Interactive Elderly Care for Patients with Dementia - A Virtual Assistant
Abstract
Dementia is a progressive cognitive disorder, as a result of which, those affected gradually lose the ability to carry out normal, everyday tasks. As the proportion of global population with the age 65 and above continue to grow, especially from the developed nations the number of people with dementia is set to soar over the next few decades that lead to crisis in the dementia care. At the same time, the use of digital and wireless technology such as smartphones, tablets, digital video monitors and other wearable monitors are exploding. Can technology help the elders with dementia? The present and the past studies with the assistive technology showed evidence that the older adults with cognitive decline or dementia could live independently longer with the help of modern technology. A number of products such as sensors, remainders, interactive videos and cameras and alert devices are proven to be safe for patients with dementia and caregivers. In addition sensory therapy application like Forest Project and animal therapy like PARO Therapeutic Robot designed to improve Quality Of Life (QOL) for the people with dementia to escape from their monotonous daily living space.

Though the modern technology is proven to be working well for the people with dementia and the caregivers, many devices and the multiple sensory therapy providers exist independently. These sensors, devices and the therapeutic providers are extremely costly that adds burden to the families and the people suffering from dementia. The aim of this research project is to provide a cost effective personalized care that integrates the modern devices and continuously studies every dementia patients individually to offer safety and quality of life. In addition this care solution aids patients’ independent living and lowers family and caregivers stress.

Robots and interactive computers would aid an impaired senior to complete simple tasks. Monitoring systems would send an alarm to relatives if the person fell, skipped medication, or was otherwise in difficulty. Interactive computer games and online communities tailored to people with dementia would provide cognitive and social stimulation that might slow decline. The interactive sensory therapy solution through interactive videography takes the patients from their monotonous living space to enchanted space that stimulates viscerally. A Smart System at home integrates all these devices and continuously monitors the patients. By reviewing the daily activities of the dementia patient from the Smart System in resident of dementia patient and incorporating societal and healthcare needs a Centralized Technology Integrated Care Center learns the patients and assists with care solution and medications. A futuristic view of Assistive Technology development and use is presented.
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INTRODUCTION: FACTS ABOUT DEMENTIA

The human brain has been called the most complex object in the known universe, and in many ways it's the final frontier of science. A hundred billion neurons, close to a quadrillion connections between them, and we don't even fully understand a single cell. The brain is a deviously complex biological computing device that even the fastest supercomputers in the world fail to emulate. Markus Diesmann and Abigail Morrison succeeded in creating an artificial neural network of 1.73 billion nerve cells connected by 10.4 trillion synapses (1). While impressive, this is only a fraction of the neurons every human brain contains. Scientists believe that every human brain contains 80-100 billion nerve cells, or about as many stars as there are in the Milky Way. It took 40 minutes with the combined muscle of 82,944 processors in K computer to get just 1 second of biological brain processing time (1). While running, the simulation ate up about 1PB of system memory as each synapse was modeled individually.

Dementia is a progressive brain disorder that damages and eventually destroys brain cells, leading to memory loss and changes in thinking and other brain functions. It usually develops slowly and gradually gets worse as brain function declines and brain cells eventually wither and die. It is a syndrome, usually of a chronic caused by a variety of brain illnesses that affect memory, thinking, behavior and ability to perform everyday
activities. Although dementia mainly affects older people, it is not a normal part of ageing.

Dementia usually occurs in older age. It is rare in people under age 60. The risk of dementia increases as a person gets older. Most types of dementia are nonreversible (degenerative). Nonreversible means the changes in the brain that are causing the dementia cannot be stopped or turned back. Alzheimer disease is the most common type of dementia.
PART I: AGEING POPULATION

Population ageing is a global phenomenon. With increases in life expectancy and reductions in fertility, countries in Europe and North America were the first to have a significant proportion of their population aged 65 and over. These populations are continuing to age, but those in Latin America and countries such as India and China are ageing much more rapidly and catching up fast. While nearly two-thirds of the world’s older people now live in low or middle income countries, this figure will rise to four-fifths by 2050.

