

## Shared Vision System Support for Maintenance Tasks of Wind Turbines

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**Abstract :** Communication is the most challenging part of maintenance operations. Communication between expert and fieldworker is crucial for effective maintenance and this also affects the safety of the fieldworkers. To support a machine user in a remote collaborative physical task, both, a mobile and a stationary device are needed. Such a system is called a shared vision system and the system supports two people to solve a problem from different places. This system reduces the errors and provides a reliable support for qualified and less qualified users. Through this research, it was aimed to validate the effectiveness of using a shared vision system to facilitate communication between on-site workers and those issuing instructions regarding maintenance or inspection works over long distances. The system is designed with head-worn display which is called a shared vision system. As a part of this study, a substitute system is used and implemented by using a shared vision system for maintenance operation. The benefits of the use of a shared vision system are analyzed and results are adapted to the wind turbines to improve the occupational safety and health for maintenance technicians. The motivation for the research effort in this study can be summarized in the following research questions: -How can expert support technician over long distances during maintenance operation? -What are the advantages of using a shared vision system? Experience from the experiment shows that using a shared vision system is an advantage for both electrical and mechanical system failures. Results support that the shared vision system can be used for wind turbine maintenance and repair tasks. Because wind turbine generator/gearbox and the substitute system have similar failures. Electrical failures, such as voltage irregularities, wiring failures and mechanical failures, such as alignment, vibration, over-speed conditions are the common and similar failures for both. Furthermore, it was analyzed the effectiveness of the shared vision system by using a smart glasses in connection with the maintenance task performed by a substitute system under four different circumstances, namely by using a shared vision system, an audio communication, a smartphone and by yourself condition. A suitable method for determining dependencies between factors measured in Chi Square Test, and Chi Square Test for Independence measured for determining a relationship between two qualitative variables and finally Mann Whitney U Test is used to compare any two data sets. While based on this experiment, no relation was found between the results and the gender. Participants` responses confirmed that the shared vision system is efficient and helpful for maintenance operations. From the results of the research, there was a statistically significant difference in the average time taken by subjects on works using a shared vision system under the other conditions. Additionally, this study confirmed that a shared vision system provides reduction in time to diagnose and resolve maintenance issues, reduction in diagnosis errors, reduced travel costs for experts, and increased reliability in service.

**Keywords :** communication support, maintenance and inspection tasks, occupational health and safety, shared vision system

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