UBISENSE – UBIQUITOUS IR SENSING AND BEHAVIOUR PROFILING FOR THE CARE OF ELDERLY AND CHRONICALLY-ILL PATIENTS

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ABSTRACT

The UbiSense project aims to establish smart sensing networks for homecare monitoring based on low cost embedded video hardware for capturing abnormalities related gait and posture changes. To address the issue of privacy, the UbiSense system is designed to convert the captured images at the device level into blobs, which only encapsulate the shape outline and motion vectors of the subject. This avoids the use of appearance information for motion tracking and activity recognition. This demonstration will outline the concept of "from blob to personal metrics to behaviour profiling", and illustrate the latest hardware platform and software implementation of the UbiSense design.

1.0 UbiSense System

The UbiSense project aims to provide an unobtrusive health monitoring system for the elderly. It differs from existing approaches by using embedded smart vision techniques to detect changes in posture, gait and activities. One of the major challenges of vision-based systems is the apparent intrusion of privacy due to the way that image data is transmitted and analyzed. To circumvent this problem, the captured images in UbiSense are immediately reduced at the device level into blobs, as shown in Fig. 1. Visual images are not stored or transmitted at any stage of the process so that it is impossible to reconstruct the abstract information back into an image showing the visual appearance of the subject.



Fig. 1. (a) The original video image, (b) the background subtracted image, and (c) the extracted blob.

To analyze the activity of the subject, the position, gait, posture and movement of the blobs in the image sequences are tracked, and this subject-specific information is called "*personal metrics*". These personal met-

rics can be transmitted between sensors so that complex behaviour profiling can be performed by utilizing resources of other UbiSense nodes in the network. Fig. 2 illustrates a simulated house set up with a network of UbiSense system. Considering the fact that behaviour profiling involves a set of highly demanding computational tasks that typically require expensive hardware and sophisticated setup procedure, the UbiSense project investigates the use of a networked low cost embedded smart video sensors to provide complex behaviour profiling functions based on resource scavenging, dynamic clustering and self-configurations.



Fig. 2. A schematic diagram of UbiSense in a home environment

2.0 UbiSense Node

A prototype UbiSense node is designed with an embedded smart camera VCSBC50 (a DSP camera), a wireless link provided by an integrated BSN node, and a battery, as shown in Fig.3. The BSN node is a miniaturized (26mm) generic wireless sensing platform for context aware sensing environments. With its compact design (10x7x6cm), the UbiSense node can be installed easily by the user.



Fig. 3. A prototype UbiSense node.