Population ageing is an undeniable fact for humanity. However, for those who live into older age are accompanied by a higher risk of dementia. Such older people are more frail and likely to experience increasing needs for care without intervention. The global share of older people (aged 65 years or over) increased from 9.2 per cent in 1990 to 11.7 per cent in 2013 and will continue to grow as a proportion of the world population, reaching 21.1 per cent by 2050. Globally, the number of older persons (aged 65 years or over) is expected to more than double, from 841 million people in 2013 to more than 2 billion in 2050.

1. Global Cases Dementia in 2050

The total number of new cases of dementia each year worldwide is nearly 7.7 million, implying 1 new case every 4 seconds. The number of people with dementia is expected to increase from 36 million now to 75.6 million in 2030 and 135.5 million in 2050 are mainly due to population ageing with an increase of 277% (2)
The high cost of the dementia will challenge health systems to deal with the predicted future increase of cases. The costs are estimated at US$ 604 billion per year at present and are set to increase even more quickly than the prevalence. Caring for dementia patients is overwhelming for caregivers. The stresses include physical, emotional and economic pressures. Caregivers require support from the health, social, financial and legal systems.

1.1 Dementia Care
A fundamental challenge is how we will deliver Quality Care and Quality Of Life (QOL) to today’s and tomorrow’s dementia population while reducing healthcare costs that already burden their family finances. The principal goals for dementia care are:

• Diagnosing cases early
• Optimizing physical health, cognition, activity and well-being
• Detecting and treating behavioral and psychological symptoms
• Providing information and long-term support to caregivers.

1.2 Dementia Caregiver Challenges
People with dementia are frequently denied the basic rights and freedoms available to others. For example, physical and chemical restraints are used extensively in aged-care facilities and acute-care settings. Improving the awareness and understanding of dementia across all levels of society is needed to decrease discrimination and to improve the quality of life for people with dementia and their caregivers. There is a need to develop new and more effective technology assisted treatments and to better understand the causes of dementia for individual cases, that identifies the modifiable risk factors of individual dementia patient and provide a personalized care.

Dementia is a public health priority and therefore we have to address this important health priority and to

• Promote a dementia friendly society
• Make dementia a public health and social care priority everywhere;
• Improve attitudes to, and understanding of, dementia
• Invest in health and social systems to improve care and services for people with dementia and their caregivers.

The number of people with dementia is rising dramatically with increased longevity. While the core dementia symptom is cognitive deterioration, agitation (inappropriate verbal, vocal or motor activity) is common, persistent and distressing. Its impact can be devastating for people with dementia, their families, and paid care givers, and is associated with distress, deteriorating relationships and nursing home admission. Drug treatments, for example antipsychotics or benzodiazepines, have undesirable effects and modest benefits in agitation, and agitation is often difficult to manage. The 2010 National Institute for Health and Care Excellence (NICE) dementia guidelines recommend non-pharmacological interventions, including aromatherapy, music therapy and dance therapy (3). Since then, there have been a large number of studies by many non-profit organizations and evidence for non-pharmacological treatment specific for neuropsychiatric symptoms, particularly agitation. Effective management may improve
quality of life, reduce inappropriate medication use, delay institutionalization and be cost-effective.

2. Need for Technology Assisted Dementia Care
People with mild to moderate dementia enjoy a variety of activities both on their own and with their families. Concerns included getting lost, a loss of confidence with usual activities, and caregiver anxiety. Existing technologies (sensors and mobile devices) are used as a start-up. However, the future devices should be integrated easily into their daily routines. The role of technology to facilitate independent living for people with dementia is not fully realized.

