

Chapter 27

Visual Sensor Networks: Critical Infrastructure Protection

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ABSTRACT

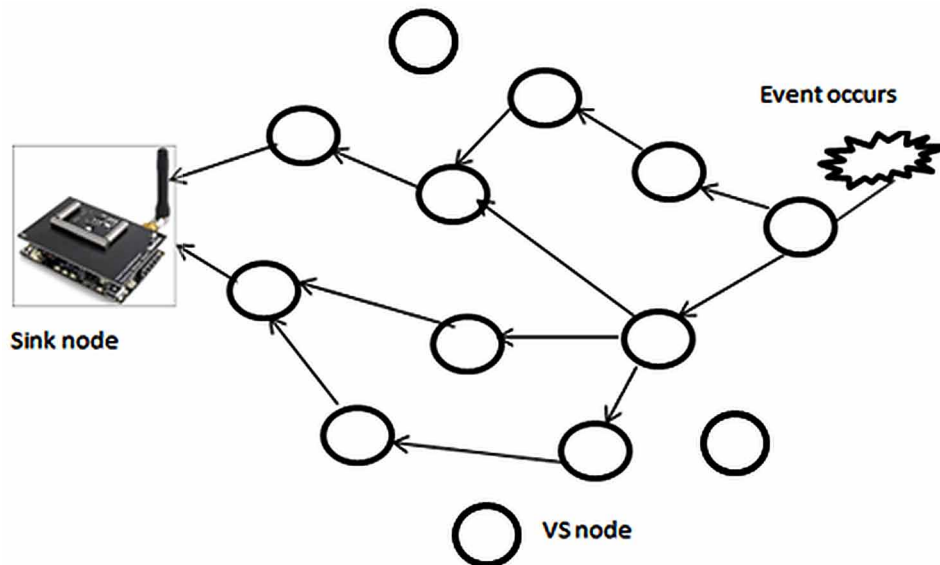
Visual Sensor Network (VSN) is a network of distributed battery-powered low-cost cameras and CMOS image sensors, each with the capability of capturing, processing, sending, and receiving images. VSN applications include remote monitoring, Security, elderly assistance, Visual Ubiquity, home monitoring, tracking. The highly sensitive nature of images makes security and privacy in VSNs even more important than in most other sensor and data networks. However, the direct use of security techniques developed for scalar WSN will not be suitable for VSN due to its resource constraint. Hence light weight security mechanisms need to be explored. In this chapter the challenging security issues at various layers in VSN are addressed. It also fosters discussion on privacy protection techniques like subjective privacy, Video masking techniques and identifies recent trends in VSN security and privacy. A discussion of open research issues concludes this chapter.

INTRODUCTION

The modern advancements in CMOS technology and micro electro mechanical systems, the traditional scalar Wireless Sensor Network (WSN) equipped with low cost digital cameras, fostered it to sense and transmit the visual data and conceived as Visual Sensor Network (VSN). The camera attached sensor nodes are called as VS node, and each such node has the ability to capture, manipulate and transmit image data to the base station or sink node using intermediate forwarding nodes in multi hop fashion. Usually the sink node will act as aggregator, it is more powerful and it will act as a gateway. The schematic architecture of VSN can be as shown in Figure 1. A sensor node defined as an embedded system with one or more sensors, micro controller, transceiver and a battery unit capable of sensing, processing and transmitting. Figure 2 shows the architecture of sensor node or mote.

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Figure 1. Visual Sensor Network



The VSN differs from their predecessor scalar wireless sensor networks basically in two aspects. They are type and volume of pixel data being captured and transmitted. The inherent resource constraint nature of WSN in computation, memory, bandwidth and energy makes the visual sensor network designs more challenging for image transmission.

VSN APPLICATIONS

In Visual Sensor Network the VS nodes are arrayed in places where they can be used to monitor environmental conditions by cooperating and communicate with each other over the wireless communication channels.

Visual Sensor Networks will enrich the existing sensor network applications such as tracking, environmental monitoring, industrial control and smart home systems. Yet quite a lot of new commercial applications are emerging out (Hemant, Subhas, Xiang & Nagender (2015), (Bambang & Song, 2010). Figure 3 shows some of the applications of VSN. They are:

- **Visual Surveillance:** Low cost image sensors will be used to enhance and complement existing mission critical systems against criminality and terrorism like surveillance systems. The scalable visually equipped sensor network can extend the ability to support law prosecution activities to monitor zones, communal events, private stuffs, and hard to access areas like borders, high mountains.
- **Traffic Monitoring and Control:** The cheaper, easily organisable VSNs when deployed to monitor and regulate the vehicular traffic over the civilian structures such as highways, bridges. The image data or video streams along high level image processing system, the traffic COPS can enforce the rules and law of civilian bodies.

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