Fiber Perimeter Monitoring System (FPMS)
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System Introduction

Perimeter intrusion prevention is an important part of the Sensor Network applications. YOFC’s fiber perimeter Monitoring system (FPMS), use optical fiber as sensor to implement distributed perimeter Monitoring alarm system. The main sensor part of the system is the sensing cable unit and the unique design of the optical fiber make it sensitive to motion, pressure and vibration. It can be laid along the fence or the wall to detect attempts to climb over wall or shear the fiber; in addition it can be laid under the soil, gravel or sod to detect attempts to trampling, mining, etc. When someone climb over, pass through, or duck under the fence the FPMS deployed on the fence boundary will give an alarm. When installed on the concrete or masonry wall, the system can detect attempts of destroying or climbing over the wall.

YOFC’s Fiber Perimeter Monitoring System (FPMS) uses optical fiber as front-end detection devices, which has high reliability and easy remote networking as its optical detection. The system has advantages of low power consumption, electromagnetic interference resistance, no radiation, all-weather lightning protection, so it can be used in inflammable and explosive places.

The fiber perimeter Monitoring system is mainly used in airport, transportation, municipal and other infrastructure sectors; in electricity, petroleum, coal and other energy field, petrochemical,
non-ferrous metallurgy and other heavy industry; in defense boundary, ammunition depots, radar and other defense and military field.

**System Principle**

The optical fiber is not only used for signal transmission, but can also be used as the sensing unit in the application of safety precautions. The fiber perimeter Monitoring system is based on the nature of optical fiber which can be used as sensing unit and signal transmission medium at the same time. The system uses the vibration sensing fiber as the sensing unit, when there is interference effect on sensing fiber, some characteristics of the light transmitted in fiber will change.

![Normal condition vs External disturbance signals to the sensing optical fiber](image)

When the sensing fiber is affected by the interference in protection zones, some characteristics of the light transmitted in fiber will change. Special sensing equipments can monitor the changes of light (that is, attenuation, phase, polarization, wavelength, mode field distribution, and propagation time). By detecting changes of optical signal many measurements of the events and the states can be achieved, including: tension, displacement, damage, destruction, vibration, shock, sound waves, temperature, load, etc.. Special algorithms and analytical processing of the alarm controller can realize alarm and positioning functions.

This fiber perimeter Monitoring system is mainly composed of sensing cable, transmission cable and Alarm Processing Unit (Acronym processor APU).

**System Composition**

Based on region partition, vibration sensor units of FPMS monitor a number of completely independent areas continuously by time division multiplexing technology. When there's an intruder attempting to sabotage the boundary, the system can detect vibrations generated by the intruder, alert and identify the exact location of the invaded zone. The alarm processing units can be mounted great distance from the zone to be protected, and in accordance with the need to be configured with other
devices such as switch and video linkage device.

YOFC’s FPMS system mainly consists of the following four parts, as shown in the figure below:

**Signal Processing Part**

Alarm processing system adopted the most advanced optical fiber sensing probe and signal processing technology. The system is suitable for standard 19-inch rack, when its unique cable assemblies connected to the device, the signal processing unit can real-time monitor attempts of intrusion.

A signal processing components induced optical
cable distribution throughout the perimeter can be divided into multiple zones. Each independent zone can detect vibration signal of the intrusion. By continuous monitoring of various zones and return signal to the terminal equipment for processing analysis, the system can determine whether there is invasion incident. And by modulating separate protection zones the system can work in the best condition.

The system uses RJ-45 interface, and transmits alarm and system status information in XML format. There is a separate USB port for user’s calibration of the system.

**Sensing Cables**

Sensing cable can be divided into two kinds according to different laying ways: buried in land, or laid along the fence (including walls). Sensing cables are protected by different kinds of tubes, which can proof water, moist and pressure, etc.

**Transmission Cables**

Transmission cables using common communication optical fiber, play the role of connecting protection zones. Specific number of the cores is based on system requirements, usually 2 to 48 cores.

Single point of failure or damage in the system will only cause the corresponding zone fault occurs, while the rest of zones will continue to work normally.