*The new technology assisted care must address the important health priority, safety and quality of life. The aim of this study is to create acceptable service that effectively integrates devices and technologies to facilitate independence for people with dementia through a user-centered design process involving them and help their caregivers.*

Bringing together the cross-discipline development by integrating the semiconductor device manufacturer (4), software and hardware experts, device engineers, gerontologists, social scientists, medical experts, and clinicians to explore how to gather information and communicate through technological devices might help dementia patients and caregivers. Small-scale, evidence-based pilot as a start will promote a shift from hospital focused or “mainframe healthcare” paradigms to home-based or “personal health” paradigms. Once these pilots are proven in few locations and few dementia cases, it can easily be expanded in many parts of the world, to focus on dementia patient’s safety and quality of life.

Current advances in connectivity, sensor technology, computing power and the development of complex algorithms for processing health-related data are paving the way for the delivery of innovative long-term health care services in the future. Given the demographics of our aging population, there is a critical need for such innovations. Recent technological developments, including medication reminder systems, wearable devices for safety, home safety, implanted heart monitors, and other home health care systems, will assist the elderly and infirm to live independently, at home, for much longer periods. Along with the technological advances come valid privacy and security questions arising from the fact that the data collected and transmitted through these technologies could also include individual monitoring as well as unauthorized access to critical diagnostic and other health data. In the wrong hands, this information could lead to serious personal consequences for those whose data has been compromised and legal penalties for those responsible.

Interventions for individuals with the dementias include a variety of approaches. Cognitive training and therapy focus on remembering information, assisting memory recall, and finding one’s way. Interventions that involve reminiscence use the person’s imagination and memories to involve them in activities that may provide a range of benefits. Exercise interventions and music therapy use specific therapies to maintain health, both physical and cognitive, and to address behaviors that caregivers find
potentially difficult to deal with. Interventions involving technology represent another avenue, one that may be particularly helpful where direct human assistance and involvement may be more difficult, such as for persons living alone or in remote geographic areas. There are also interventions that focus on specific sensory dimensions such as aroma and touch. Finally, support groups provide a variety of potential benefits to persons with dementias. Many interventions combine several approaches.

- Cognitive Training and Therapy
- Reminiscence/Life Review
- Exercise and Movement Interventions
- Music Therapy
- Interventions Involving Technology
- Sensory Interventions
- Multi-Dimensional Interventions
- Support Groups

Technology, modern digital communications and sensors have the potential to move dementia patient care to a more proactive, family-centric model of care, capable of providing personalized care that improves the cost, quality, and accessibility of health care services.

Home-based dementia care is particularly promising application of health technology (5). Many remote home health care systems allow individuals to personalize and customize devices, with the goal of enabling greater patient freedom, reducing costs, and improving the ability for patients to be able to follow the wellness and treatment plans created for them by their medical practitioners. As such, the home is becoming a locus for health care innovation that may, in the future, compete with the hospital. Technology systems that encourage long term care patients (e.g. seniors and those with chronic illnesses) to maintain their physical fitness, nutrition, social activity, and cognitive engagement, so they may function independently in their own homes, for as long as possible, can help to address the social and financial burdens of an aging population.

Technological systems can also reduce the risk of harm by detecting whether patients are properly following their course of treatment, and by providing communication channels between patients and their care givers and loved ones. Informal caregiving networks, such as family and friends, need options available to them to be able to check in on long term care patients and the infirm, both to increase communication and to respond to emergency situations. Professional caregivers also need access to remote, real-time diagnostic data through home-based technologies that help them conduct remote checkups on their patients, and to potentially detect a number of troubling trends. Remote home health care technologies can help to achieve those goals.
PART II TECHNOLOGY ASSISTED DEMENTIA CARE

1. Caregivers

Many interventions are directed at improving the life of caregivers. Many of these approaches use more than one technique and have more than one objective. As a result, in most cases assigning an intervention to a category is a difficult process. Some focus more on education, while others focus more on psychological counseling, and others are in the form of support groups. Some interventions use technology to provide these services, training, and therapies to caregivers. Finally, the primary purpose of some technologies is to monitor the care receiver. These sets of caregiver interventions are in the following categories:

- Caregiver Education
- Caregiver Counseling
- Support Groups
- Caregiver Interventions Involving Technology
- Caregiver Monitoring of Care Receiver

The authors (PG, AN, SP and UK) reviewed the abstracts of the several sources and excluded duplicate citations as well as assistive devices or sensors that did not have direct implications for one or more functional impairments associated with dementia (memory loss, executive dysfunction, aphasia, agnosia, apraxia, visuospatial impairment, behavioral, activity, and mood disturbances). Thus focuses on intelligent cognitive aids, physiological sensors, simple and multimodal environmental sensors and advanced integrated systems that may have particular relevance for dementia care.

