The average age of the world population is growing rapidly, while the fastest growing segment of the population is adults over the age of 65. Compounded by this growth is an increase in longevity, escalating instances of age-related diseases such as Alzheimer's and dementia.

Supporting the ability for the elderly or people with disabilities to live at home longer is of both personal and economic benefit to the individual.

We expect that emerging technologies can facilitate this process. Our goal is to build a home, rich in technology, to help people age in place.

Faculty of Computer Science
Dalhousie University
The bathroom will be the center of all health monitoring and diagnostic activity. Integrating new sensing technologies will allow for subtle testing methods, appropriate for use in a home rather than a hospital.

New types of interfaces can be investigated, including the use of the bathroom mirror as the portal to health information as well as a ‘virtual doctor’ that advises on health-related matters.

Our privacy-focused consumer-state database and network protocols ensure that the patient can inform their doctor of ongoing health issues while maintaining privacy.
The focus in the kitchen is on using technology to ensure proper nutrition. Assistance can be provided in every step of food preparation, from grocery reminders and delivery to remote cooking to promoting healthy eating habits.

For able-bodied clients with full mental capacity (e.g. Diabetic or cardiovascular patients), assistance can occur through suggestions for shopping according to Health Canada healthy eating guidelines or interactive support for healthy recipe makeovers for high-fat or high-glucose favorite recipes.

For patients suffering from memory-loss, the smart appliances can prompt action from the client, such as reminders to eat lunch or turn off the stove. For more progressive dementia, remote access to the appliances allows a caregiver to check fridge contents, order groceries, or even cook a meal.
The cornerstone of our bedroom technology is the intelligent bed. Consisting of an array of pressure sensors embedded in a mattress, the bed monitors patient movements and records events such as rolling, sitting up, and falling out of bed. This information is translated via secure network protocols developed in the Faculty of Computer Science to relevant caregivers. The presentation of information is contextually appropriate for each viewer to preserve the privacy and dignity of the patient.

In addition to the intelligent bed, we propose to build and deploy new technologies to assist with relaxation and sleep regulation.
Supporting the ability for the elderly or people with disabilities to live at home longer is of both personal and economic benefit to the individual. Emerging technologies can facilitate this process; however, the drawback is that traditional technologies can be socially isolating, replacing human-human contact with technological solutions. This isolation is compounded for elderly people living alone as their physical ailments make it difficult to meet up with friends and family outside of the home.

The living room will not only be the center of entertainment, but will also be the social interaction and communication hub of the house.

**friend finder:** system senses when friends or family are also available for socialization and encourages social connections

**device bloat:** many devices aim to make interaction easier but are complicated and difficult to use

**chair:** embedded sensors allow for direct and contextual control of all living room devices

chair and friend finder from http://goodgestreet.com/research/ppr.html
Community involvement in the aware home project is essential for the well-being of the client and the success of the project. Community can be broken into different layers.

The first layer is municipal response which includes the hospital, health professionals, and emergency response such as the police and firefighters.

The second layer is community resources which includes recreation centres, grocers, and shopping.

The third layer is social interaction which includes friends and family. Overlap can occur between the layers.
The first layer of access relates to health monitoring and emergency response. Clients will have access to their doctor, clinic, caregiver, and pharmacist. These health professionals will be able to monitor aspects of the client’s health care regimen. Data gathered from the monitoring equipment in the house can be presented at contextually-appropriate levels of granularity to the different health-care professionals.

Municipal emergency response teams, such as firefighters and the police play a significant role in the community. Clients should be able to quickly and easily contact emergency response workers, while monitoring equipment in the house will alert response workers to abnormal and dangerous conditions. Emergency workers can also check in with the client during daily rounds. This familiarization process will create a sense of comfort in case of emergency and may increase the inclination of the client to call when help is required in non-emergency situations. When clients do call for assistance, images of the emergency response worker can be displayed on the client’s television, creating a sense of comfort, familiarity, and trust.
Technological solutions for aging in place have benefits for health and wellness. We believe that we can also use technology to connect people to the resources in their community.

Monitoring equipment within the kitchen can alert local grocers to the need for food delivery. Equipment could also remind clients with memory loss to go to the store to select their food, while lists of essential items are sent to the grocer automatically. We are interested in solutions that respect the client’s autonomy, but assist when memory fails. Restaurants and grocers can also be used to enable healthy eating patterns.

