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Monitoring and Automatic Forest Fire Detection within the first 5 minutes

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CHARACTERISTICS:

DISTANCE COVERAGE PER SYSTEM: up to 15km of radius

MAXIMUM TIME DETECTION: typically 5 minutes of the detector angle view

COVERED AREA: up to 700km<sup>2</sup>

WORKING TEMPERATURE: -20° up to 60°

INSTALLATION LOCALIZATION: preferably the lowest possible above the tree crowns

SYSTEM WEIGHT: tower: 30kg control: 40kg

MAXIMUM REQUIRED ENERGY: 24VAC, 100W

COMMUNICATION: any system that allows IP with 300kbps up to 30km

EXTERNAL OBSERVED NORM: IP65

WARRANTY: 2 YEARS

REQUIRED MAINTENANCE: easily replaceable composition by modules, easy maintenance, scheduled cleaning, 5 year estimated lifetime of the system.

INTEGRATION: with GIS technology.



High Reliability

Small Number of False Alarms



## SUMMARY

Portugal, as well as many others, is one of the countries especially afflicted by forest fires and the recent years have borne witness to this situation. The country's edafoclimatic conditions make fire fighting and, most importantly, early fire detection difficult. The new forest fire fighting philosophies include a speedy intervention during the initial stage of the fire and demand less material and human resources. Notwithstanding the advantage of such measures, fire detection is still done in a non-systematic way, through direct visual analysis, which means that for an effective control of each forest acre it would be necessary hundreds of watchers, working 24h a day. Ideally, a warning system should be automatic, autonomous, fast and capable of indicating the precise spot where the combustion began.



The FOREST FIRE FINDER is the only system in the world that allows forest fire identification in less than 5 minutes after the fire has begun.

NGNS Ingenious Solutions Lda is a Portuguese company that develops forest fire detection systems. Its associates, Pedro Vieira and João Matos, have collaborated intensively with Universidade Nova de Lisboa with the aim of presenting a new technology of high reliability and easy implementation.

The culmination of this collaboration happened with the registration of the patents that originated the system now presented by NGNS: the FOREST FIRE FINDER (FFF). With the capacity to detect fires at their initial stage and with a range of action up to 15km FFF is a true revolution in the arduous task of keeping our forest resources intact.

**How fast is the Forest Fire Finder?** Each complete rotation of the FFF Detection System lasts approximately 11 minutes. With two FFF systems working out of phase, 5 minutes is the maximum period between fire ignition and its detection. This is the time lapse that the FFF systems require for a positive and precise identification not only of the fire position (coordinates), but also the production of images of the fire and the collection of atmospheric data, thus providing, valuable reference points for the ground teams, and the weather conditions for an accurate adaptation of the forest fire fighting techniques.

**How does this system work?** The following chapters will explain with further detail the method principle and the multiple communication and portability capacities that FFF presents, which will certainly change the way we face and control this problem in the future.

## DESCRIPTION

### PRACTICAL SUMMARY

The FOREST FIRE FINDER system, developed by NGNS Ingenious Solutions, Lda, monitors and detects forest fires up to a distance of 15km and plays an important role in decision support.

### WORKING PRINCIPLE

The FFF working principle is based on a chemical analysis of the atmosphere by an optical spectrometry system. This means that the system analyzes the atmosphere chemical composition up to a distance of 15km and generates a spectro (graphic) that represents the analyzed chemical composition. This way the system is able to decide, in a completely autonomous way, whether there are grounds to send a fire alert.

### SPECTROMETRY WITH REMOTE DETECTION



In the event of alert, the FFF provides additional information, such as the precise location of the fire, detection photograph and atmospheric data.

### FIRE DETECTION



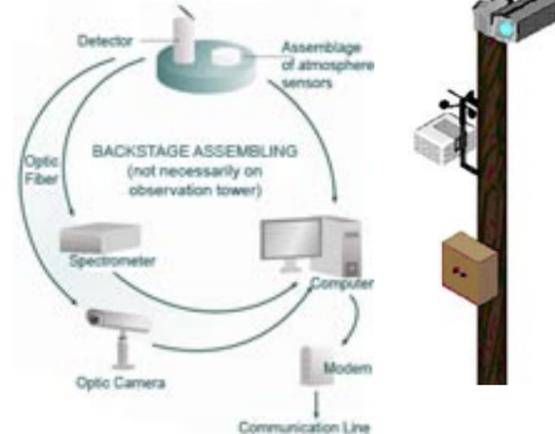
### DEVICE COMPOSITION

The device consists of a scanning unit holding an optical camera and a wide-range optical system. This unit is characterized by its capacity to do a 360° horizontal scan and -45° up to 90° vertical scan. It also includes temperature, humidity, wind direction and speed, atmospheric pressure and rainfall atmospheric sensors.

The FFF should be placed slightly above the tree crowns to allow the fastest detection possible. This way it is possible to detect a fire a few minutes after it has begun. Once the smoke comes up above the tree crowns the FFF will detect it.

