DUNAY – DISTRIBUTED ACOUSTIC SENSOR
System for monitoring security zones of extended objects
T8 – TECHNOLOGIES OF INFINITE

About the company

T8 SENSOR, LLC is the leader in developing of fiber optic sensor systems in Russia and CIS countries. T8 SENSOR LLC is part of T8 Group of Companies and resident of Skolkovo Innovation Center. The main areas of company activities: photonics and distributed acoustic sensors research and development. Doctors of science, Ph.Ds and several dozen of qualified engineers perform innovation activity in T8 Group.

T8 SENSOR actively works on engineering research and development in the optical physics area in order to create innovative solutions and newest designs. All developments are covered by patents valid on Russian Federation and Eurasian Patent Convention territory. Lots of scientific researches is also made for Company T8, leading telecommunications manufacturer in Russia.

Optics laboratory of T8 Sensor Company is one of the best equipped in Russia. It is strongly equipped by state-of-the-art equipment and tools for all kinds of photonics research and supports research and development services either for T8 Group of Companies or 3rd Party Companies.

Developing of modern high-tech equipment and implementing of innovative technologies requires high professionalism and creative approach of all employees. Training and education center for young specialists has been created; Company selects the best graduates from leading Russian universities such as MIPT, MSU, Bauman MSTU, and others and force their professional growth.

The innovative distributed acoustic sensor system Dunay has been developed in company’s laboratory. System is intended for monitoring of protected zones of long-distance objects: polygons and perimeters, pipelines, railways and motor roads, communication lines, and so on.

Several first versions of Dunay system has already been installed at fuel and power plants and transportation facilities. Gazprom, Russian railways, Domodedovo Airport are among the system users.

The very important direction of further development is system adaptation for railways infrastructure applications.
EARLY DETECTION IS THE BEST PROTECTION

The system advantages are as follows:

- Low cost of long-distance objects security organization.
- Integration with other security systems.
- Hidden operation of the system - no visible sensors, no metal detection, no emission.
- Immunity to electromagnetic influence and interferences.
- Standard optical fiber G.652 as distributed sensitive element.
- Stable system operation regardless weather conditions: fog, raining, snowing, wind, etc.
- The system can be taught depending on new events and facility types.
DUNAY - DISTRIBUTED ACOUSTIC SENSOR

Distributed acoustic sensing (DAS) uses standard single-mode optical fiber (G.652) as highly-effective distributed sensitive element, detecting soil vibrations (acoustic vibrations) at distance of up to dozens of kilometers along the optical cable. Dunay system monitors linear zone of up to 40 km, or up to 90 km with remote signal pumping (ROPA).

Dunay allows to detect various events with 10 meters accuracy throughout monitored zone: approach to a guarded zone, movement along the border, or trespassing the monitored zone border. Detection accuracy increasing greatly if several monitoring zones are arranged. If any person or car approaches to guarded zone, or any active process starts near protected object, Dunay system generate and send alarm event to the operator’s computer indicating the source location. The system permits to detect any kind of activity that is causing water or soil vibrations. When installing the system with a client, T8 specialists set the system individually by taking into consideration the particular features of every facility.

Areas of application of the system:
- Pipelines monitoring and diagnostics:
  - Routine works monitoring.
  - Protected zone monitoring.
- Perimeter guarding.
- Transportation infrastructure objects monitoring:
  - Rail tracks.
  - Landing strips.
  - Bridges, tunnels, highways.
- Communication lines guarding.

### Parameter | Value
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Type of optical fiber | G.652
Maximum fiber length | 40 (75) km
Accuracy of determination | up to 10 m
Power consumption | 300 W
TRANSPORT, PETROCHEMICAL INDUSTRY, METALLURGY, FUEL AND POWER INDUSTRY, MACHINE BUILDING AND MILITARY INDUSTRY COMPANIES

- Dunay system is successfully operated in the perimeter security of the 1st maneuvering area of Domodedovo International Airport in Moscow.
- System tests are in progress at Orlovka local airport in Tver region and Roschino airport of Tyumen city.
- System has been successfully tested at the polygon of Research & Design Institute of Radio-Electronic Engineering (NIKIRET)
PERIMETRAL SYSTEM FOR CRITICAL INFRASTRUCTURE FACILITIES

When organizing perimetral systems for monitoring of long-distance zones placed over dozens and hundreds of kilometers, the main security goal is not to ensure the physical security but to detect trespassers on time.

We offer developed in Russia the most cost-effective and best technical solution for long-distance objects security zones monitoring.

When any person or car, or any earthwork run activity near the protected object, Dunay system generate and transmit alarm event to the operator’s computer indicating the location of the source. It is possible to arrange several security zones for critical infrastructure and sensitive facilities in order to determine the exact direction and speed of trespasser’s movement.

