Environment (including Climate change)

FIRESENSE Project
Protection of Cultural Heritage

The FIRESENSE Project - www.firesense.eu

FIRESENSE (Fire Detection and Management through a Multi-Sensor Network for the Protection of Cultural Heritage Areas from the Risk of Fire and Extreme Weather Conditions, FP7-ENV-2009-1–244088-FIRESENSE) is a Specific Targeted Research Project (STReP) of the European Union's 7th Framework Programme Environment (including Climate Change). The project started on December 1, 2009, and will last 36 months.

The Goal

FIRESENSE aims to develop an automatic early warning system to remotely monitor areas of archaeological and cultural interest from the risk of fire and extreme weather conditions. Since these areas have been treasured and tended for very long periods of time, they are usually surrounded by old and valuable vegetation or situated close to forest regions, which exposes them to an increased risk of fire. Additionally, extreme weather conditions (such as storms and floods) pose great risks for these sites.

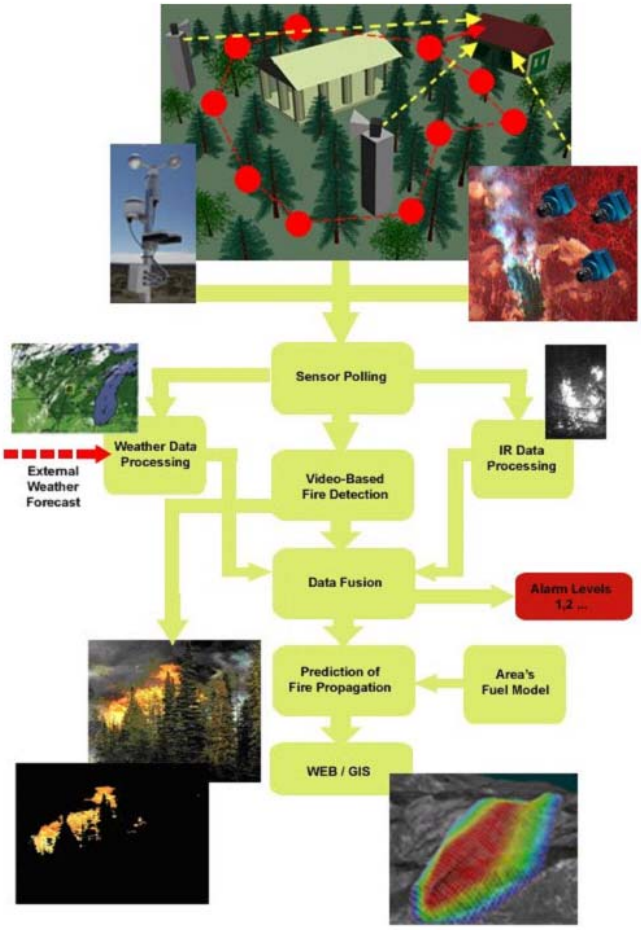
Methodology

The FIRESENSE system will be based on an integrated approach that uses innovative systems for early warning. Its main purpose will be to **remotely monitor areas of archaeological interest from the risk of fire**, while simultaneously **providing weather data** that can be used for efficient protection and preservation of cultural heritage assets. It will take advantage of recent advances in **multisensor surveillance technologies**. The key idea is to place a **Wireless Sensor Network** (WSN), capable of monitoring temperature, and **optical and infrared cameras** on the deployment site. The signals collected from these sensors will be transmitted to a monitoring center, which will employ intelligent computer vision and pattern recognition algorithms as well as data fusion techniques to automatically analyze sensor information. The system will be capable of generating **automatic warning signals** for local authorities whenever a dangerous situation arises.

In a typical application scenario, **multimodal wireless sensors** are deployed at the site, which will be monitored. The sensors will acquire periodic measurements from the environment (e.g. ambient temperature, humidity) and provide their readings through the network to the monitoring centre. **Optical cameras** will monitor not only the site itself, but also the surrounding forested land. The collected measurements from multimodal sensors will be fused in the monitoring centre for evidence or indications of fire in the monitored environment. In addition to periodic sensor measurements, events requiring attention can be triggered by activity, **smoke or heat detection sensors**. In the case of fire detection, the system will create an alert message for the fire fighting management. Moreover, the system will receive **weather data** from official weather information services e.g. TSMS as well as from

local meteorological station installed at the demostration site and will create alerts in case of extreme weather conditions.