The scanning unit is connected to a control unit consisting of a WatchDog (an intelligent control and monitoring system that verifies constantly if the system is working and sends out an immediate alert in case of breakdown or anomaly); spectrometer (observed optical signal analyzer), a computer (signal processing and alarm supplier), atmospheric data control system, communication system and energy control and maintenance system. This whole unit should be placed up to 30m from the observation unit.

### OBSERVATION TOWER



### ELECTRICAL SUPPLY

The FFF requires only 12V with 100W which can be obtained from the electrical grid or from alternative energy (windy, solar or others).

### COMMUNICATION

All information generated by the FFF is supplied via IP protocol. This means that it can be used in a vast array of data transmission systems. All that is necessary is a system that transmits via IP and has a minimum baud rate of 300kbps, such as Wireless, GSM, 3G, ADSL, Satellite, Radio (microwave), etc.



## WORKING MODEL

### FFF CONTROL SYSTEM COMPOSITION

The FFF control and decision support system works on a WEB platform and consists of one WEB server that controls user permissions, accesses and working status of units on the ground. According to the installation dimension it can be made up of regional servers that receive information from a limited number of sensors and will make it available to end-users. The communication between the towers and these servers should occur in a private network circuit (VPN radio) or through public internet network (less advisable).

The system users have access to the information through the internet on a website created for that purpose that can work in local servers and have, through this, objective access to the towers in the regions where they are located.

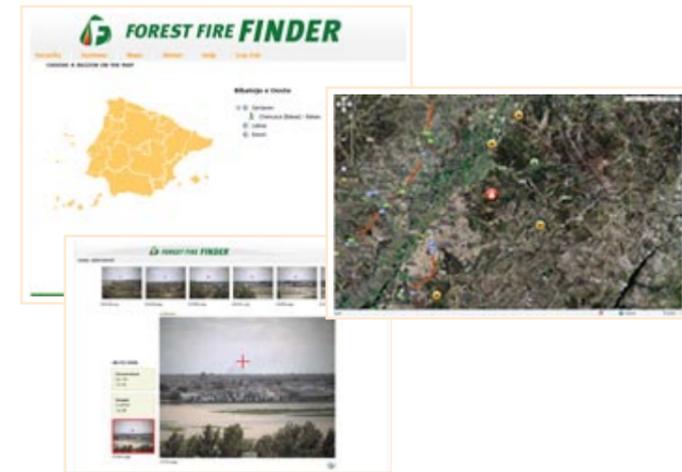
There is also the possibility of having mobile units that can be placed inside vehicles or personal portable mobile units (such as PDAs with GSM/GPRS and GPS) that receive localization information and fire images, as well as the fire local atmospheric information. The mobile unit should have GPS, allowing visual location of its current position in the FFF Control System and the best route to the fire spot.

### PORTABLE UNIT



### HOW IT WORKS

The detection system can work 24h a day and rotate according to specific programming and follow the ground surface so that the horizon (sky) is always on its background.



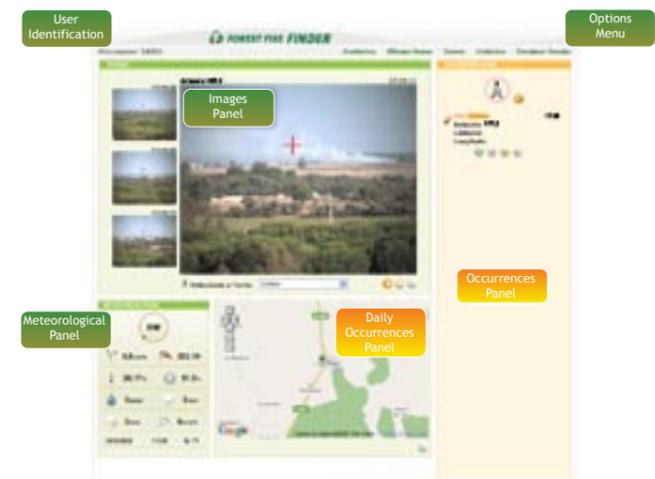
The digital camera will take pictures during the scan and make the available to be transmitted, or not, according to the user's wish. If the pictures are sent to the WEB servers, the required communication bandwidth will have to be larger than that necessary if only alerts are sent. However, these pictures are very important to verify and to follow the event.

The system can work in two modes: manual and automatic.

### Automatic mode:

When smoke is detected an alert is sent immediately through SMS to one or several pre-selected mobile units; this alert says that a fire has been detected and gives its localization. This is accomplished by triangulation, when two FFF units detect the same fire. After this, the system may send through GPRS the image captured at the moment the fire was detected to the same mobile unit(s) so that the user can have a better notion of the emergency of the situation.

### USER INTERFACE IN CONTROL BASE



### Manual mode:

When a fire is detected the control system that is connected to the WEB server issues an alarm (visual and sound). It will wait until the user verifies, through the screen, if there is in fact a fire and what is its general position. Once the other tower detects the same fire, a triangulation is done and the user receives the precise fire localization. The user decides to whom the alerts should be sent and continues to follow up the development of the fire.