



TEDAS - Sensor Network System for Facility Security

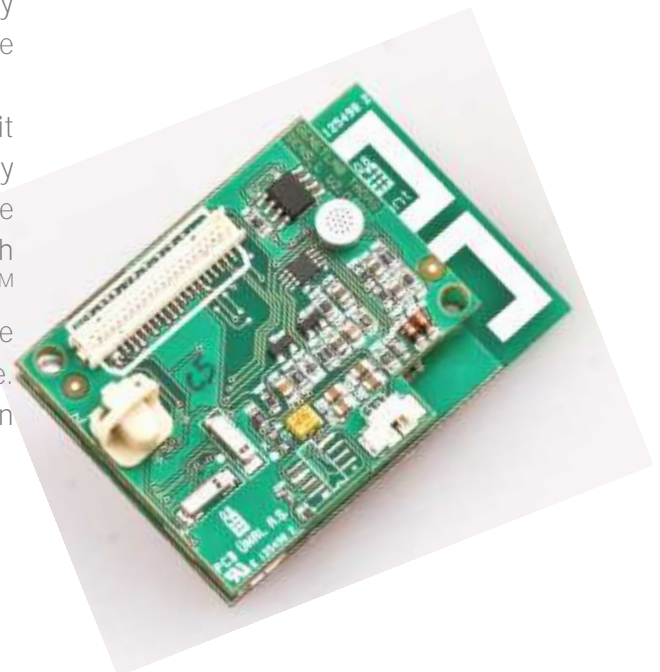
TEDAS™ is a state-of-the-art Wireless Sensor Network (WSN) System designed for providing peripheral security for important facilities. It may be adapted to many types of fences such as wire fence, panel fence or wrought iron fence etc. Unauthorized persons trying to access through the peripheral fencing are immediately detected by TEDAS™.

Any unauthorized access through the fence (by breaching the fence, climbing over the fence, or trying to enter the periphery by lifting up the fence etc.) is immediately detected and precisely localized by TEDAS™.

Possibility of false alarms caused by natural impacts (such as wind, heavy rain etc.) or harmless incidences (such as leaning on the fence, or hitting a ball to the fence etc.) is diminished by intelligent signal processing methodologies. TEDAS™, based on a sophisticated state-of-the-art technology and comprehensive field experience, provides a reliable solution for peripheral security.

Thanks to WSN technology, the SenseNodes™ transmit the alarm information wirelessly to TEDAS™ Sink Units by using each-other as a hop. TEDAS™ Sink Units send the gathered data via conventional communication channels such as RS485, UTP or F/O Ethernet, GPRS etc. to TEDAS™ Command & Control Center, where the alarms and threats are made audible and visualized on a geographical user interface. Auxiliary equipment such as cameras, siren or illumination can be integrated to TEDAS™ as well.

- Next Generation Wireless Sensor Technology
- High Reliability
- Effective Control (Senmot)
- Easy Configuration and Setup
- Cost-Effective Design
- Integration of Camera, Siren and/or Illumination etc.
- **±5 m Accuracy in Localization**
- Low False Alarm Rate



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Next Generation Wireless Sensor Networks

TEDAS™ is a Sensor Network System developed by using the Wireless Sensor Network (WSN) Technology and making usage of the joint detection function of multiple sensors and analyzing the detected data according to a sophisticated logic. Sensor nodes (SenseNode™) communicating wirelessly with each other alert the user in case of an unauthorized access through the fence.

High Reliability

The SenseNodes™ used in TEDAS™ System are able, thanks to the ad hoc network they form, to substitute each other in their detection and communication functions in case of breakdown of anyone thereof. Thus, the probability of shut-down of the System due to any failure in anyone sensor node is eliminated.

Effective Control (SenMot)

The Command Control Software Senmot, being one of the main components of the TEDAS™ System, makes the control of the system thanks to its effective and user-friendly Graphical User Interface (GUI), easier. Through the SenseNodes™ marked on the satellite images or on the map of the monitored area, Senmot provides all alarm information to be traced with all details throughout the entire area.

