Wind Turbine Remote Maintenance With Wearable Technologies

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ABSTRACT

This article describes how the renewable energy sector is increasing in size and wind turbine technology has improved. With the development of internet technology maintenance efficiency has improved. Maintenance is a core activity of the production life cycle since it accounts for 60 to 70% of its total costs. This has led to increased need for maintenance planning and the implementation of new technologies. Shared vision system (SVS) is another enabling technology used for dealing with the increasingly complex maintenance procedures. The main objective of this article is to develop a SVS technology for remote maintenance by enabling cooperation between the technician and the expert. The system represents a solution within the intersection of the areas of problem solving and remote support in the context of collaborative work. As a test case application to show the potential of a SVS considering the following targets: improve time taken to complete maintenance tasks and improve the communication between the technician and the expert.

KEYWORDS


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INTRODUCTION

The first large wind machine to generate electricity was installed in Ohio, in 1888, use of 25 kW machines throughout Denmark was widespread (Kaldellis and Zafirakis, 2011). In Denmark, the Gedser mill 200 kW three-bladed upwind rotor wind turbine operated successfully until the early 1960s, while in Germany, a series of advanced horizontal-axis designs were developed. One of the most important milestones of the wind energy history coincides with the USA government involvement in the wind energy research and development. On the other hand, in northern Europe wind farm installation increased steadily through the 80s and 90s after 1990 most market activity shifted to Europe. In the last 20 years, wind energy is at the front line of the global scene from all over the world regions (Kaldellis and Zafirakis, 2011). Reducing maintenance and operation requirements push the development of maintenance strategies. Wind energy installations are leading all other forms of new energy installations in U.S. and Europe. To increase the capacity and meet the expectations, wind energy should be reliable. Structural health monitoring plays critical role in making this goal successful (Butterfield et al., 2009). Currently, condition-monitoring systems are used in all multimegawatt turbines. Site maintenance workers are learning how to use the complex information provide by wind turbines in their operational strategies. Those methods help to improve maintenance efficiency, minimize downtime and maximize energy production. However, damage rate prediction for wind turbines is very difficult. Further, blades and other major components require unexpected maintenance and they are not monitored. This is due to the lack of an effective method. Sometimes performance, control settings and faults on turbines can be compared to detect the faults. This technique can be quite powerful but always requires a skilled technician or an engineer to investigate the fault. This process is aided by a Supervisory Control and Data Acquisition (SCADA) systems. However, to determine the best strategies for correcting the problem and to diagnose the problems, expert systems are needed (Butterfield et al., 2009).

The field of wearable computing aims to take place in our everyday life. Smart glasses offer an exciting new way of integrating technology in our everyday lives and marks the beginning of new era in computing. The growing demand for technologies allows remote collaboration. Conversations during collaborative physical tasks include identification of target objects, description of actions to be performed and confirmation of the actions that have been performed successfully (Fussel et al., 2003). 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 (SVS) and the system supports two people to solve a problem from different places. This system, which is the integration of multimodal user interfaces, is a solution to reduce the complexity
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