The most important advantage of the Dunay system is its hidden operation, as monitored zone is not visually accessible. When dielectric cable is used, the system cannot be detected in the ground even with special devices (metal detectors). The concealed location of the sensing elements allows to resolve several problems: impossibility of pre-reconnaissance, vandal resistance, and preservation of the secured area landscape. The hidden operation of Dunay system prevents potential trespasser from performing preparation and workup activities, which increases the chance of detecting a trespasser. The higher vandal resistance is crucial for remote areas, where equipment theft or damage is highly probable. And landscape preservation feature allows to use the system in specially protected cultural heritage areas.

One standard Dunay system is capable to monitor zone of up to 40 km. No infrastructure and power supply units needed throughout the zone. Vibro-acoustic sensor allows to detect digging of underground tunnels and passages. Dunay system is indispensable for industrial and security-sensitive facilities as well as for various polygons.

Dunay system has open API and allows developers connect Dunay system to all modern security applications using Ethernet channels. Dunay system may be easy integrated to any existing security system. Video surveillance and Dunay systems can operate jointly, when alarm signal orients camera directly to relevant zone section, detected by Dunay sensor, thus, operator gets immediately alarm and event image on his monitor. Joint operation of Dunay and other security systems on the facility permits to decrease substantially the number of any false alarms.

System allows operators detect, recognize and mask routine safety events, such as vehicles or people passing through permitted areas. Dunay system has proven it’s high efficiency in the airport perimeter guarding.
ONE DUNAY CAN REPLACE THOUSANDS OF POINT SENSORS

- The system is in operation at the Gazprom Transgas Ufa gas pipeline.
- Trials were carried out successfully on the Surgutneftegas OJSC pipeline.
OIL AND GAS INDUSTRY PIPELINES MONITORING AND DIAGNOSTICS

Pipelines and communication lines monitoring always implies substantial expenditures for the security system infrastructure. If conventional solution is applied, the security zone would contain a lot of elements requiring regular maintenance and verification.

We offer our customers a unique solution that would allow monitoring zones of up to 75 km long per one device with the ROPA system. One fiber in the fiber optical cable substitutes thousands of sensors.

The Dunay system warns independently or within security complex about heavy machinery approaching a pipeline and allows to detect tie-ins and unauthorized works, Dunay system can be easily integrated into a video surveillance complex and provides video image of pipeline section where the alarm has been activated; it also generates an alarm event notification to security department employees via various channels.

Vertical seismic profiling system is being created. The system sensing element - fiber optical cable - requires no maintenance. According to the manufacturers, the average fiber service life time is over 25 years, and the Dunay system service life time is over 10 years. The possibility of system operation via Ethernet channels allows operator or dispatcher monitor it remotely.

As the sensing elements are buried in the ground, the probability of its malicious damage is minimized.

The detection zone for a person is several meters wide. Even before a person could get close to the facility, the person will be detected by the system. It should be pointed out that Dunay also provides passage digging detection. Additional advantage of the system: it allows monitoring the passage of pig receivers (cleaning pigs) and defectoscopes in the pipes.

The Dunay system can be integrated into any security system which allows using of external API interfaces. The complete automation of the system is possible, e.g. integration with drones. The automatic launch of the device would allow receiving photo and video images of the scene promptly and without additional involvement of a dispatcher.
• Russian Railways PJSC tests the system at several railroad sections. The aim of the tests is railway traffic organization.
• Tests have been successfully carried out at Kazakhstan Temir Zholy JSC on the Kazakhstan railroads.
TRANSPORTATION FACILITIES SECURITY

Railroads

Railroads are the most important throughways of the country, and they cannot operate without monitoring and control automation, same as any up-to-date transportation system. Railroads infrastructure operation requires real-time monitoring of trains movement and railtrack condition.

Dunay system allows to record works progressing along railtracks, register trains speed, record cargo dragging in case of emergencies. The sensor allows to do the following in real-time mode: reveal wage wheels defects, find gripping brake boxes and determine worn wage wheels. Besides, the continuous data analysis helps to reveal on time any degradation or damage of the railroad tracks and to detect rockfalls.

A big advantage of the system is its immunity to electromagnetic disturbance. The sensor operates fault-free under lightning discharges, tolerates the vicinity to electric mains, and ensures sustainable operation under substantial electromagnetic disturbances.

Bridges, tunnels, highways

Dunay system can be used to organize secured zones over tunnels and bridges, including those in fluvial plains.

Communication lines

One of the most common reasons for the failure of fiber optic communication lines is the accidental fiber cable break. It can be caused by works near the cable line or vandalism. Dunay allows preventing such an accident by notifying an operator about unauthorized works close to the communication line.

There is positive experience in using the Dunay system for restoring fiber optic communication lines.

Example of recording trolley passage: horizontal axis — time, vertical axis — distance. In the image, one may see wage wheels clamoring.

LOCALIZATION ACOUSTIC INFLUENCES

- DAMAGE TO RAILWAY TRACK
- TRACKING TRAINS
- MONITORING THE CONDITION OF THE RAILWAY TRACK

OPTICAL FIBER
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