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A Wireless Sensor Network in Vibration Monitoring of Equipment's

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Abstract

Main target of this paper is to improve monitoring performance of rotating equipments with the help of sensor networks. We focus on high accurate methods of vibration and displacement measurements needed for diagnostics of engineering structures like Pipelines/injection pumps, Pipeline/injection compressors, Turbines, Heaters, Boilers, Dams, and Bridges etc. How monitoring nodes and sink node work under monitoring software by taking inputs from vibration methods. Also discuss about how we transplanting Tiny Operating System in monitoring nodes and sink nodes. These monitoring nodes gather/ retrieve multimedia information such as video and audio, images, scalar data from surroundings. Telnet and Web server are used as a remote control tools.

Keywords

Telnet, Web Server, Tiny Operating System, Monitoring Nodes, Sink Node, Monitoring Software, WSN

1. Introduction

There are two ISO standards for vibration monitoring 1) ISO-2372 2) ISO-10816. In case of ISO-1086 we use lower frequency range 2 to 10 Hz and upper frequency range 1000Hz. Measurement done in three directions Horizontal, Vertical and Axial. Condition based maintenance is a predictive equipment maintenance strategy. The condition of machinery/equipment is measured in order to assess whether they may fail during some future period, and then taking appropriate action to avoid the consequences of that failure. By doing the right maintenance at the right time rather than just operate a calendar based maintenance regime can have significant positive impact on your profit. Classification societies have now recognized the potential for reliability based maintenance approach and have started to adapt their requirements and introduce a condition Monitoring Notation alongside the traditional planned maintenance requirements [1].

Instead of inspection and opening up equipment Class societies will increasingly accept, trending of vibration, performance monitoring and evidence of other non-intrusive condition monitoring methods as the basis for inspection and survey. The laser light divided into two parts one directly goes to object and second goes to acousto-optic modulator. We simply represent working with the help of diagram shown below:

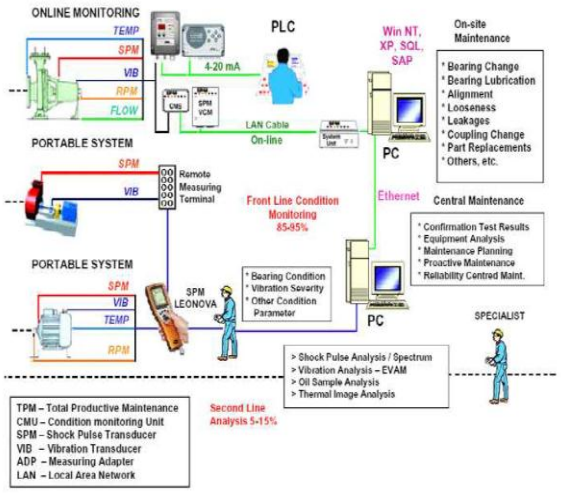

Fig 1: Online calculation methods

The error of the best devices is ^L = 1mm and Frequency=10..80MHz at the Photo Detector. The sensitivity of phase deviation=2*22/700000. The atmospheric noise will decrease sensitivity into 100 times [2]. To explain it one first has to look at the technique. There are two types of shocks generated by a bearing. To analyze them one has to look at the bearing rolling element and race contact area. During the development of the shock pulse method SPM found that the amplitude of the shocks generated by a bearing is a function of the speed (and not the momentum) of the Rolling element. By testing many different size bearings under varying running speeds, SPM was able to establish a function that describes the relationship between the running speeds and size of the bearing and the shock level generated by that bearing. This relationship is expressed as a value which is called the initial (dBi) value. This value represents the shocks levels one would expect of a specific bearing running at a specific speed under ideal conditions. The measurements taken by the instrument measures the absolute shock pulse level and then subtracts the dBi value (which is calculated

automatically when entering the running speed and diameter of the shaft/bearing to be measured), thereby giving an indication of how the bearing operating condition differs from the same bearing running at the same speed but under ideal conditions. By further testing of different size bearings with different levels of damage SPM has been able to determine the acceptable shock pulse levels for all bearings under various operating conditions. In the case of slow rotating bearings shocks are still generated by the bearing as the lubricant is still subject to the same contact pressures and is forced into the surface asperities. Impact with debris or defects still causes shocks but these will have lower amplitudes as the impact speed is low.

2. Frame work of WSN for vibration monitoring

Now a day's wireless microcontroller based on wireless sensor network has been developed.

