

OptumSense

The System

OptumSense is an autonomous and reliable integrated system for forest fire detection in close-to-real time. Its main elements are the OptumSense sensors and OptumGate gateways. The OptumSense sensor is an environmental-friendly wireless sensor device, appropriate for detecting forest fire incidents as soon as possible. Designed to cover large areas, sensors are placed camouflaged in the canopy of trees, at a density of 20-50 meters. If a fire is detected, an alarm signal is transmitted to the OptumGate gateways in range before the sensor that captured the event gets destroyed by the fire. OptumGate is a wireless gateway, responsible for transmitting sensor alarms to central locations such as operation centres for forest fire crisis management. OptumGate supports WAN connections through multiple interfaces, including GSM data, GPRS, 3G, and Wi-Fi. Designed to be reliable, OptumGate devices may be placed in forest as far as 600 and as close as 300 m to each other, providing redundant and dependable communications between an OptumSense network and an operations centre.

The OptumSense Integrated WSN-based forest fire detection system

The OptumSense WSN-based forest fire detection system is comprised of a wireless sensor network consisting of thousands of sensors camouflaged in the canopy of trees, and of gateways to convey alarms to central locations. A typical sensor deployment may range from one to many square kilometres, and is limited only by the WAN coverage; the network may contain thousands of sensors organized in cells.

Sensors generate alarms that need to be transferred to operations centres to be further processed and dispatched to the authorities in charge. This is done by OptumGate gateways, which are placed properly camouflaged, such as in bird houses, in forest areas with at least one supported WAN service in range. Every OptumGate device develops a cell similar to the GSM network cells. OptumSense sensors located within the cell area use this gateway to transfer alarm messages to central operation centres. Alarm messages are comprised of a unique sensor ID and a timestamp added by OptumGate gateways. In addition, OptumGate transmits all kinds of diagnostic messages so as to ensure high reliability and network availability. The OptumSense system network hierarchy is shown in Figure 1.

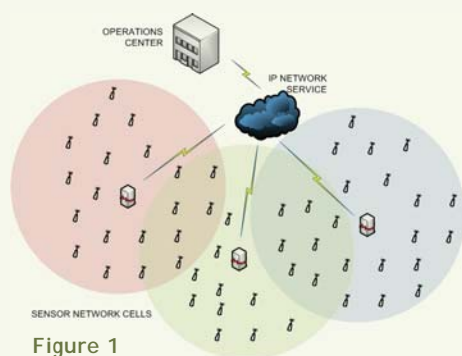


Figure 1

The OptumSense sensor communication protocol is a low-power, simple and reliable protocol designed to provide dependable forest fire alarms. The network topology is a two-level star topology the first being the sensor-to-gateway communication and the second being the gateway-to-WAN communication.

This simple and comprehensive concept enables the deployment of very large numbers of sensors in forest areas, while being able to provide redundant and reliable fire alerts.

The sensors can be located at any distance within the effective range of at least one OptumGate gateway, which is a few hundred meters. A typical sensor-to-sensor distance ranges from 20 to 50 m, which implies that 400 to 2500 sensors per square kilometre may be needed. Depending on the sensor density, the local topography, and the redundancy and reliability requirements, 4-8 local OptumGate devices are required per square kilometre, as shown in Figure 2 and Figure 3.

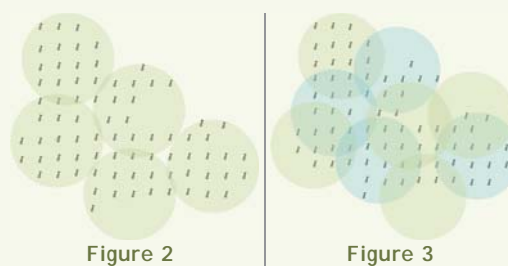


Figure 2

Figure 3

Multiple interfaces, including GSM data, GPRS, 3G, and Wi-Fi are supported by OptumGate gateways. If an alarm is received, the Gateway will begin the procedure of sending a data message to the communications server.

In spatially dense deployments, where the same sensor is in range of more than one OptumSense gateways, all the gateways transmit its alarm messages, which is not taken as multiple alarms since they contain the same sensor ID. OptumGate provides a digital interface that allows communication with other devices such as weather stations that can be set up to transmit meteo data through the OptumGate's radio device to the operations centre. OptumGate requires minimal maintenance once a year or less often, depending on each specific installation's power plan.

To effectively design OptumSense sensor networks, a software simulator along with sophisticated optimal positioning algorithms are used. Demos and evaluation kits are available on request.

Key Features

OptumSense sensor

Temperature sensor	Factory set alarm point
Topology supported	Star
Effective sensor range	Up to 1000 m
Operating frequency	433 MHz
Sensor to gateway time	<30 ms
Multiple gateways/sensor	YES
Battery lifetime	3-5 years
Warranty	3 years

OptumGate gateway

Type of gateway	Autonomous integrated WSN
WSN topology	Star, unlimited sensors/ gateway
WSN frequency band	433 MHz
Transmit data protocol	TCP/IP over GSM
TCP/IP support	YES
3G/Wi-Fi/WIMAX/Satellite	Optional
Battery autonomy	9-12 months
Warranty	3 years



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