WORKSHOP DESCRIPTION (ABSTRACT, OBJECTIVES ETC)

WORKSHOP PROPOSERS ARE COLLABORATING IN FP-7 PROJECT 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 project addresses the Topic "ENV.2009.3.2.1.2 *Technologies for protecting cultural heritage assets from risks and damages resulting from extreme events, especially in the case of fires and storms*" of the FP7 Environment (including Climate Change) call and is partially funded by Directorate General "Research", Directorate I "Environment".

THE OBJECTIVE WILL BE TO DISSEMINATE THE RESEARCH CARRIED OUT AS A PART OF FIRESENSE AND INVITE OTHER RESEARCHERS WORKING IN THIS FIELD.

LIST OF SPEAKERS

1. Speaker's Name: Ibrahim Korpeoglu, Alper Ulucinar

Affiliation: Bilkent University

Presentation Title: QoS Lessons from a WSN Fire Experiment

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Abstract:

Detecting fires and monitoring fire progress using wireless sensor networks is a promising approach, but there is not much WSN experiments done using real fires using real sensor nodes. As part of the EU 7th Framework project 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), we have performed a fire experiment with a WSN deployed nearby a real and controlled fire, collecting temperature data. The primary goal of the experiment was to observe the network and application behavior of the WSN in a real world setting, rather than analyzing the temperature data collected, so that the experience gained from these observations can be incorporated into the WSN protocol and application design. During the experiment all messages originating from the MICA2 motes were labeled and time-stamped for further analysis of various QoS metrics. In this paper, we detail the experimental setting together with the WSN application used for collecting data. We also present our results for the observed phenomena and for the various QoS metrics such as packet loss ratio and timely delivered packet ratio. We conclude our work with a discussion on the design of our SOS (Sensor Observation Service) implementation which is based on 52North's SOS software. The experiment data is exposed via this SOS service hosted on our servers and Pachube, and is available on-line for researchers worldwide.

Keywords: Wireless Sensor Network, Firesense, MICA2, Sensor Observation Service, QoS

2. Speaker's Name: Sinan Isik , Cem Ersoy

Affiliation: Boğaziçi University

Presentation Title: Evaluation of Fire Detection Performance of a Wireless Sensor Network

Email:

Abstract:

Bogazici and CERTH teams have started a collaborative work to investigate the performance of a WSN using the proposed routing algorithms in a fire environment via OPNET simulations. For this purpose, we generated a temperature map to be fed into OPNET simulations. CERTH team has already implemented a fire simulator module (FIRESENSE EFP module) that extends the fireLib library. We suggested a temperature field model to be used in calculating expected temperature increase at a given distance from the fire. CERTH integrated the model into the FIRESENSE EFP module to provide temperatures at sensor locations after each iteration of fire propagation. The temperature information at each sensor location at given timesteps are used to estimate a continuous-time temperature increase sensed by each sensor.

We integrate the fire simulator with our OPNET simulations as follows: Initially, we generate a WSN topology (area dimensions, sensor locations and grid size) and feed it to the FIRESENSE EFP module. The EFP module outputs the temperature changes at each sensor location and the grids on fire. Our simulator uses temperature information for data generation. The temperature map information is reported periodically, whereas event triggered data such as video is generated if temperature is above a threshold. Our simulator uses grid information to determine the destroyed nodes which affects the routing decisions and accessibility to sinks.

Using this simulator we aim to evaluate and compare the effect of different network parameters on the fire detection performance of a WSN. The performance metrics used in the evaluation phase are: (a) latency, (b) reliability, (c) energy expenditure and (d) spread monitoring accuracy, which is the accuracy of fire information received by sinks with respect to the actual fire spread. The network parameters affecting the performance of WSN in our simulations include: (a) number of sensors and sinks, (b) sensing and communication ranges of a sensor, (c) routing algorithms and parameters, (d) duty cycle of MAC protocol, (e) sleep schedule for density control, (f) reporting rate, (g) area and grid size, etc.

3. Speaker's Name: A. Enis Cetin, Kivanc Kose, Ihsan Inac, Osman Gunay

Affiliation: Bilkent University

Presentation Title: 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**

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Abstract:

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.

FIRESENSE will take advantage of recent advances in **multi-sensor surveillance technologies**, using a **wireless sensor network** capable of monitoring different modalities (e.g. temperature) and optical and infrared cameras, as well as local weather stations 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. It will be capable of generating automatic warning signals for local authorities whenever a dangerous situation arises.

Detecting the starting position of a fire 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 forest fire management. FIRESENSE will provide real-time information about the evolution of fire using wireless sensor network data. Furthermore, it will estimate the **propagation of the fire** based on the fuel model of the area and other important parameters such as wind speed, slope, and aspect of the ground surface. Finally, a 3-D Geographic Information System (GIS) environment will provide visualisation of the predicted fire propagation.

Demonstrator deployments will be operated in Rhodiapolis, Antalya, Turkey, **Kabeirion, Thebes, Boeotia, Greece, Temple of Water, Tunisia, and Monteferrato-Galceti Park, Prato, Italy.**

In this talk, we will present the system in Rhodiapolis in Antalya.