Modern computing, consumer electronics, and telecommunications technologies have the potential to improve the quality of life for both dementia patients and their caregivers. They also hold the promise of creating innovative approaches for detecting the disease and its progression.

Virtual reality (VR) technology can be used to measure visuospatial ability, and may be both less burdensome and more probative than traditional two-dimensional (2D) pen and pencil tests. Virtual reality can be used in two classic paradigms that assess visual-spatial memory. First, the classic shape-comparison test, in which one mentally rotates images of test shapes to determine which one matches a standard shape, can be performed through VR technology which allows the participant to “see” the objects in three dimensions (3D) and physically manipulate them.

Second, the Morris water maze, a commonly used test of spatial learning and memory for animal models of dementia, can also be performed in 3Dspace (6, 7). These tests can be performed with relatively inexpensive VR machines that use special eyeglasses called shutter glasses that rapidly and alternately occlude the eyes. Virtual reality tests, in both 2D and 3D, are currently under evaluation to see if they can detect dementia symptoms earlier than traditional pencil and paper tests, and if they can predict how well persons with dementia can orient themselves in their environment. Similarly, music technologies may offer valuable diagnostic information because they probe neuropsychological markers for the episodic domains shown to be sensitive to early detection of cognitive
decline (8), while offering unique opportunities for community-wide use. Music was shown to arouse individuals in late-stage dementia who were otherwise not very responsive (9). Hyperscore, a computer application that allows people with no musical education to compose their own music, has spurred people suffering from dementia to overcome physical limitations and start using fine motor control to interact with the interface (10). New music tools are being developed to move neuropsychological testing into the auditory domain, where melodies are being used to probe associative memory and thereby help distinguish early AD from other diseases such as semantic dementia or depression.

2. Home Safety for Dementia Patients
Specialized preparations and technological advances can enhance dementia patients’ mobility and safety in the home environment. Adapting the home to best address the needs and safety of an older adult presents a major challenge. There’s a wealth of information and resources available and easily accessible. But flexibility holds the key to success. Regardless of calculations and preparations, dementia patients’ needs will change. Buying expensive, high-tech gadgets to assist individuals with daily tasks may not always be the best option.

It’s essential to look at the home in a brand new light. What hazards exist that could be easily removed? What environmental features should be introduced to foster independence while maintaining safety? And perhaps the most difficult question: Where does one begin? The following are five key areas that will be affected as the disease progresses:

i. Judgment: for example, forgetting how to use household appliances
ii. Sense of time and place: getting lost on one’s own street or being unable to recognize or find areas in the home
iii. Behavior: becoming easily confused, suspicious, or fearful
iv. Physical ability: experiencing difficulty with balance or depending on a walker or wheelchair to get around
v. Senses: for example, experiencing changes in vision, hearing, sensitivity to temperature, or depth perception.

There are new technologies to improve safety and security. For example, electronic tagging for checking the safety of people with dementia is used in some facilities as an option to locked doors and medication for people who want to leave. Other technologies include hidden switches and control lockouts, electric strikes and reed switches on outside doors giving people freedom of movement without staff supervision.

Sensors are another safety-related technology. They can detect extreme temperatures: the device, useful in the kitchen, sends a warning signal if the temperature is very low, very high, or there is a rapid rise in temperature. Scalding baths: a temperature-regulated plug replaces the standard bath plug, changing color from blue to bright pink at high temperatures.

