Automatic Failure Detection and Monitoring of Ventilation and Cooling Systems

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Nowadays, due to the general market conditions and the ever increasing competition and rivalry, industrial companies are pushed more than ever to optimize their operational costs, and improve the product and service related business processes. In addition to the regular requirements, service continuity and availability are also expected. Maintaining a high level quality requires the detection of occasional failures of the included service elements as soon as possible. Consequently, the automatization of this aspect of support could be essential to minimize the time, personnel, and financial costs in a company's everyday operation.

A local service company, which maintains and installs ventilation and cooling systems for a wide range of customers, including hospitals, office buildings, and private homes too, asked us to develop a computer system for failure detection purposes in cooperation with the engineering department of our institute.

Considering the operation of cooling and ventilation systems, one may see or even hear that malfunctions affect and alter the normal vibration caused by the moving parts, mainly the engine and the fans, therefore it is a sound way to monitor such systems by motion sensors. These regularly measure the vibration over a fixed-length of time interval in terms of signed one dimensional acceleration. The moving parts work on specific frequency which means that the collected data of each sensor is a periodic one dimensional time series, or signal in other words.

Our task is the classification of the current condition of the monitored system based on the information of the last measurement using predefined malfunction classes. We present this industrial sample classification problem, the structure and operation of the developed solution including the basic theoretical background [1, 2]. In addition, we discuss the possibilities of reducing the number of monitoring devices with an acceptable loss of detection rate. The test results of our technique, implemented in MATLAB [3], and its future applicability are also presented in detail.

References

[1] BISHOP, C. M. , Neural Networks for Pattern Recognition, *Oxford University Press, Inc. New York, NY, USA* (1995).

[2] SMITH, S. W. , The Scientist and Engineer's Guide to Digital Signal Processing, *California Technical Publishing, San Diego, California* (1997).

[3] THE MATHWORKS, INC. , MATLAB, *http://www.mathworks.com/products/matlab*.