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Sensing System for Offshore Structure

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With the increasing demand for energy in the world; petroleum, natural gas, facilities such as drilling, oil rig and production platforms have become important assets for countries like Singapore. Maintaining the economic progress is strongly dependent on having a reliable monitoring and control systems for these expensive infrastructures that significantly help in inspecting and saving them from unforeseen circumstances or human mistakes. Any defect or damage to these facilities may result in major environmental and economic consequences. For example, the BP's Deepwater Horizon oil rig exploded on April 20, 2010 which killed eleven people and caused widespread pollution in the Gulf of Mexico. A report released by BP concludes that accident was caused by "a complex and interlinked series of mechanical failures, human judgments, engineering design, operational implementation and team interfaces."

To reduce the impact of these consequences, an underwater monitoring system can be used. These systems can provide effective, predictive and fast detection mechanisms to discover defects and respond to them in a timely and more effective manner. Furthermore, using appropriate program of continuous or periodic monitoring, to the offshore platforms can be of effective support to the conventional techniques of inspection. There are a number of technologies to monitor, maintain and protect the facilities. Examples of these technologiesare sensor network architecture design, algorithms and mobile underwater robots. Most of these technologies are designed specifically for detecting and locating the leakage, corrosion or other anomalies on the underwater pipelines and surface offshore structure integrity . These techniques were designed to provide a remote facility to detect and to report the positions of a defect or any important sensed information. They are usually wired using copper or fiber optic cables and are connected to regular MEMS-based sensor devices such as accelerometers and PZT transducer sensors that measure specific attributes such as vibration and distance, respectively. Acoustic wave propagation theory, distributed control, fuzzy-logic, neural networks and statistical signal processing are then used to analyse signals for defect prediction, detection and isolation. The wired networks are considered the traditional way for communication which is easy to install and provide power supply for through the network wires.

For example, there are a number of reliability problems related to using wired networks with regular sensors for monitoring. A single cut on the wire will disconnect all the sensing and it is often easy for the unauthorized people to disable the network supply by cutting some of the network wires. Besides, theses cable can be easy damaged under fire. Hence, the monitoring system for offshore structure can be partially affected.

Hence, the research agenda for using monitoring system for offshore structure is to reform and transform activities using intelligent or innovative techniques in the systems design, sensors technologies, focusing on both research, and importantly on applications that are significant and impact in technical and economic performance.

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