- gas: if gas is accidentally left on, the device shuts it off and raises an alarm
- falls: sensors worn on wrists can detect the impact of a person falling
• absences from bed or chair: the device alerts staff if a person gets up from their bed or chair and does not return for an unusual period of time
• night-time disturbances: a pressure mat sensor is put by the bed and activates an alarm when a person gets up during the night.

Passive infra-red systems, giving ‘notification by exception’, are another innovation. While costly, they are cost effective over time. Activated in the evening, they check movement in the bedroom and bathroom. Sensors respond to unusual behavior, such as agitated movement or a person staying too long, for example in the bathroom. They alert staff via a vibrating pager. Infra-red sensors are supported by a computer system that can be tailored to people’s needs.

Technologies successful in domestic settings are
• automatic lighting control
• stove-top monitors and automatic shut-offs
• automatic taps that turn off if users forget
• time-orientation support
• place and time reminder, a device giving verbal reminders to a person with dementia as they approach a door, for example, ‘It is still night-time. I should go back to bed’
• bed use sensors.

When including working or activity kitchens in a facility, think about induction cook-tops. Induction cook-tops use a magnetic field to heat saucepans that then heat pan
contents and the cook-top stays quite cool. Because they are not directly heated, cooking surfaces cool more quickly. There are no open flames or fumes produced with induction cooking. If a unit is on and there is a pot, the surface is cool to touch.

Mobility aids are a form of assistive technology. They need careful thought about individual appropriateness. There are many different walkers, wheelchairs, handrails and walking sticks to meet different needs.

Smart toilets have technology that can check blood pressure, heart rate and sugar in urine. Information is gathered and sent to a GP or other health professional. An optional feature has verbal prompts and speech recognition. Smart toilets can be tailored to meet personal needs.

Another new technology in smart toilet design involves an altered seat fitted to an existing toilet. It cleans and dries sensitive body areas with a warm spray of water and warm airflow, both with adjustable temperatures. This is done through two self-cleaning nozzles. The heated seat can be preset as desired.

An assessment of this toilet showed it lessened staff and resident stress, mental and physical, around toileting and reduced bacterial growth in urine. Smart toilets have weaknesses needing further improvement, but they can greatly help toileting care.

Other innovations relating to continence include:
- a plastic ring put under the toilet seat, raising it up 10 cm to help transfer on and off the toilet
- personal sensor and radio transmitters alerting staff to an incontinence episode and storing information on a central computer
- biofeedback machines that move pelvic muscles to help bladder control.

3. Technologies for Tracking Dementia Patients

Wireless audiovisual networks and pocket personal computer (PC) technology can be used both to monitor people’s activity over time, and to look for behavioral changes that might be indicative of dementia or show progression of disease. These monitoring systems can be combined with simple magnetic switches on appliances and pressure pad switches on furniture to get a picture of the types of activity that people engage in during their daily routines. Such systems offer many advantages to people suffering from the disease and to caregivers. When those affected by dementia are living alone, the systems can provide caregivers and family members with the peace of mind that comes from knowing there is a system in place to monitor their loved one (11). In an institutional or nursing-home setting, these systems can also provide valuable backup, since they operate 24 hours a day, 7 days a week.

In nursing homes, where professional caregivers are often overworked or may be unfamiliar with the medical history of their charges, monitoring system shave the potential to identify anomalous behavior that might otherwise be missed. Families and facilities will have the option of choosing monitoring technologies that vary along a
continuum of intrusiveness. For example, once installed and activated, in-home sensors will monitor movement, room use, and device use. This tends to be intrusive, although the opportunity to turn off the sensors may be available. Data entry devices such as iPad will only accumulate and transmit information that a caregiver has entered, thus falling on the nonintrusive end of the continuum (12).

Feasibility studies indicate that monitoring systems are very beneficial. For example, in a small pilot trial conducted on eight adults over 10 days in a nursing home, video camera technology found three episodes of aggressive behavior that had been missed by staff members, and six attempts to wander outside the building that had gone unnoticed.