**Fiber Distribution Box**

The distribution box is used to protect connection points in the Monitoring area, using the international standard interface specification.

**The FPMS Advantage**

**Alarm Processing**

In the Monitoring area, when there is an intrusion behavior such as climbing or breakage, the sensing unit can accurately detect signals, and sends the signal to the processor. After processing and analysis of the processor, an alarm signal would be send out.

1. When the alarm is triggered, real-time alarm record is displayed, including the alarm sequence number, alarm zones, alarm start time, alarm events number and note information, etc.
2. Adjusting sensitivity parameters in the system such as amplitude, frequency and phase detection system can filter out some disturbance signal caused due to passing pedestrians, vehicle noise, branches swing, changes in the weather and other environmental factors, making the entire Monitoring system has high probability of detection with very low false alarm rate.

**Global Electronic Map**

Display zone distribution, the alarm point distribution in electronic map, and selectively display multi-zone map through audio and video auxiliary devices.

**System Monitoring**

Waveform monitoring: monitoring waveform curve is published graphically, and by real-time waveform signal graphics, staffs can grasp real-time information and historical data of each zone.

**System Management**

1. Initial setup: After the completion of the initial parameter settings, the system can automatically detect the last set parameter information being saved and do not need to set again.

2. Multiple permissions user management: you can easily add, delete, modify and browse the user's basic information, including account number, password, permission, etc.

3 User login log: When user log in, the system will automatically record user’s information;

4. Regular automatic database backup.

**Action with Alarm**

Alarm unit of each zone can sent alarm protocol data through network or interface to other devices and software systems. Other Alarm linkage system such as video surveillance linkage, GSM Alarm System, live recording, lighting broadcasting can be freely configured. When a zone generates an alarm, system can be one-to-one, one-to-many or many-to-one to get linkage video surveillance, sound–light alarm and central monitoring platform.

**Damage Resistant Performance**

In the case of distributed fiber optic perimeter alarm system working normally, when someone damaged cable, the system will alarm

The structure of the system is perfect, in which each region is complete and independently adjustable and will not
be affected by disturbance or cut of a certain area.

**Application Area**

Compared with traditional electronic perimeter Monitoring equipment, FPMS has congenital advantages: covert detection, high environmental adaptability, all-weather lightning protection, maintenance-free and other prominent advantages. This technology has been used in the following areas:

Flammable and explosive places--Petroleum, petrochemical facilities, oil and gas pipelines, oil and gas Library;

High insurance demand places--Prisons, banks, consulates, museums, etc.

Places need anti-jamming-- Airports, radar stations;

Water areas--Borders, railways - long-distance, large-scale applications, ports, scenic, water facilities;

Large villa - need covert detection to keep environment harmonious and beautiful

National defense and Monitoring applications--Defense borders, military, armory.

**Common Perimeter Monitoring System Comparison Chart**

<table>
<thead>
<tr>
<th></th>
<th>Infrared</th>
<th>Video Cameras</th>
<th>FPMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakthrough Chance</td>
<td>Visible, can play a deterrent effect, easy to install and maintain, but vulnerable to damage, easy to break, susceptible to external factors</td>
<td>Visible, can play a deterrent effect, installation and maintenance is relatively easy, not easy to break and damage, but there may be blind angle</td>
<td>Concealed, when adopting multi-level and multi-form combination of fence and buried pressure induction setting, it is almost impossible to break through</td>
</tr>
<tr>
<td>Energy Consumption</td>
<td>High, each sensor need power supply</td>
<td>High, each camera need power supply</td>
<td>Low, fiber optic is passive component</td>
</tr>
<tr>
<td>Corrosion Resistance</td>
<td>Poor, external metal parts are easy to rust</td>
<td>Poor, external metal parts are easy to rust</td>
<td>Corrosion resistance, optical cable is not easy to corrosion</td>
</tr>
<tr>
<td>Intelligetize</td>
<td>Low</td>
<td>Low, rely on personnel monitoring</td>
<td>High, automatic monitoring and judgment</td>
</tr>
<tr>
<td>Reliability</td>
<td>Low</td>
<td>Low, average failure time rapidly increase when a lot of applications are layout</td>
<td>High</td>
</tr>
<tr>
<td>Alarm Function</td>
<td>Low</td>
<td>Low</td>
<td>High, warning threshold can be set</td>
</tr>
<tr>
<td>False Alarm Rate</td>
<td>High, it is difficult to identify small animals</td>
<td>Low</td>
<td>Low, sensing object category can be set</td>
</tr>
<tr>
<td>Weather Effect</td>
<td>High, snow, rain and winds are likely to cause false alarm</td>
<td>High, rain, snow, dust and light changes can affect the system</td>
<td>Low, immune to weather</td>
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<td>------------------------</td>
</tr>
<tr>
<td>Temperature Effect</td>
<td>High, cannot work stably above 50°C</td>
<td>High, cannot work stably at low or high temperature</td>
<td>Low, good tolerance with high and low temperature</td>
</tr>
<tr>
<td>EMC</td>
<td>Relatively low</td>
<td>Relatively low</td>
<td>High, immune to EMI</td>
</tr>
</tbody>
</table>

