

# Embedded System for Condition Monitoring of Marine Pumps

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## 1 PROBLEM DESCRIPTION

Condition monitoring describes measuring systems externally during operation to estimate health. Currently, most pumps on board ships (marine pumps) are not monitored at all. This means that maintenance schedules are heavily inefficient and that the health of subsystems on ships is not known accurately. This is largely a result of the high cost of condition monitoring solutions. With recent developments in embedded processors and sensor technology, the cost of condition monitoring systems no longer needs to remain high. Lloyd's Register, industrial partners on this project, envision a future with widespread condition monitoring systems on ships. While much of the literature is focused on diagnosis of specific faults, this is often done in laboratory conditions after failure has occurred - of little relevance to the maritime industry. This project aims to perform simple on board processing to extract key parameters, which can then be used as inputs by a diagnostics system. There is also a need to investigate how well the system can perform using sensors which are less expensive and less accurate than current state-of-the-art systems. The most successful methods, noted in the literature and industry, are vibration analysis and Motor Current Sensing Analysis (MCSA). These are the methods which will be focused on in this project.

## 2 GOALS

- Identify suitable methods and measurement ranges for condition monitoring of pumps
- Produce a working embedded system which collects data related to the condition of the pump
- Perform on-board processing of the data to extract useful information
- Assess the impact of sensor capability on system performance
- Verify system performance by comparison with existing condition monitoring setups
- Outline future work which will develop a viable commercial system

## 3 SCOPE

While this project may involve assessing several accelerometers/current sensors, it is not intended to produce a matrix detailing the benefits of specific devices.

The system produced does not aim to be a fully developed solution, only to demonstrate the viability of such a solution using cheap and readily available hardware.

While system cost is of concern to this project, there are many costs associated with bringing a fully operational, certified product to market which will not be heavily investigated as part of this project.

The system will provide a basic level of fault detection, based on ISO standards.