

The Delivery of Effective Integrated Community Care with the Aid of Agents

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Abstract. The INCA (Intelligent Community Support for the Elderly) architecture is based on the integration of a number of autonomous systems; home monitoring, community alarms, care management systems and emergency systems command and control systems using agent technology to build effective co-ordinated care systems.

It is possible, by taking an agent-based approach to allow each of the agencies involved in community care to communicate effectively so that they can co-ordinate care provision by the use of wrappers. In this way, users can use the exiting services, with which they are fully familiar, effectively and are able to take full advantage of the full range of communication facilities without compromising privacy and confidentiality.

1 Introduction

This paper shows that current research into distributed knowledge sharing and intelligent agents [4] can be used to provide a much higher level of support and care than is currently practical. Recent work by the present authors[1] has shown that with proper management of the various conversation classes to provide effective and secure communication with the various support agencies.

Currently individual care providers use their own database, workflow and command and control systems with little or no integration between them. This causes difficulties, not only in the provision of the most effective response to emergencies, but also in the provision of routine care as the older person's requirements change, often quite rapidly.

The move is towards franchising of different aspects of care delivery with the responsible agency preparing a detailed specification, in the form of an Individual Care Plan. It then places contracts to actually deliver the various components of the care, as appropriate. This means that here is now no single agency with the overall authority to manage and monitor the provision of community care.

2 Approach

The provision of care inevitably requires a considerable degree of co-operative activity between individuals and agencies. Each actor is likely to have to interface with a number of different systems and organizational structures, each of which will have its own concept base (or Ontology) [3].

3 The Problem Area Addressed

While community care covers a wide range of activities:

1. The development and updating of an Individual Care Plan developed to meet an assessment of the needs of the individual.
2. The provision of routine care as specified by the Individual Care Plan
3. Emergency support in response to an accident or medical emergency

A number of organisations and individuals play a part in these activities and the interactions between them can then be shown in the form of Use Case diagrams.

3.1 Developing an Individual Care Plan

Before care can be provided effectively, the care co-ordinator has to assess need, and develop an individual care plan. This can be quite difficult, particularly with the severely disabled or those with dementia.

It is also necessary to contact both formal care providers and informal carers

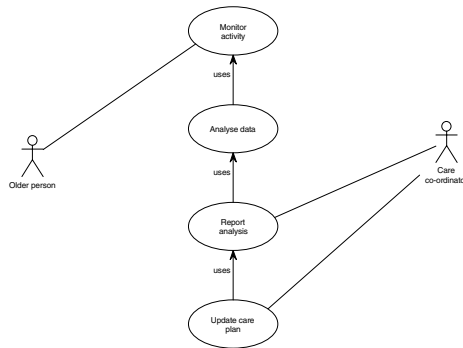


Fig. 1. Individual Care Plan Development Use Case

3.2 Routine Care

The actual delivery of routine care has to be carefully monitored. The objective is to provide the assistance necessary to make up for the disabilities of the individual. The main problem with existing systems is the lack of responsiveness of the services providing it. The INCA system is designed to enhance the responsiveness of the service by:

1. Allowing users to request care directly from care providers and coordinators.
2. Providing users with better information about care schedules.
3. Monitoring very disabled people in order to fit care interventions more closely to their patterns of daily activity.

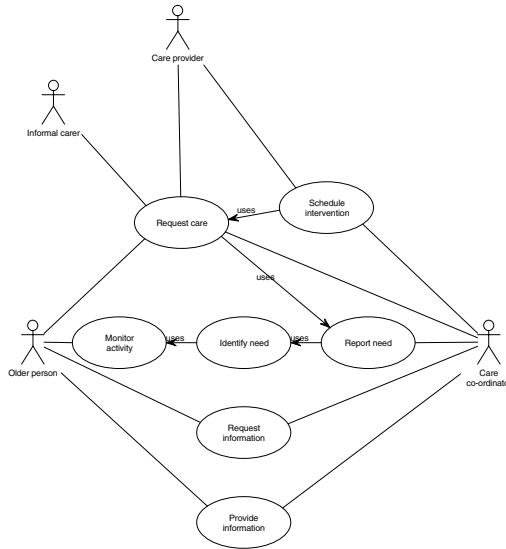


Fig. 2. Routine Care Use Case

3.3 Emergency Support

The case of emergency intervention is rather different. The intention is to provide a proactive alarm system, in addition to the current reactive systems that operate independently of the overall care provision. The primary interface is through the home unit that raises an alert either when some set of environmental conditions

is considered out of range, as defined within the individual care plan, or there has been some direct request for help (such as pressing a 'panic button'). These