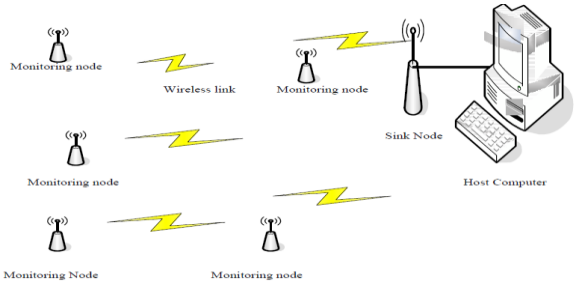

Fig 2: Frame work of WSN for vibration monitoring

Monitoring nodes are installed in monitored equipments. Sink node collect data from monitoring nodes and handed over to Host computer with the help of series ports. Finally the user of monitoring software obtains the analytical results. Communication between monitoring nodes and sink node depend upon distance .Suppose monitoring node is far away from sink node in this case monitoring node transfer information to nearby node. This node selection process based on some algorithms [3].

Before installation of monitoring and sink nodes we use best topology according to organization. Dynamic nature of WSN makes it easy to add or remove monitoring node, due to this nature we enhance the expandability of the system.

3. Flowchart of the Software

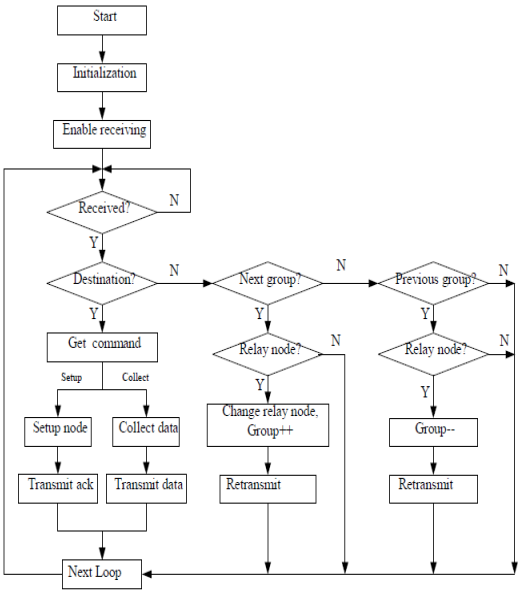

Fig 3: The Flowchart of Software

VC-6000 tool developed by Bruel and Kjaer to follow the highest standards of reliability .The working of these tools depend on the monitoring tool which we represent with the help of flowchart shown in figure 3[4]. The working of VC-6000 is based on modular application, this tool require low maintenance and cost effectively with minimal setup. This tool also fulfils the requirements of standards of vibration monitoring for example ISO-7919, ISO-10816 and API-670. Performance and cost of VC-6000 depend on the number of inputs and output ports they support[4][5]. The University of California designs a small operating system for wireless sensor networks called Tiny Operating System. Most common hardware CC2431 chip and monitoring software are programmed to transplanted Tiny Operating System into monitoring nodes and Sink node. [6][7].

4. Characteristics

- Resources Constraints
- Cross layer Coupling of Functionalities.
- Multimedia Source Coding Processing.
- Multimedia in Network Techniques.
- Variable Channel capacity.[6][7]

Applications

- Surveillance.
- Traffic Monitoring and Enforcement.
- Personal and Health care.

- Gamming.
- Environmental and Industries.[6][7]

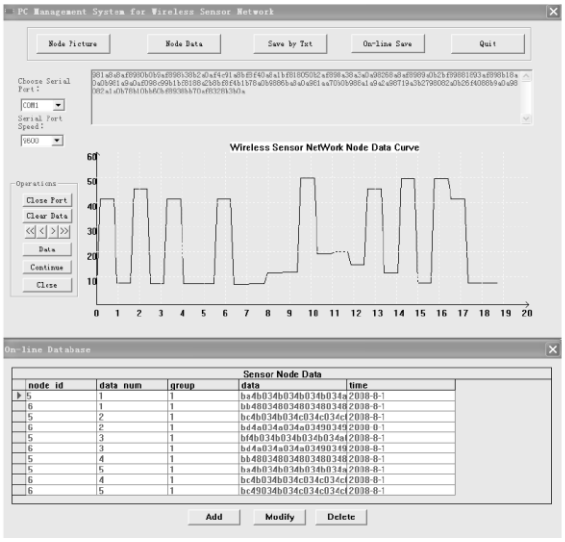

Fig 4: System Interface result with the help of tool

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