Low False Alarm Rate

As TEDAS™ is able to be calibrated pursuant to the individual properties of different fencing systems, and as it is able to process the received signals, TEDAS™ is capable of distinguishing the threats from natural impacts such as heavy wind or rain or hail fall as well as from any harmless incidents such as hitting a ball onto the fence or leaning against the fence etc. Thus, the possibility of false alarms is diminished to the minimum level.

Integration of External Systems

Depending on various alarm-levels available in the TEDAS™ System, additional auxiliary equipment such as cameras, siren, illumination etc. can be integrated to TEDAS™ and triggered at any desired alarm-level. For example, in case of alarm, a camera used in the monitored area can be triggered to turn to the location from where the alarm signal is received. Thus, a full security check can be provided by one and the same software.

± 5 m Accuracy in Localization

Depending on the type of the fence, the SenseNodes™ of TEDAS™ are attached to the fence at an interval of 10 to 15 meters and their exact positions are marked on the map screen of Senmot. As the sensor node detecting the signal is visible on the map, the System localizes the threat by an accuracy of ± 5 meters. Compared with conventional systems used for the same purpose, TEDAS™ provides a much more efficient control and monitoring capacity thanks to its sophisticated localization feature.

Functioning also in ambient without any infrastructure

All components of TEDAS™ are designed and developed by Genetlab™, and by its unique features such as low energy consumption, easily adaptation to environmental conditions and capability to use alternative communication ways, TEDAS™ is able to run on various communication means like GPRS, RS485, satellite connection, copper or fiber optic cable etc. Genetlab™ can also tailor the system to use electrical power generated from alternative energy resources like solar panels, fuel cells, wind turbine etc. These features alone make TEDAS™ an efficient and reliable solution for facilities that are located far away from the user at a difficult accessible place without energy infrastructure.



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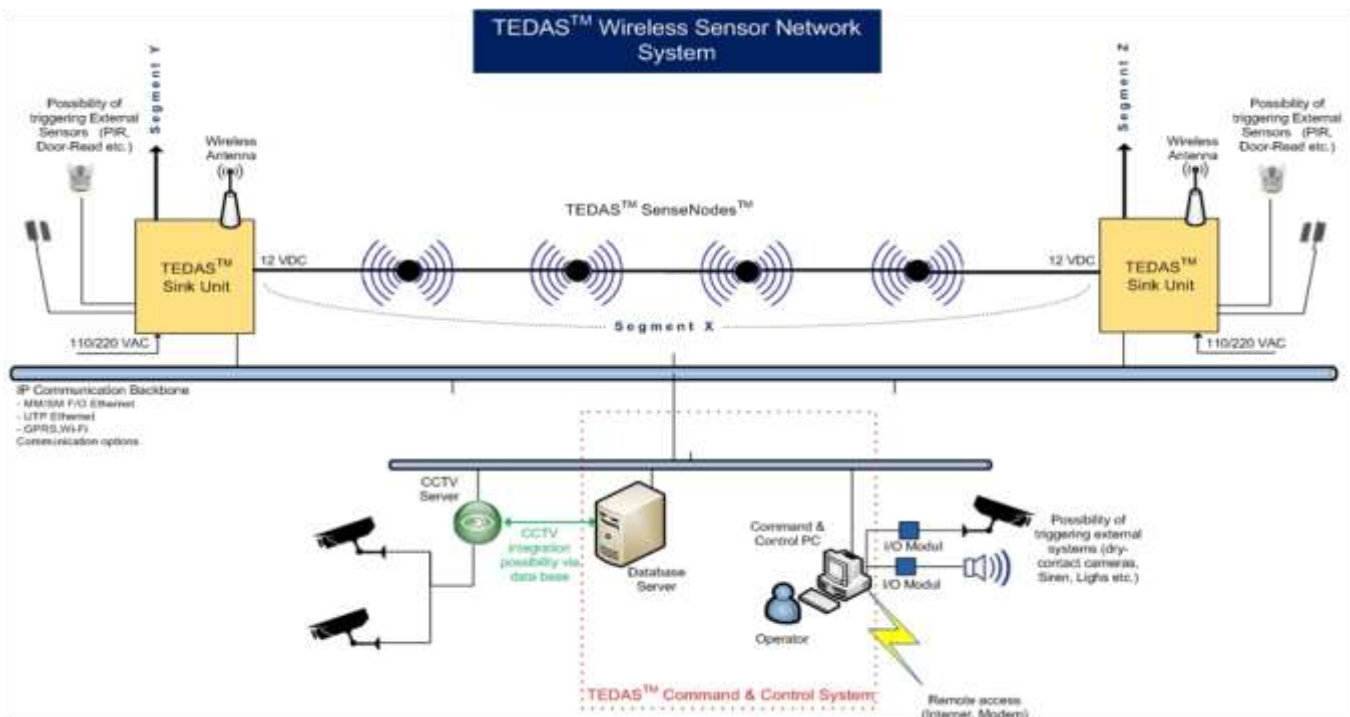
Working Logic

