

# SCIER: FIRE DETECTION IN THE URBAN RURAL INTERFACE

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## 1. Introduction

The SCIER (Sensor & Computing Infrastructure for Environmental Risks) project designs, develops, and demonstrates an integrated system of sensors, networking and computing infrastructure for detecting, monitoring and predicting natural hazards (fires, etc.) at the Urban-Rural-Interface (URI). The overall goal of the SCIER system is to make the neglected URI zone safer against any type of natural hazards or accidents using wireless sensor network technologies, fusion techniques to assess dangerous situations, and predictive models to estimate the evolution of the hazardous phenomena. The fusion techniques used in SCIER are implemented in a special component of the SCIER system: the Local Alerting Control Unit (LACU). LACU controls a Wireless Sensor Network (WSN) and is responsible for the early detection of potential fires, the fire location estimation and the subsequent alerting functions. For the detection phase, sensor readings are evaluated and probabilities are assigned on each situation. If the probability of fire event exceeds a predetermined threshold, the system shifts to fire location estimation phase. In this phase the centre of the fire outbreak and the radius of the fire spread are determined.

## 2. System Architecture

The SCIER system constitutes an integrated platform of sensors and computing infrastructure capable of delivering valuable real time information regarding natural hazards at the “Urban-Rural-Interface”. As an environmental hazard approaches, or has occurred in the URI region, SCIER will provide the capabilities of both monitoring and predicting its evolution. Sensors spread in the region will monitor environmental parameters (e.g., temperature) and feed with already fused data the predictive models in the computing infrastructure. SCIER system is composed by three entities: the Sensing Subsystem, the Computing Subsystem and the Localized Alerting

Subsystem.

## 2.1 Sensing Subsystem

In URI two kind of sensors are deployed: Citizen Owned Sensors (COS), installed by land/home owners in fixed and registered locations in private areas, and Publicly Owned Sensors (POS), installed by state authorities in fixed and known locations in public areas. In SCIER system the use of vision sensor, temperature and humidity sensor and air direction/speed sensors is adopted. The sensor nodes communication unit is composed of a micro-controller and a radio communication unit. The micro-controller is needed in order to control the radio communication (implementation of the communication protocols, transmission energy consumption management), to control the sensor data acquisition and, possibly, to perform some degree of data aggregation.

## 2.2 Hardware

Sensor nodes are based on the MSP430 micro-controller and the Chipcon CC1100 radio, which operates at 868 and 902 MHz. The two components communicate through an SPI serial port. The nodes are battery-powered. Their size and shape are similar to the WiseNet nodes. The network is made of nodes and a gateway. The nodes and the gateway use WiseMAC as the communication protocol. Vision sensor is based on a low-resolution high-dynamic range contrast camera. It provides a very stable representation of the scene under uncontrolled illumination conditions. The contrast representation of a scene can be used to elaborate a robust representation of the moving objects covered by the FOV. Various algorithms are used to segment connected areas where motion activity is detected, and follow such representation over the time to find out trajectories and behaviors leading to discrimination between human beings and animals. The node is based on a processor having abilities in micro-controlling as well as DSP. The elected model is the Blackfin 533 running at 500MHz.

## 3. System deployment and demo overview

The town of Stamata is located 25 km north of Athens. It is one the most northern suburbs of Athens, neighbouring to Mount Penteli. The small town is fully constructed, to the extent that homes are separated with a distinctive line from the forestry front. Hence, Stamata is a clearly categorized as an "URI town". The SCIER system has been deployed in Stamata in the summer of 2008. During the demonstration of SCIER system will be presented real-time data from the test site. The system consists of 21 temperature and humidity wireless sensors covering an area of about 20 hectares, two vision sensors pointing to the same area and one sensor measuring wind speed and wind direction. Moreover the alerting function (through SMS) of LACU will be demonstrated.

## 4. Acknowledgments

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