Chapter 23
A Shape-Based Object Identification Scheme in Wireless Multimedia Sensor Networks

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Abstract. Multimedia communication is highly attractive in Wireless Multimedia Sensor Networks (WMSN) due to their wealth of information's. However, the transmission of multimedia information such as image and video requires a specific scheme and an efficient communication protocol. In fact, the performances of multimedia based applications on WMSN are highly dependent on the capabilities of the designer to provide low-power data processing and energy-aware communication protocols. This chapter presents a contribution to the design of low complexity scheme for object identification using Wireless Multimedia Sensor Networks. The main idea behind the design of this scheme is to avoid useless multimedia data streaming on the network. In depth, it ensures the detection of the specific event (target) before sending image to notify the end user. The chapter discusses the capabilities of the proposed scheme to identify a target and to achieve low-power processing at the source mote while unloading the network. The power consumption and the time processing of this scheme were estimated for MICA2 and MICAZ motes and showed that it outperforms other methods for communication in WMSN such as the methods based on image compression.

23.1 Introduction

Recently, research in the area of WSN is more focusing on the idea of enhancing the capabilities of the WSN to provide the end user with useful information's gathered in a smart scheme instead of simply sending all the measurements to report

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about a single event occurrence or information of interest. This idea becomes with big interest when talking about multimedia communication over Wireless Sensor Networks. In fact, a Wireless Multimedia Sensor Network (WMSN) is built using wireless sensor nodes that integrates multimedia devices such as image and audio sensors enabling to retrieve video or audio data streams. The use of these sensors provides the application with rich visual verification, in-depth awareness of the real scene and recognition with a lot of others interesting capabilities. As the multimedia applications are characterized of the production of relatively huge data streams, the power consumption appears as the major challenge to face when deploying the WSN for the transmission of multimedia information's. Since the power consumption is proportional to the number of bits to be transmitted that represents the multimedia information, then, as a first reflection, reducing this amount of data will help to reduce the power consumption. However, most of the research works concerning image compression in WMSN have noticed that classical compression methods for video and image are not suitable to be processed within weak hardware capabilities characterizing the wireless sensor nodes [11, 15].

From another approach, to minimize the amount of images transmitted through the WMSN, it will be recommended to first check if the captured image contains interesting information's about phenomena that interests the end user. Then, sending the minimum of bytes that represents the detected object or the physical phenomena will contribute to achieve low power consumption.
The efficiency of this method depends on the scheme used to extract the useful information from the video stream at the source node and its capabilities to detect the occurrence of a specific event. So, while this idea looks very attractive to keep a strategic balance between the local processing resources of the mote and power saving, we think that more focus is still required to design an efficient scheme that will be implemented in the multimedia sensor.

The main contribution of this chapter is to specify a low-complexity scheme to detect and to identify an object based on image processing and to notify it to the end user.

In the remaining part of the chapter we will first present the specified scheme for object detection and identification. Then we will discuss its performances to identify the target and it's invariance for different parameters. The end part of the chapter, will address the performances of this scheme when implemented on MICA2 and MICAZ motes.

23.2 Related Works and Motivation

WMSN(s) were deployed for remote object detection. Some research contributions were developed to detect a new object in the background of the video scene then to remotely notify that to the end user. The image of the detected object may be then transmitted through the network when demanded by the application. Shin-Chih Tu et al. In [1] presented a new scheme to detect change in the background of a video scene using WMSN. They have based their approach on the detection