Thus, compared to other perimeter Monitoring system, YOFC’s fiber perimeter Monitoring system has the following technology advantages:

- **Intrinsically safe**: non-conductive; immune to EMI/RFI; immune to lightning; will not case explosion
- **Multifunction**: fit for application on tubes, fence, wall, lawn; auxiliary functions such as the invasion direction discrimination of different regions and voice monitoring can be used according to specific environment and user’s requirements
- **Robust**: immune to weather; immune to corrosion; expected long installed lifetime
- **Low power consumption**: In addition to the monitoring terminal, the system front-end for passive optical fiber devices, without power supply
- **Strong concealment**: unlike regular Monitoring settings, the system of laying way has extremely high concealment and is not easy to be found by intruders so as to avoid damage and failure
- **Adjustable sensitivity**: set sensitivity of the system according to the site environment and installation
- **Immune to weather**: fiber optic monitoring makes the system not affected by changes of seasons, day and night.

**System Certificate**
Application Cases

Case 1 Along oil tubes of SINOPEC

Sensing Cables are laid along oil tubes of SINOPEC, FPMS can well protect oil tubes, making alarms at real time and telling users the precise locations of invasion.

Case 2 The fiber perimeter Monitoring system of a campus
Perimeter Monitoring system is mainly implicated around walls and fences of the campus to prevent foreign personnel from climbing over the fence into the campus. In this FPMS, two laying ways of perimeter fence monitoring and ground monitoring are both used, and effectively meet campus safety requirements.

Case 3 The fiber perimeter Monitoring system of a troop in Beijing

Sensing cables can be mounted on the barbed wire used as top guards and linkage with the military early warning system at the same time, effectively guarantee safety of the camp.

Case 4 The fiber perimeter Monitoring system of a company
In companies, government agencies, and other important buildings of perimeter, FPMS can effectively prevent invasion and ensure the safety of enterprise.

**Case 5 The indoor monitoring system of Beijing Municipal Labor and Social Monitoring School Training Center**

Sensing cables are laid under the carpet and behind the cabinet, which are covert and have high sensitivity. Invasion will be timely warned at real time.

**Case 6. The fiber perimeter Monitoring system of Hubei chemical fertilizer plant**

Sensing cables are laid on the barbed wire fence of the factory, output the invasion signal to the video system, which effectively prevent invasion and large objects to smuggle.
Warranty and Maintenance

Beginning on the day of purchase, all the products under normal usage circumstance will be provided with a one-year warranty of free maintenance and repairs. Damages due to misuse and other factors will be charged for the cost of the components and its related materials. At the same time, YOFC provides the spare parts of products all the year round and offers life-long maintenance for these spare parts.

Besides, YOFC is still responsible for system upgrade and service after the system is running. Service time: remote diagnosis and maintenance can be offered immediately after receiving on-site service requests; for site service, we shall arrive on the scene within 48 hours following receipt of user application, and solve the problem as soon as possible.

After-sale Technical Support

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