TEDAS™, comprising of the components TEDAS™ SenseNode™, TEDAS™ Sink (Collecting) SenseNode™, Command Control Software Senmot, TEDAS™ SenseNode™ Casing and the power supply cable, is a robust, flexible and reliable state-of-the-art security system.

TEDAS™ Sensor Network System detects the vibrations on the fence by the accelerometer attached to the TEDAS™ SenseNode™ and pre-processes the detected signal for the assessment of the reason of such vibration. According to the outcome of this assessment, the system decides, pursuant to the previously specified assessment criteria, whether there is any reportable incident, and, if yes, the user is alerted through wireless communication via other nodes. Since the logic of such wireless communication is based on an ad hoc network architecture, the nodes automatically chose the most suitable and reliable way of communication for themselves through intercommunication with adjacent nodes. The Sink SenseNodes™ at both ends of each segment receive such data and transmit them to Senmot by using conventional communication channels. Any Sink SenseNode™ act at the same time as the substitute of any other one, and, as it is the case for the detecting nodes, they substitute each other in their function in case of breakdown of anyone thereof, so that the probability of shut-down of the System due to any failure in anyone Sink SenseNode™ is minimized. Thus, different than other systems available at the market, any segment continues to work despite of any eventual damaging of the System at any point within such segments. This unique feature is an additional measure against any eventual tactical deception attempts.

The Command Control Software Senmot completes the signal processing process started at the SenseNodes™ and any unauthorized accesses or trespassing as detected and picked out are real-timely indicated on the display.

The working logic of TEDAS™ bases on the two most important features of the wireless sensor networks: ad hoc network architecture and signal processing skill. Unique characteristics of TEDAS™ such as Low False Alarm Rate, Elimination of the Probability of Shut-down of the System and Low Energy Consumption owe to these two features.



TEDAS WORKING LOGIC SCHEMA

TEDAS - Sensor Network System for Facility Security

System Components

TEDAS SenseNode — Wireless Sensor Node

TEDAS™ SenseNode™ is a sensor node designed specifically for the Sensor Network System for perimeter security. TEDAS™ SenseNode™ consists basically of two units: Sensor-L and Node-RF. Sensor-L is designed so that it detects the vibrations on the fence by its 3-axis accelerometer on the most efficient way and transmits the detected data to the Node-RF unit. The Node-RF preprocesses the coarse data that it receives from Sensor-L by its microprocessor and transmits the preprocessed data via its RF-Transceiver module to the Sink SenseNode™ (Collecting Node) over neighbor SenseNodes™. Working logic of the system is fully managed by the protocol infrastructure, signal processing algorithms and general working logic of the Operating System GenOS, which is the embedded operating system of the SenseNode™.



