Vibration Monitoring System

- Detect early problems
- Wide signal coverage
- Low energy, longevity
- MEMS technology
- Big Data/AI technology
- Wechat APP support

Case Study
Services for Cement Industry

Milling machines are commonly used in cement plants, the reducer part of them is a difficult balance. On the one hand, it needs a high degree of force to twist, turn and crush materials. On the other, it needs fine control and versatility to keep it running in good status.

Vibration monitoring is a good method to measure a reducer’s conditions. Measurements can be normally taken on machine bearing casings with accelerometers. Identifying a significant change in vibration may be indicative of a developing fault.

The use of vibration monitoring allows maintenance to be scheduled, or other actions to be taken to prevent failure and avoid its consequences.
Reducer Machine Monitoring

For a three-step reducer, there are several key points to be monitored, including:

1: front-end of auxiliary drive; 7: back-end of auxiliary drive;
2: low-speed gear casing; 3: middle-speed gear casing; 4: high-speed gear casing;
5: back-end of motor; 6: front-end of motor;
Our customer used to have manpower check machine’s condition. For point 1~4, inspectors use vibration probe to measure machine’s vibration. For point 5, inspectors use infrared thermometer to measure machine’s temperature. For point 6 & 7, they are uneasy to access.

Today, the factory have deployed *WiiHey Vibration Monitoring System* for condition monitoring. The system benefits from MEMS and Wireless technology making it easy to acquire and transmit data. Additionally, by adopting Big Data and Artificial Intelligence (AI) technology, the system is able to automatically recognize potential faults:

![Typical machine problems](image_url)

Once the system detects a problem, it would alarm people and WiiHey would provide factory with appropriate maintenance suggestions.

Successfully using this system enables the repair of problems prior to machine failure.
System Deployment

WiiHey has its system deployed on the site, including vibration sensors, IoT devices such as wireless gateway and local servers:

On-site Devices

Up: Vibration Sensors; Middle: Vibration Sensors;
Bottom: box of Wireless Gateway and Local Server
The system architecture is like this:

System Architecture

Data report rate: 1 minute @ 18 month battery life.

In this case, we have two reducers to monitor, with 7 sensors for each reducer, there are totally 14 sensors. Because the two reducers located within 15m range, one gateway can provide sufficient wireless signal coverage. If the two machines are separated far away, then we need two gateways, one for each.

Here is a list of devices deployed on the site:

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Connectivity</th>
<th>Power Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration Sensor</td>
<td>14</td>
<td>BLE(Bluetooth Low Energy)/2.4GHz/Sub-GHz</td>
<td>Li-Battery</td>
</tr>
<tr>
<td>Wireless Gateway</td>
<td>1</td>
<td>BLE, Wi-Fi, Ethernet, GPRS/3G/4G, Sub-GHz</td>
<td>PoE, 220V</td>
</tr>
<tr>
<td>Local Server</td>
<td>1</td>
<td>Ethernet, GPRS/3G/4G</td>
<td>PoE, 220V</td>
</tr>
</tbody>
</table>

WiiMine sensor is able to measure vibration and temperature simultaneously.
Monitoring & Analysis Services

1. Data Report

*WiiHey datacenter* offers several types of data report, like daily report, weekly report, and monthly report.

In daily report, we can see statistical data of a 3-axis accelerometer, including peak data per hour, RMS data per hour. The unit of vibration data is mg, where 1mg is 0.00981m/s².

![Daily Report](image)

Highlighting color: yellow – middle vibration level, red – high vibration level.

2. Fault Alarm

When *WiiHey datacenter* detects a fault, it sends an alarm message to administrator on Wechat, which is a popular mobile APP in China. By supporting Wechat, the notification message is very easy for people to get.
Notification on Wechat

High value in Z axis: potential problem occurs; Low value in Z axis: problem solved;

3. Fault Analysis

**WiiHey datacenter** provides spectrum analysis tools, like FFT/Wavelet:

Wavelet Algorithm\(^2\)
Customer Feedback

“With WiiHey Vibration Monitoring System, we don’t need to venture our people into unsafe areas for data collection. Also, the measurement result is more accurate so that if there is a fault, we can handle it quickly.”

—— Mr. Liu, Manager of Equipment Dep.

“WiiHey Vibration Monitoring System reduces my inspecting job, it filters out machines in good shape, so that I could only focus my work on defective ones.”

—— Mechanical
Reference