Detecting the starting position of a wildfire is only the first step in fire fighting. After detecting a wildfire, the main focus should be the **estimation of the propagation direction and speed**, in order to help the forest fire management. If the vegetation model and other important parameters like wind speed, slope, and aspect of the ground surface are available, the propagation of the fire can be estimated. Finally, a **Geographic Information System** (GIS) will visualize the predicted fire propagation in 3D, providing services for decision and operational support in forest fire suppression.



Impact

Natural hazards do not respect national boundaries; therefore, coordinated and collaborative research is required at the European level to reduce the uncertainty, the unpredictability and the consequences of natural hazards. Since the loss of a cultural heritage site is irreversible, there is great significance in integrating the technological components required for the protection of these sites. More specifically, the FIRESENSE system will:

- contribute to the protection of cultural heritage; the basic asset on which tourism is built. Tourism, closely related to Cultural Heritage, is at the moment the main industry in the world, with an increasing ratio of 12 % of the GDP (gross domestic product) P.I.B. (Produit Intérieur Brut). This sector

employs 8 million people in Europe and accounts for nearly 5,5 % of European GDP.

- protect forested areas of extreme cultural importance, which constitute a significant portion of historical heritage in many European countries.
- have a positive contribution to environmental issues, as the forest fires are significant causes of air pollution, harmful carbon emissions, biodiversity loss through elimination of animal and plant species and water supply problems.
- reduce losses for natural hazards and prevent man-made hazards (forest arsons) from happening.
- contribute to better forest fire management.

The FIRESENSE project aims to develop a powerful ***cost-efficient*** approach that can be used for the protection of cultural heritage providing:

- ***High reliability:*** The system utilizes different sensing technologies (CCTV cameras, PTZ, IR, temperature sensors).
- ***Early detection of fire:*** Automatic detection of flame/smoke/rise in temperature.
- ***Forest fire management:*** The system provides real-time information about fire's extent/location through WSN, while it also estimates and visualizes its propagation based on the area's fuel model, the local weather conditions and ground morphology.
- ***Early warning for extreme weather conditions***: Local weather stations will provide useful sensor readings like temperature, wind direction and speed, relative humidity, barometric pressure, rain gauge etc. Short-term and long-term weather forecasting will be made available to the system as well, which makes it straightforward to use it as an early warning system for extreme conditions.

Pilot Sites

Demonstrator deployments will be operated in selected sites in:

- Thebes, Boeotia , Greece
- Rhodiapolis, Antalya, Turkey
- Dodge Hall, Bogazici University, Istanbul, Turkey
- Temple of Water, Djebel Zaghouan, Tunisia
- Monteferrato-Galceti Park, Prato, Italy

CONSORTIUM

Centre for Research and Technology Hellas - Informatics and Telematics Institute – Greece
http://www.iti.gr

Bilkent Universitesi - Turkey
http://www.ee.bilkent.edu.tr/
http://www.cs.bilkent.edu.tr/

Ecole Supérieure des Communications - Tunisia
http://www.supcom.mincom.tn/

XenICs nv - Belgium
http://www.xenics.com/

Stichting Centrum voor Wiskunde en Informatica - Netherlands
http://www.cwi.nl/

Marac Electronics S.A - Greece
http://www.marac.gr/

Bogazici Universitesi - Turkey
http://www.cmpe.boun.edu.tr/

Hellenic Ministry Of Culture, IX Ephorate for Prehistoric and Classical Antiquities - Greece
http://www.yppo.gr/

Titan Building Systems Technology, Industry And Trade Limited Company - Turkey
http://www.titanbt.com/

Consiglio Nazionale delle Ricerche - Italy
http://www.irpi.cnr.it/,
http://www.issia.ba.cnr.it/,
http://www.isti.cnr.it/

Contact:

Nikos Grammalidis (Coordinator)
Centre for Research and Technology Hellas (CERTH)
Informatics and Telematics Institute (ITI)
1st Km Thermi-Panorama Road, 57001 (PO Box 60361)
Thermi-Thessaloniki, Greece
Tel: +30-2310-464160 (int. 112)
e-mail: ngramm@iti.gr