ZigBee Wireless Applications and Unobtrusive Home Monitoring

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Home Telecare

Advances in communication technologies over recent years have provided the foundation for remotely supervised home-based physiological monitoring – a system commonly referred to as home telecare. Due to the limitations of public health care services and in order to adapt to the ageing population, there is a growing trend away from institutionalised health care and towards the adoption of the remote patient monitoring paradigm, which has the potential to alleviate much of the stress on government health care expenditure.

System Overview

In affiliation with the efforts of the Biomedical System Laboratory at UNSW to build a complete telecare system, this thesis project involved the development of an unobtrusive home monitoring system which detects the motion and tracks the location of occupants for the purpose of correlating this activity with their general health status. In the same way we display our emotions via our facial expression, our system is able to indicate the occupant’s health condition via their activity around the home. Specifically, passive infrared (PIR) sensors are strategically placed around the home, and their output processed by a microcontroller before the relevant data is wirelessly transmitted to a local computer for storage and evaluation, as displayed by the system diagram:

Design and Implementation

Hardware

The ZigBee Protocol

The emergence of ZigBee (specified in the IEEE 802.15.4 standard) and its promise of a low data rate, low power consuming alternative to other wireless communication protocols and their associated hardware is a motivating factor for this thesis. With portability and ultra-low power consumption as guiding requirements, ZigBee-compliant transceiver modules were incorporated into the system design.

Alternative Applications

Security Systems – Units may be easily interfaced to an alarm speaker, and configured to sound when the security system is enabled and motion is detected.

Smart Homes and Office Automation – A myriad of devices, including smoke detectors, child monitors and thermometers, could be interfaced to our sensor units such that occupants receive an automatic notification upon detection of unusual events.

Industrial Monitoring and Control – Continuous monitoring of critical equipment; Centralised control and management of heating, cooling and lighting and many other environmental parameters; Optimisation of natural resource consumption via embedded intelligence.

Home Installation Trial

A home trial was conducted in order to ascertain the efficacy of the system in linking occupant activity with their health condition. In view of the statistical data extracted from the motion sensor records, positive results were found, demonstrating their ability to be used as a basis for developing a profile of occupant health status.