been any student internship for the MOWER project**
   We have three students working on the project:
   Mr. Avinash Dudi, Graduate Student
   Ms. Veni R. S. Dasari, Graduate Student
   Mr. Brian Miller, Undergraduate Student
5. **Any possible follow on work or funding opportunities**
   Investigation of the use of wireless sensors and associated Supervisory Control and Data Acquisition (SCADA) systems in the offshore wind industry and the study of the environmental impact of offshore wind farms.