A substantial amount of information may be collected from these systems. Basic individual welfare can be ascertained. Medication status can determine if persons being monitored are taking their prescription medications at the appropriate times and correct dosages. The system can potentially recognize a problem indicative of dementia, e.g., repeatedly opening and closing a refrigerator door, or some other activity that would not be expected of cognitively normal individuals. Disease monitoring could also warn if behavior is indicative of disease progression. For example, more frequent aggressive symptoms may signal a significant change in health status. This type of monitoring can be fine-tuned to both gradual and dramatic behavioral changes. These systems can be used to detect household maintenance such as running faucets and showers, to detect blocked or overflowing toilets, and to monitor household appliances. Systems and technologies have the potential to detect behaviors and events that warn of global safety...
issues and dangerous risks. For example, doors left open, backed-up toilets, or stove burners left operating may all pose a significant risk. Actual reports of falls, wandering, and other behaviors through interactive systems provide similar safety alarms.
PART III: PROPOSAL FOR INTEGRATED PERSONALIZED CARE USING TECHNOLOGY

1. A Technology Integrated Personalized Care Solution

However, potential problems exist with these systems. One of the major difficulties with this type of technology is mapping, i.e., it can be difficult to pinpoint the precise location of the participant. With video-based systems, this can be overcome by using multiple cameras to build a 3D picture of the living space. With radiofrequency-based systems, which are not very accurate at measuring distances, one can focus on the shape of participants in their environment rather than on their exact location. This allows the identification of frequently occupied locations within the “trajectory shape,” which can then be calibrated to exact locations by comparing reported activity (e.g., watching television, sleeping, or eating in the kitchen) with the position of a participant in the trajectory map at that time.

Several other technical difficulties with electronic monitoring exist, including signal interference, technology incompatibility, and data-review limitations. Signal interference from a variety of household electronics and radiofrequency transmitters can be troublesome for monitoring systems. Appliances such as microwaves, household heating and cooling sensors, wireless phones, and wireless computer networks cause problems and can result in false alarms. This problem is likely to become worse as more appliances and applications become wireless. For radiofrequency-based systems, the selection of a frequency band that is interference-free is important. In the case of systems that rely on off-the-shelf software and hardware updates from manufacturers can often be detrimental.
because they may introduce incompatibilities or new interference patterns. Dedicated systems such as the iPad apps or smart phone apps use custom-written software with automatic updating. With video monitoring systems, the amount of data collected can be too cumbersome for manual review. Software-based reviews will need to be developed that can handle trillions of frames of video per day. Likewise, systems need careful adjustment to reduce the number of false positives. With video-based surveillance systems, privacy is of primary concern (13). A possible future solution, allowing monitoring systems to maintain an individual’s privacy, is to monitor infrared wavelengths only.

2. Multimedia
Interactive websites that offer online support groups are under development to help families, caregivers, and people with neurodegenerative diseases. These websites provide educational videos and handbooks. In addition, multimedia technology is being developed to assist people with cognitive and memory problems. The initial projects focus on remembering and reminiscing in people with mild cognitive impairment and mild to mid-stage dementia. The aim is to develop multimedia DVDs that store and play patient biographies. By regularly viewing these DVDs, participants better retain their sense of identity, and the multimedia format also provides nurturing and emotional support for family members. These DVDs also have the advantage of giving caregivers who are not family members a better understanding of the persons for whom they are caring. There are some hurdles to overcome in the production of these relatively short biographies. Determining how to summarize a person’s life can be challenging, and conflicts can arise in families over content.

3. Interactive exercises
Interactive programs under development fall into two main categories: video-based and electrophysiological. The video system relies on a television and monitoring system to show and monitor exercises, respectively. This system faces the same problem as other video monitoring technologies, i.e., the difficulty in accurately tracking the participant. One solution currently being explored is to dovetail the camera to a computerized model of the human torso that has 14 jointed segments. By mapping these segments on the person, and then comparing their actual movements with how they should be moving, the system can decipher how well the person is performing the exercise. Robust prompts are being developed that will help this system provide feedback to the participant. Algorithms are also being designed so that the system can cope with extraneous body movements that could otherwise confuse and crash the interface.