TEDAS SenseNode – Node RF



TEDAS SenseNode - Sensor L

TEDAS Sink (Collecting) SenseNode

The SenseNodes™ transmit the data that they collect and preprocess to the Sink (Collecting) SenseNodes™ by using each other as a communication hop. Multiple Sink SenseNodes™ are used in the system in order to create the many-to-many logic within the System and, thus, to eliminate the probability of shut-down of the system. As the SenseNodes™ in each segment transmit the data to both Sink SenseNodes™ at two ends of such segment, in case of any failure in anyone of these Sink SenseNodes™, the data transmission is performed by the other one. The Sink SenseNodes™ are able to transmit the received data through alternative communication channels (such as GPRS modem, Ethernet cable, fiber optic data line, RS-485, satellite connection etc.) to the command & control center, where Senmot is installed.

GenOS Operating System (Genetlab Operating System)

GenOS is an operating system running on the SenseNode™. GenOS is designed and developed by Genetlab™ specifically for Wireless Sensor Networks (WSN). Thanks to its onboard communication protocol, signal processing and decision algorithms and small sized structure, GenOS is indispensable for the low-energy-consuming wireless sensor nodes. As during the design and development stages of GenOS, any and all product and system needs are considered by Genetlab™ in all details, it fulfills all system requirements and can be modified by Genetlab™ to meet different needs. Moreover, as GenOS is a closed-source-code software, it provides a safer solution compared with other operating systems with open-source-code software, especially for special projects with high confidentiality.

- Fast and easy program development
- Working with well-known platforms
- (Standard C code and compilers)
- Well defined hardware abstraction
- Cross-layered network architecture
- Low power consumption by reliable networking
- Extensive I-O Libraries
- Robust concurrency model
- Easy configuration and setup

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System Components

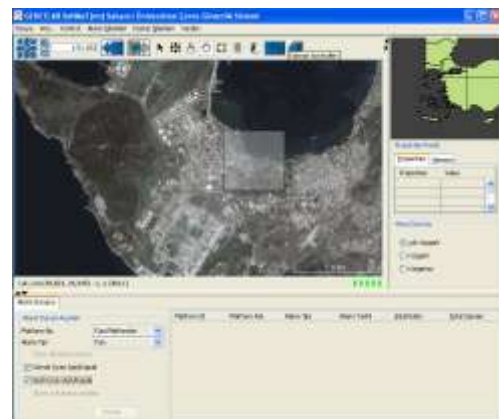
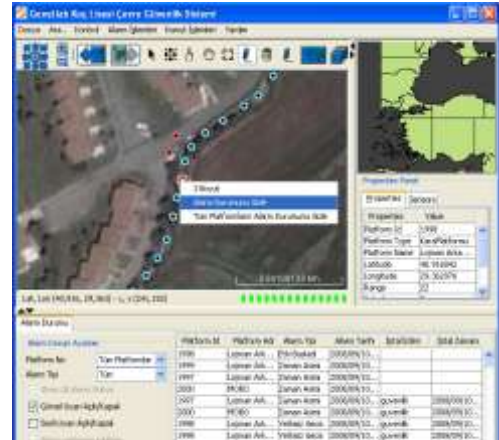
SenMot Command Control Software

Senmot is the Command and Control Software, where the alarm-info received from TEDAS™ are visualized, recorded and made audible if necessary. By means of this software, the received alarms are transmitted visually and aurally to the security operator. Furthermore, through recording the received alarms, Senmot enables the user to track the alarm-info at any time through filtering them in the sense of node and alarm type. Senmot, designed and developed by Genetlab™, provides an effective and user-friendly Graphical User Interface (GUI) to meet all needs of the user. Different authorization levels depending on user type are also available at Senmot. Thus, for the purpose of reducing any utilization or operation mistakes to minimum level, the power user of Senmot is able to arrange and/or restrict the authorization of other personnel, who will jointly use the system.

