Telecare Usage Scenarios Explored Using a Dolls' House

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Abstract

This paper proposes the use of an instrumented dolls' house as a means of modeling plausible and reasonable home data about older people for use in promoting the development of telecare systems.

Author Keywords

Home, Methods, Older People

ACM Classification Keywords

H.5.2. User Interfaces: Theory and Methods

General Terms

Human Factors.

Introduction

Care is a dialogue between a patient/client and carers [5]. This dialogue depends on information about the condition causing the need for care. Currently most information is gathered in consultations, generally taking place in formal settings such as health centres or hospitals, between a patient/client and a formal carer. Life however happens outside these institutions, centred on the home. As telecare becomes more pervasive, the dialogue can be enhanced with rich data about the effect that treatments and therapies are having on the life, and quality of life, of people with chronic conditions, disabilities, or the impact of ageing

on older people. This is a sensitive topic, however, as telecare changes the home from being a private space to also being a care space and changes the way that care is delivered. One approach being explored by various research teams and commercial technology providers is to model the lives of domestic residents as they live in their home, with the aim of detecting change in the behaviour patterns that could be correlated to changes in well-being. Such information would then be used to inform residents and carers about what is happening in the lives of residents and help support the dialogue (the "dialogue of care") between residents and carers [3,4].

The proliferation of data should be used to enhance the quality of care. Not only will the data about the condition be richer, the data about how the treatment is affecting the condition will also be richer and the data showing how the condition is affecting the quality of life of the person will be available for the various care stakeholders. In many ways this is new data compared with traditional institutional care models and should allow new forms of care and new care strategies to emerge, including the prediction of care needs based on changes in home behaviour [1].

Position Statement

The development of algorithms for understanding and acting upon information within home data is challenging however, because:

- Home data is typically "dirty" and has data missing

- It is easy to make assumptions about what the data might mean but less easy to be confident that such assumptions are valid

- Home behaviour is modified by unexpected events, causing modulation of cycles in the underlying home data

- Comprehensive (large sample) real home data is difficult and expensive to collect so there is typically insufficient data for research and system development, particularly in the development of algorithms that attempt to attribute meaning to the home behaviour as represented in the home data.

Addressing the Position Statement

The proposed solution is to work with care stakeholders with expertise in the way that changes in home life affect quality of life, to build a database of simulated data into which real life modulations, anomalies and errors can be introduced in order to evaluate the suitability of various data mining algorithms to reveal information about the well-being of the home dweller.

A dolls' house has been built as a sensored space that mirrors a plausible telecare-equipped dwelling. A variety of sensors have been installed to detect:

- Movement of dolls around the dwelling and through the doors

- Occupancy of seats in the sitting room

- Occupancy of the beds and use of the wardrobes and cupboards in the bedrooms

- The use of various appliances in the kitchen and the storage spaces in the kitchen

- Interaction with various bathroom fittings
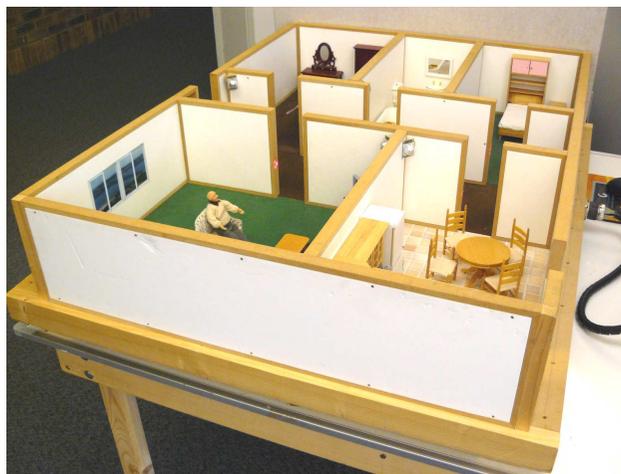
Figure 1. The Dolls' House. There is no roof on the house so that people can interact directly with items in the house, e.g. to open or close cupboard doors or move dolls around within the house.

The sensors allow various normal activities and behaviours in the house to be enacted and modeled, including behaviours associated with sleeping, eating, personal hygiene and relaxation. Together with professional carers with extensive experience in the care of older people, various scenarios (e.g. getting up and starting the day, leaving the house, having lunch) have been constructed. Each scenario has been broken down into elemental behaviours which can then be enacted using the dolls as representing the appropriate home dwellers. When a doll is active in the house its behaviour is detected by the sensors and recorded into a database.

Once the data have been recorded further discussions take place with the various care professionals and other stakeholders [2] who can advise on aspects such as:

- The degree to which the behaviour represents sub-groups of older people within the general population of older people

- How representative it is of people with a particular chronic condition and how it would change as the condition changed

- How the behaviour would vary naturally in the life of an older person and the nature of that variance

- How the behaviour would vary over a population of older people, particularly the variance across a population that shared the same essential characteristics, including chronic conditions, if any.

The advice given by the care professionals would be incorporated into a data randomising algorithm. This would then be used to generate additional "days" of data for the older home dweller and also to generate simulated populations of similar home dwellers. The additional days could then be tuned to include the effects of events such as preparing for or recovering from vacations, hospital visits, visitors or the effects of changes in health or well-being, as well as appropriate proportions of "good" or "bad" days. The populations would include appropriate variance in behaviours to reflect the specific chronic condition or well-being aspect being explored.

Having collected data from a dwelling, analysis needs to be performed in order to distil the health and well-being information from the data. Questions to be asked could explore whether it is possible to:

- determine if a person is displaying symptoms of a condition for which they are at risk (predictive) or if they are continuing to persist in a particular home behaviour (historical)

- decide when to propose a particular care intervention in preference to another

- anticipate how events and seasonal changes will affect the lives of older people in their homes

- organise elemental activities (e.g. passing through a doorway, getting up from a chair) into more complete activities (going to bed, preparing food, etc.)

- learn that certain behaviours or sensor firings tend to occur before a significant event (e.g. onset of illness), or after an event (e.g. funeral, visit by family)

- recognise a sequence of elemental actions, even if they are surrounded by other events, such as preparing food, being in a place where food is eaten, and eventually visiting the bathroom

- focus on the behaviour of a particularly vulnerable person within a multi-occupant household

- guess at the meaning of home behaviours when clear rules or patterns are not available.

Business Intelligence tools such as in the form of OLAP (OnLine Analytical Processing) cubes have been seen to be valuable in giving insights into the information obtained from dwellings. They can also act as powerful vehicles for organising and segmenting home data into a form that can be more usefully data mined.

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