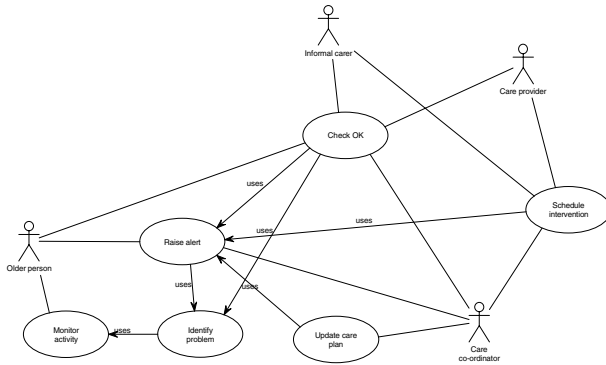


Fig. 3. Emergency Support Use Case

4 The Design of the Conversation Classes

The previous section shows some of the wide range of activities can be supported effectively by the INCA system. Traditional database design techniques have difficulties with this richness, as each scenario contains actors with the same roles performing differently depending on their beliefs and intentions within that scenario. Agent approaches are specifically intended to address these issues.

An alarm condition is raised only when the home unit detects sensor readings outside the normal range. A facilitator is contacted to obtain the address of a suitable service mediator, which is then alerted. This mediator routes the alert to a suitable service provider after adding additional information from the service database. The service provider's mediator determines the appropriate course of action and notifies the necessary carer, possibly via further mediators.

The basic mechanism for the home unit to communicate with service providers is shown diagrammatically in Figure 4. This shows the actions required summoning assistance. The actual service provider summoned depends on a number of factors:

1. The type and severity of the problem
2. The service providers able and willing to respond and the anticipated speed of their response
3. The 'cost' of that response in relation to the perceived need

The first is initially controlled by the guard conditions on the conversation class [2] and is determined by information local to the Home Unit. Decisions based on the service provider’s ability or willingness to respond require much more general knowledge that is available to the mediator, which can negotiate with a number of service providers. If a service provider is able to do so, then the mediator accepts the most appropriate offer, rejecting all others, and informs the Home Unit.

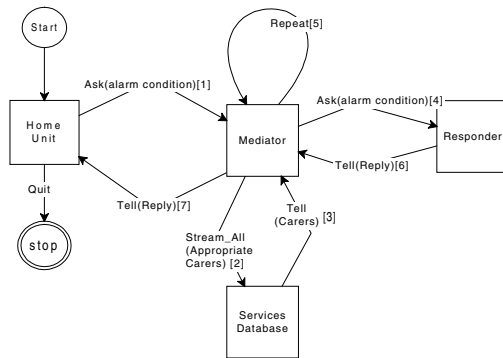


Fig. 4. The Basic Response Conversation Class

5 The Database Perspective

A particular feature of the community care system is that each of the agents involved will typically have its own administrative and scheduling systems that will handle all its activities, not just those using the community care system. It is essential therefore that it interfaces with the existing database systems. This can be done effectively by the provision of Wrappers that map the queries being transmitted within the INCA environment into a form that is understood by the care provider’s own systems.

The design of the mapping functions may well cause considerable difficulties, as the different care providers will have very different perceptions of their roles, expressed in the form of different ontologies. These will have to be mapped onto the much more general INCA ontology that has to cover all aspects of care provision. Considerable success has however been achieved by providing mapping functions only for that information required for both sides to perform their intended functions.

6 Discussion

The scenario to be followed is determined by the guard conditions of the relevant conversation class. Each scenario a different service potentially delivered by different service providers using their own information systems and services. For example, the delivery of community care is probably through the local Social Services Department, possibly contracted out to an independent service provider, whereas the delivery of health care would be through the local family doctor, and possibly health visitors. If each has to rely on only its own information valuable time and resources will inevitably be lost in duplicating actions. Even a minimal level of co-ordination can therefore be extremely valuable. It must however be managed effectively to:

1. Maintain the autonomy of all agencies
2. Maintain the privacy of the older person as far as possible
3. Ensure the security and integrity of the information held
4. Link effectively with others involved.

7 Conclusions

The architecture described in this paper allows for the provision of an extremely flexible care package that can be tailored closely to the changing needs of the older person. This is a considerable advance on current arrangements that tend to be quite inflexible because of the difficulties of effective co-ordination. Needs do change, often very rapidly. It is also not always the case that the level of care necessarily has to increase. Current care provision, particularly in the effective response to emergencies, is limited by the lack of co-ordination between the potential responders. An agent-based architecture provides effective answers to these problems by ensuring that the most appropriate information is always used. In this way, help should be provided speedily and effectively when needed.

References

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