INHABITED INTELLIGENT ENVIRONMENTS GROUP

DISCUSSION DOCUMENT

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Rethinking the intelligent building paradigm.
A discussion document
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Intelligent building research has been vigorously pursued in the Department for over ten years now but without any dramatic breakthrough in the development of building control systems that might qualify as intelligent building according to the general expectations of researchers in the field. This may be a technical problem in that no one has yet invented a mechanism or mechanisms to address the problem adequately or it might be a conceptual problem, no one has yet found the right approach with its attendant algorithms to allow the technical solution to be developed or it might be that the underlying paradigm is intrinsically unfulfillable.

Having participated in research projects in which there were practical failures to achieve anything like a satisfactory result in technical or software terms it seems to me that we need to look again at the overall intentions or aims of this sort of research, at the underlying paradigm that guides the research.

This will need to be separated out from the general category of pervasive or ubiquitous computing since there are many circumstances where multi agent systems can work together to achieve their goals successfully.

What then is the underlying hope, dream, phantasy, goal of intelligent building research? As I understand it, it is that a computer system that may be embedded within your dwelling or workplace as a multi agent system of ubiquitous sub-components, some of which may be intrinsic to the building infrastructure, some of which may have been purchased by the owner/user/occupier, some of which may have been added to this already complex mix in order to add another layer of control, can, in a non-simplistic way, learn from the user(s) and act to satisfy their needs over time and as they change and develop, or modify, according to other circumstances e.g. new people being introduced to the home, new needs arising, new kit added to the mix etc.

A crucial aspect of this systemic response to the wants of the occupying group of persons is that their needs will become known and adapted to and then those needs will be anticipated and the home will independently act to satisfy the needs it believes the people to have based upon their past behaviour.

It is important to distinguish this from a process of automation even though automated processes might be able to deliver many of the benefits assumed to flow from an intelligent building solution.

I think that the first question to ask is, given the amount of work that has been done on this problem, without there being a robust and universally recognised solution to it, whether there is something wrong with the problem as it is currently posed.

Another way of posing this problem give that the system is trying to arrive at its predictions of peoples needs on the basis of their past behaviours is whether any system can predict the next number of a series that is random? If not then the idea that

the intelligent building solution as currently understood will ever be able to be good enough to make accurate predictions as to future needs is flawed. This may not be what is being designed for currently but in my experience this was the underlying hope based upon the idea that the variety of people's behaviours would not be completely intractable and that over a period of time that variety would become well enough known to the system learning from them and thus potentially predictable.

This seems to me to be a major problem in the research paradigm since there is in fact no way in which a spontaneous user could ever be known perfectly enough for the system to make its decisions 100% accurately. Given this you then have the potential cost to the user of having to intervene in the system having been told that it will satisfy your needs. Contrast this with a system where the user is responsible for all of the systems at his/her disposal. Here the user knows that if they want this or that environmental setting they have to set it up themselves. Whether or not there are a variety of ways of increasing sophistication in which user activity is the main input and the system or sets of systems may be tuned to achieve these ends is a different matter. One could imagine a lighting deck, central heating systems, sophisticated multi media systems with manifold options all under the control of the users but many of them operating more or less by themselves once activated. This however wouldn't be within the intelligent building paradigm as it is assumed to operate since predominantly pre-programmed to operate in systematic ways with minimum user intervention but intervention is seen as the norm here. The aim in intelligent building work has been to see user intervention as correction rather than action and this is another aspect of the confusion within the paradigm.

Correction rather than action is the way that the IB paradigm casts user intervention and this is an underlying problem. If the user is in charge of any system and they activate according to their wants this feels like freedom to do what I want, to be in control. If action only takes place to correct system errors then all action becomes correction and sets up the wrong sort of expectations.

In many cases it is argued that the logical terminus for the intelligent building is the space ship or extraterrestrial space station whether free floating in space or located on one of this solar systems planets. But some small consideration of this situation should indicate that what is required in this context is reliable efficient systems that are able to satisfy the bulk of the population in an energy efficient way with a maximum of recycling of the various major components like air and water. This is not a system geared to the whims of individuals so much as the overall needs of a group to survive in extreme conditions for as long as possible with robust and error free systems. There may be variety in the levels of light or the ambient temperature in particular areas but in general it would be much more likely to be a 'one size fits all' solution, which is as efficient and durable as possible. Reliable automation would be what is really required in this context not a system that is working hard to satisfy and micro-manage the needs of everyone aboard so much as providing background reliable ambient conditions for everyone.

None of this means that the development of sophisticated agents or their co-ordination together to achieve collective goals needs to be given up but complex automation should be able to achieve not just a sub optimal intelligent building solution but a much more viable and robust and flexible and energy efficient solution to the problem of ordering our homes to our own needs than a system that is always trying to catch up to our latest needs or out guess those needs itself.

I think that the space station may well be the ideal paradigm environment for the intelligent building paradigm to focus on but like the Starship Enterprise there is little

if anything that exists on that spacecraft that couldn't be achieved with sophisticated forms of automation. Lights that go out when there is no one in the room and come on when someone comes in, knowledge of where people are, efficient use of background heating and air conditioning, efficient recycling of waste water, air etc. these are the fundamental building blocks of an intelligent approach to providing a flexible and intelligent environment it seems to me rather than trying to satisfy the whims of the individual. They can satisfy these themselves in any sufficiently sophisticated automated system with ubiquitous sources of multi media input etc. by their own choices which extend far beyond the IB paradigm – colour, decoration, style, design etc.

This does not therefore exclude the ideas of making systems from separate parts of existing systems and then having individuals control them, it says nothing about the many and various ways in which people may both tailor and use multi media sources for their own ends, these are not the same problem or paradigm as the intelligent building paradigm discussed above.

I suspect that one could learn a lot from the sort of high tech buildings that are being designed and constructed on a daily basis currently, the BMW factory, the Lloyds building, the Gherkin etc etc but that what you would find is that the combination of structure and services and the overall design of the building itself were what constitutes an intelligent building. That the art of making an intelligent building is not to do with the degree to which the individual within that building is being served personally but the high degree of personal service that is offered to all of the buildings occupants.

This notion of services, which has been used, may well be the answer to the problem since the way that we choose and orchestrate the services available to us is personal and idiosyncratic and can make our particular lives unique and satisfying. It does not however require an intelligent agent to guess what we want to do next so much as require a wide variety of different services to be available under user control and to make those services as user friendly and generally useable as possible, some of which might entail intelligent approaches to their design.