WiiHey 威惠智能

Vibration Monitoring System

Case Study

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

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.

Reducers in cement plant

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:

Monitoring target

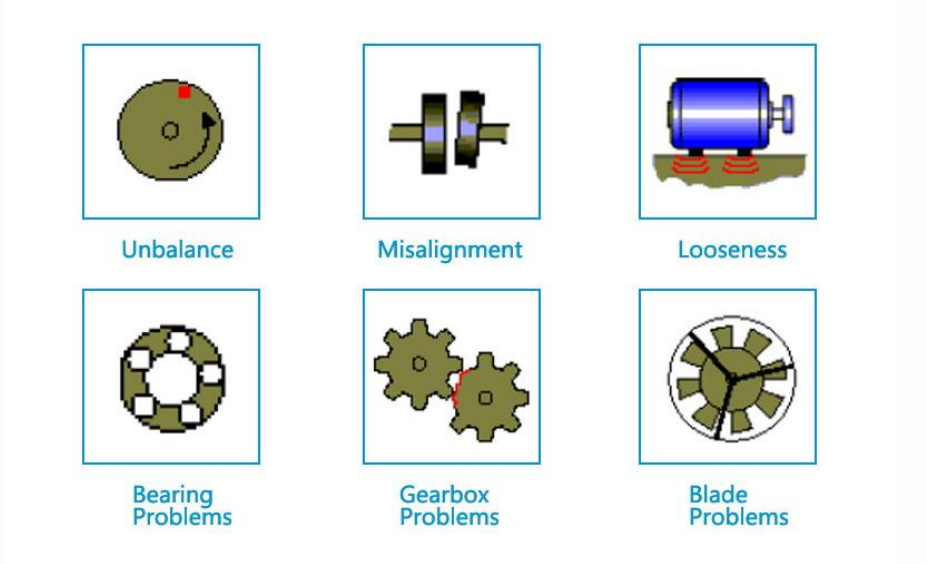
1: front-end of auxiliary drive; 7: back-end of auxiliary drive;

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

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

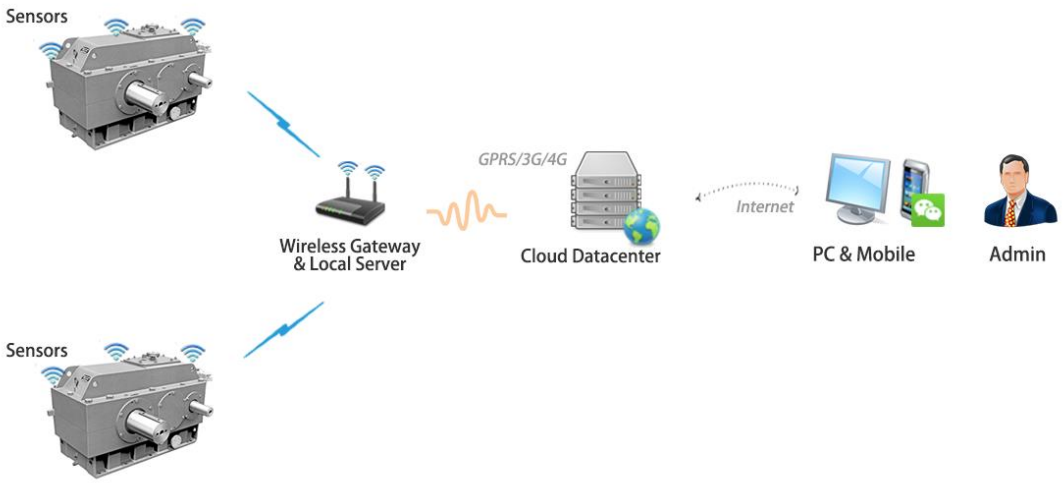
WiiHey has its system deployed on the site, including vibration sensors, IoT devices such as wireless gateway and local servers:

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 flow: Sensor->Gateway->Local Server->Cloud Datacenter->PC & Mobile.

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:

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

WiiMine[1] 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/s^2.