4. Sensory Therapy – The Forest Project
The Forest Project uses video game technology—specifically, Microsoft’s Kinect motion-sensing cameras together with the power of the Unreal Engine 4 gaming engine—to create a sensory therapy application. As its name suggests, “sensory therapy” aims to engage the senses in relaxing, novel activity that prevents idleness and boredom (14). Butterflies flitting by before you. Sunlight filtering through the trees. Snow fluttering to the ground in a gentle breeze. This virtual reality is a place that is like the setting of a happy children’s tale—peaceful and happy. But it’s also alive around you, and responds
directly to your movement and motions. For someone with dementia, it offers the possibility of experiencing fascination and even joy.

5. Technologies for Caregiver Assistance

Monitoring can be a two-way street. In addition to receiving monitoring information about a person with dementia, everyday technologies can also be used to contact and assist people in managing their everyday lives, thus giving their caregivers respite. Technologies that are actively being explored include verbal live systems, digital television, and simple cell-phone interfaces that give individuals prompts to help them cope with activities of daily living.

Live systems based on video monitoring are designed to track people engaged in specific tasks (e.g., making tea), to recognize if they get stuck at a particular point, and then give them a verbal prompt. The development of software for this type of system can be extremely challenging. Consider a simple task such as drying one’s hands, for example. The hands will often be covered by the towel or by each other making it extremely difficult for the video system to keep track. Sophisticated software algorithms are being developed to ensure that tracking systems are accurate and widely applicable, so that new models need not be reinvented for each specific task that one may want to monitor.

Digital television prompting systems may be very useful for people affected by AD who tend to spend a lot of time in front of the television. This type of system may be extremely useful not only to the person living alone, but also to those living with caregivers, because this system can relieve some of the “prompting” burden from the caregiver and help reduce conflict. The prompts can range from very subtle (images of food near mealtimes) to explicit (a message to take a particular medication), but must be scheduled via an easy-to-use control interface. Requirements gathering and system design are real challenges, calling for a range of coordinated methodologies (15).

Cell phones are relatively simple, light, and wearable devices that can be used to communicate with individuals, mainly as a reminding device (16, 17). A week’s or a month’s worth of short video messages, recorded with a computer and webcam, can be loaded into the smartphones and set to deliver appropriate messages at the appropriate time. The smartphone apps can also accommodate a certain degree of flexibility, so that messages can be updated or substituted on the go. This may be particularly useful for the busy caregiver who may have to delay visits or alter schedules.

Appropriate target activities will be identified and developed via interviews with people affected by dementia and their caregivers. These will then be tested in the field, and appropriate adjustments will be made.
CONCLUSIONS
Although some strides have been made in assessing Assistive technology outcomes with dementia, we are still far from our goals of understanding how end users interact with the technologies and the intricacies of the effects.

This project has discussed recent trends in technologies for dementia care and provides a personalized solution by using the technology. Technology solution alone as well as caregiver’s assistance has strong potential to positively influence Quality Of Life of dementia patients. The modern technologies that utilize sensing and machine learning can autonomously perceive the environment, learn from and adapt to the user, and carry out predefined, goal-directed tasks in real-time. Particularly in dementia, they can aid in tasks that require learning and decision making (two of the primary limitations characteristic of dementia). Furthermore, there is potential for communities (Smart Cities) to play a role in the future of living with dementia by connecting the user and their devices (Internet of Things) to services through Cloud Computing. Japan Post Holdings has reached a deal that put Apple Inc.’s hardware and International Business Machines Corp’s software in the hands of many elderly people (18). The iPad could eventually be coupled with IBM software in other countries too, helping older people with dementia to connect with families and outside world. Of course, there are major issues in data storage, system integrity, privacy and security, networked architecture and service provision, but it is worth starting a dialogue on these issues and setting forward thinking, goal directed research ambitions for the future of dementia care.
REFERENCES


BIOGRAPHIES

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