

The NOCTURNAL Ambient Assisted Living System

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Abstract—We describe the NOCTURNAL system which provides Ambient Assisted Living with a focus on night-time support. This paper explains the design principles, the technological infrastructure and the software intelligence which facilitates autonomous assistance in the form of therapeutic interventions.

Keywords—Ambient Assisted Living, night-time care, therapeutic interventions, sensing, multi-agent systems.

I. INTRODUCTION

The provision of Pervasive Healthcare is attracting significant attention from a wide range of healthcare organizations. This interest is focused by demographics, the impact of demographics on healthcare economics and a desire from people to preserve their independence for longer. However, most of the contributions reported in the technical literature focus on the most active period of the day encompassing the hours of daylight. Our project, NOCTURNAL (Night Optimised Care Technology for UseRs Needing Assisted Lifestyles), is predicated on evidence from the research literature that the night period has specific characteristics which require separate analysis and technological solutions [1]. This paper explains the technological infrastructure of NOCTURNAL, as well as the design and development principles used on the deployment of this solution.

II. SYSTEM DESIGN

The NOCTURNAL system is designed to address areas of concern for the service provider as collected from their clients. These areas of concern for night care are diverse but at these initial stages of service development we are focusing on the detection of restlessness, bed occupancy and wandering and their associated therapeutic interventions. Restlessness during sleep is the first situation of concern, followed by the client leaving their bed and then moving around inside their residence, or even outside it (see Figure 1).

The strategy is to consider monitoring in levels of increasing importance the further away from bed in distance and time. Therapeutic interventions are triggered in the same order.

III. IMPLEMENTATION

The system technological infrastructure is based on X10 technology which provides easy deployment at an affordable price for more people. We use pressure mats in bed, PIR

sensors and lighting control. These allow us to monitor restlessness in bed and bed occupancy, movement in different rooms of the house and light control. This basic sensing and actuation platform is supplemented by a more versatile interface implemented on a tablet PC (see Figure 2). The technological infrastructure described above provides a flexible, yet affordable, sensing/actuation platform [2].

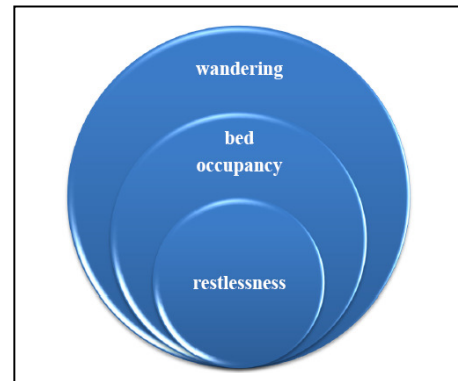


Figure 1. The strict containment of areas indicate the hierarchical relationship between situations of concern. The intervention strategy reflects this relationship.



Figure 2. A tablet PC is used to provide soothing images and music and to interact with the clients delivering therapeutical interventions when situations of restlessness, bed occupancy and wandering are detected.

At the core of the system there is a multi-agent system which monitors the environment trying to detect any of the following situations: restlessness, bed occupancy and wandering). The system has a dedicated agent monitoring each of those