time	x-pk			y-pk			z-pk			x-rms			y-rms			z-rms			humidity		
	min	max	average	min	max	average	min	max	average	min	max	average	min	max	average	min	max	average	min	max	average
000010000002 | 1#入扇减速机中速出外侧轴承 | 1#入扇减速机,水泥扇工段																					
2016/11/29 18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2016/11/29 19	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2016/11/29 20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2016/11/29 21	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2016/11/29 22	1064	1120	1092	1224	1480	1352	2312	2384	2348	348	488	416	452	464	456	736	868	800	80	81	80
2016/11/29 23	640	1272	974	784	1960	1196	952	2656	1548	288	480	372	324	640	432	400	948	548	80	81	80
2016/11/30 00	712	1352	968	856	1608	1196	968	2032	1322	320	468	376	372	544	436	368	596	468	76	80	77
2016/11/30 01	776	1320	986	936	1576	1214	984	2048	1366	300	480	376	356	552	440	400	640	476	73	75	73
2016/11/30 02	704	1248	998	992	1904	1276	1056	2016	1376	316	480	384	376	572	460	412	564	488	72	73	72
2016/11/30 03	784	1392	1028	968	2048	1300	1024	2640	1402	340	500	396	376	704	468	424	844	504	71	72	71
2016/11/30 04	784	1360	1006	888	1840	1276	984	2072	1416	328	456	388	376	600	464	400	640	488	70	71	70
2016/11/30 05	776	1360	1020	912	1672	1286	896	1984	1426	324	520	396	380	624	460	376	600	492	69	71	70
2016/11/30 06	720	1656	1000	920	1832	1256	904	2104	1432	336	472	388	368	584	464	372	616	496	70	70	70
2016/11/30 07	632	1304	1006	896	1624	1276	888	2128	1426	304	464	392	380	544	468	368	688	492	68	70	69
2016/11/30 08	728	1344	1036	944	1568	1284	1008	1840	1378	328	492	400	360	548	464	400	576	488	69	71	70
2016/11/30 09	736	1456	1012	984	1720	1320	960	1992	1434	320	488	396	372	608	468	392	624	496	71	72	71
2016/11/30 10	728	1368	972	960	1648	1240	968	1864	1390	300	480	380	376	540	448	404	644	488	72	74	72
2016/11/30 11	752	1552	1050	960	1888	1262	920	1968	1404	320	512	388	376	580	456	400	608	488	73	75	73
2016/11/30 12	744	1208	998	816	1608	1244	1112	2080	1480	336	456	392	356	572	456	388	636	500	72	74	72
2016/11/30 13	784	1384	1040	848	1712	1254	984	2048	1420	336	472	396	380	588	460	364	636	488	72	73	72
2016/11/30 14	840	1472	1080	912	1776	1250	1056	2048	1456	332	488	404	360	592	460	416	600	500	70	72	70
2016/11/30 15	712	1408	1034	960	1808	1296	992	2136	1464	336	464	396	380	560	464	380	588	484	68	71	69
2016/11/30 16	344	1416	1022	520	1968	1340	472	2184	1396	64	508	396	100	636	480	92	764	500	67	68	67
000010000001 | 1#入扇减速机低速出外侧轴承 | 1#入扇减速机,水泥扇工段																					

Daily Report[2]

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

2. Fault Alarm

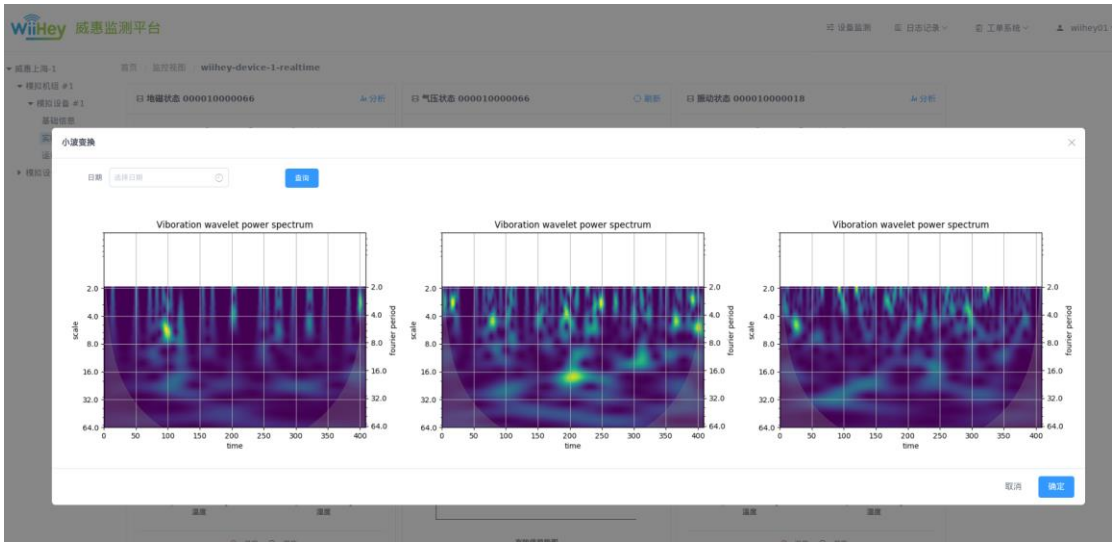
When *WiiHey datacenter* detects a fault, it sends an alarm message to administrator on Wechat, which is a popular mobile APP in China. By supporting Wechat, the notification message is very easy for people to get.

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

[1] WiiHey Product Catalog: refer to “wiihey_product_catalog.pdf”

[2] WiiHey Web Console, refer to: http://dev.wiihey.com