Recreation centres, local libraries, and favorite shops can all be essential enriching components of an individual’s daily life. Connecting clients to programs and people at community centres will be of mutual benefit.
Connecting with family
Communication technologies have been successful at connecting family members near and far. Although many older adults are open to learning and using these new tools, there are still barriers to the adoption of critical communication technologies such as email, IM, and other Internet-based tools. Older adults tend to be parsimonious, selectively using their energy to learn only when the perceived benefit is worthwhile. And for many older adults, the concept of future benefit is not enough, as the potential of reaping the benefits of invested effort decreases with age. We can design interfaces to make this transition seamless and simple, connecting seniors to their children, and grandchildren.

Remote communities
Elderly people aging at home may be connected to a global community through shared experiences. Technology can facilitate this connection, so that shared memories or interests can be honoured. Remote social interaction would be especially beneficial for clients with physical disabilities whose ailments make it hard to meet up with friends outside of the home.

Local communities
Although connecting people who live at a distance is important, so is helping to facilitate local relationships. Monitoring technology in the home can reveal when other friends and acquaintances are available for visiting or other recreational activities.

Social interactions
Friends and family
Communication tools would be especially beneficial for older adults aging in place as feelings of isolation and depression are key problems with some older adults, especially when their physical or mental capacities have been compromised. In addition, feelings of isolation might increase as social circles shrink for older adults. The elderly tend to be selective with their social relationships, focusing their energy mostly on previously established relationships with relatives and close friends.
Dealing with disease can be hard on clients and their families. The home is a place where dignity must be preserved.

**integration**

Items in the home can be built in a lab, but must be integrated in a home. The separate components are important contributions, yet the integration of all of the elements is essential to making this project a reality. With integration, our aware home becomes more than a research environment, it becomes a prototype for the home of the future.

**dignity**

Dealing with disease can be hard on clients and their families. The home is a place where dignity must be preserved.

**connection**

Our solutions aim to connect people. We want our clients to be connected to their doctors, caregivers, family, and friends.

**privacy**

Our unique peer-to-peer network protocol ensure privacy and security in the transfer of data from the home to the caregivers and doctors. Our commitment to making the technology invisible to the user makes our solutions home-appropriate and inviting. Nobody wants to live in a hospital, we want to ensure that their home doesn’t feel like one.
A high-profile research initiative, like our proposed aware home, has the ability to engage the general public, invite media coverage, inspire collaborative partnerships, and attract top researchers to Dalhousie. In addition, University commitment to our initiative will enable our industry partners to provide significant financial sponsorship.

**high-profile research**
There are only a few active research homes in the world. The aware home will be a high-profile project, attracting top researchers to the school and inviting extensive media coverage.

**industrial sponsorship**
Our innovative initiative has peaked the interest of industry sponsors such as the Royal Bank of Canada, Business Objects and IBM. Several companies have already pledged financial support.

**patents**
With three patents already underway, the aware home initiative has promising patent potential.

**community impact**
Universities have a responsibility to generate impact beyond their academic walls. The aware home has the potential to engage the general public, initiating interest in Dalhousie University.

**faculty collaboration**
Research on the aware home project is a multidisciplinary effort. Collaborative partnerships between multiple faculties leverages existing domain specific knowledge and inspires innovation. Collaboration with world-renowned academic institutions such as Yale University, Stanford University, and the University of Cambridge will raise the global profile of research at Dalhousie University.
collaborative partners

The Faculty of Computer Science will be collaborating with top institutions around the world on the aware home project. The home itself will reside in Halifax while research on the networking, data storage, and data access will be conducted by our collaborative partners who are world leaders in their domain. This project has the capability of bringing research conducted by computing pioneers to Dalhousie University.

university partners
In addition to the partners from phase one of the project, we have added a number of new university partners for phase two: the home. They include:
- Yale University, USA
- Stanford University, USA
- New York University, USA
- University of Cambridge, GB
- University of Trento
- Technion, Israel
- University of Victoria, Canada
- University of Toronto, Canada

hospital partners
Collaboration with doctors, nurses, and health professionals will occur at:
- QEII Health Sciences Centre, Halifax
- Baycrest Hospital, Toronto

For more information, please contact:

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government partners
Commitment has been provided or expressed by:
- PRECARN, Canada
- NSERC, Canada
- CIHR, Canada

industrial partners
Several business in related industries have already expressed interest in supporting our research. Of those, many have already committed to financial support. They include:
- Business Objects, Canada
- IBM CAS, Canada
- Royal Bank of Canada
- Bell Canada,
- Semantic, Canada
- CA, USA