Senmot allows the user to monitor the system on a map on which the relevant position of each node is exactly marked. The user is enabled to instantaneously monitor the positions of all nodes and their current conditions like processor temperatures and similar parameters. Moreover, if cameras are integrated to the system, the user can monitor on a separate window the location from where the alarm signal is received through the camera next to this location, as Senmot has the capacity to transmit also camera images. The users are also able to easily adjust the TEDAS™ system to weather conditions. Each of the available options enables the system to work much more effective and stable under various weather conditions (such as very windy, windy, windless). At latest within 1 minute after choosing of the weather option, the system calibrates itself automatically according to the chosen weather condition. The options may be expressed as follows: very windy weather as “very heavy wind and rain”, windy weather as “medium level wind”, and windless weather as “lull”.

Various alarm status are defined for SenMot. These alarm status inform the user visually, aurally and in writing in different forms in accompaniment of geographical localization info what a threat has been detected by which node. Moreover, independent from these alarm status, the user can also define further alarm status pursuant to his own needs and avoid any undesired situations.

Green Alarm	Feeder Cable cut off
Yellow Alarm	Impact commenced
Red Alarm	Unauthorized Access
Blue Alarm	Node out of service
White Alarm	Time out (Receiving no data)



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System Components

TEDAS SenseNode Casing

TEDAS™ SenseNode™ Casing is made of high impact strength polycarbonate resin so that any vibration is transmitted at the best level. In addition to its high resistance to environmental conditions, it has a much lighter and compacter structure than other competitive casings, and can be carried easily. Both the casing and the feeder cables have a high UV-Resistance and are of IP67 standard. Simplicity of its assembly and disassembly shortens also its installation and setup time. The design of the casing is made by Genetlab™ by consideration of eventual future additions.



Technical Specifications

TEDAS™ SenseNode™ Technical Specifications	
Processor Specifications	Value
Program Flash Memory	On Board 48 kB
Data RAM	On Board 10 kB
Serial Ports	2 × USART
Analog to Digital Converter	8 channels 12 bit ADC
RF Specifications	Value
Central Frequency	2.4 GHz
Number of Channels	16
Data Rate	250 kbps
Output Power	min. -25 dBm / max. 8 dBm
Input Power	10 dBm
Receiver Sensitivity	-98 dBm
Sensor Specifications	Value
Accelerometer	
Axis and scale	3 axis, +-2 g
Sensitivity (V/g) at 3,3V Supply Voltage	0,66V
Zero g Level at 3.3 V Supply Voltage	1,65V
Non Linearity (Typical)	+-%3
Power Specifications	Value
Input Voltage (external)	min. 6 VDC / max. 12VDC
Battery Voltage (internal)	min. 2.4 VDC / max. 3.7Vdc
Operation Current	min. 50 uA / max. 175mA

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Technical Specifications

TEDAS™ SenseNode™ Technical Specifications (cont'd)	
Operational Conditions	Value
Temperature Range (C°)	-20 / +65
Humidity Range (%RH)	5 / 98
Flammability of Case (UL94)	HB
Flammability of Cable (UL94)	HB
Min. UV Lifetime of Case	10 yrs
Min. UV Lifetime of Cable	6 yrs
International Protecting Rating	IP67
NEMA Rating (except Fittings)	6
IK Rating (EN 50102)	10
Material Specifications*	Value
Case	High Impact Grade Polycarbonate
Cable	PVC based cover 2x2.5 mm ² copper
Cable Fittings	PA6 M20
Bolts & Screws	304L
Mounting Plates	HDPE
* All materials are RoHS compliant.	
Physical Specifications	Value
Outer Dimensions (except Fittings) (mm)	183x163x58
Weight except mounting plates (g)	370
Weight with mounting plates (g)	760

TEDAS™ Sink Unit Technical Specifications	
Operational Conditions	Value
Temperature Range (C°)	-20 / 60
Humidity Range (%RH)	20 / 90
Material Specifications	Value
Dimensions (mm)	400 x 600 x 200
Case	1,5 mm DKP metal shield
Coating	Electrostatic Powder Coating (RAL 7032w)
IP Class	IP 65
Cable Fittings	PA6 M20
Bolts & Screws	304L
Mounting Plates	HDPE
Power Specifications	Value
Power Consumption (DC)	max. 90 Watt
Power Consumption (AC)	max. 190 VA