Smart-Prompt - Technical Abstract - Specific Aims

The older adult population (65+) is the fastest growing segment of the American population and is expected to grow from 12% to 21% of the US population over the next 20 years [1]. As people live longer, the prevalence of debilitating, diseases such as Alzheimer's disease and dementia will also increase. The cognitive decline associated with dementia often leads to impaired functioning with activities of daily living (ADL). The level of ADL disability will often mitigate the need for caregiver support and eventual institutionalization. The resultant increased burden for health and social support services currently approaches $100 billion annually in the United States [1]. The dominant model of reliance on human intervention must be restructured.

Attempts to minimize the demand for human support services have resulted in research investigating the use of assistive technology to support independence. These systems generally incorporate sensors and/or video surveillance techniques to remotely monitor the health and behavior of seniors. However, this population is still underserved by existing technology in the following areas: 1) the ability of the system to detect the required amount of prompting given the clients real-time needs and task demands, and 2) coaching the senior in activities of daily living (ADL) in a respectful manner that is non-invasive and non-intrusive (non-disruptive) [8].

Due to the variability in cognitive performance throughout the day/week these systems have been unable to provide a comparable level of care as seen with human intervention. This results in frustration and lower rates of adoption of these technological approaches by seniors.
Our research addresses NIA's mission and research priorities by investigating innovative technologies to support and improve quality of life, well-being, and the ability of older adults to live independently at home.

CreateAbility Concepts, Inc.'s (CCI) long range goal for this SBIR project is to produce the SMART (Sensor Monitoring and Acuity Recognition Technology) prompt system. SMART-prompt will detect and monitor an individual's task performance throughout the day and delivery person-centered prompting instructions to complete ADLs. Person-centered or variable prompting is the innovation of this technology which evaluates an individual's recent behavior and task performance to determine their current level of cognition and subsequent level of required assistance. This research benefits from new sensor technologies, including pattern recognition techniques for tracking movements and tasks that are not easily instrumented, such as cooking or bathing. This will enable a low-cost approach that can easily be retrofitted into existing home environments and economically tailored to the individual, providing an option for continued independent living.

The objective of this SBIR project is to establish the feasibility of using variable prompting technology to improve the ADL task performance of older adults with dementia.

The hypothesis for Phase I is that variable prompting technology can successfully aid in the completion of tasks associated with ADLs for individuals with cognitive impairments.

The Specific Aims CCI will use to test this hypothesis are:

- **Specific Aim 1** : Design and develop the computer vision and integrate and test the prototype subsystems to support the pilot study.
- **Specific Aim 2:** Using a pilot study, determine whether variable prompting will improve the functional task performance for older adults with dementia.

Secondary research questions: 1) What is the relationship between cognitive status and the amount of prompting required for successful ADL completion? 2) What is the relationship

between task efficiency (time, intensity, duration) and recorded sensor data of functional movement patterns? 3) What is the relationship between task complexity and task efficiency?

Impact of applied knowledge: At the conclusion of Phase I, CCI will have data from a pilot study with 60 participants to support the premise that older adults with dementia can independently complete tasks of varying complexities when a human administrator assesses their need based on the participant's task performance and supplies the correct level of detail to the participant. Information collected will include: cognitive assessment data from established instruments, state-of-the-art sensor data on participant task performance data across three levels of difficulty and video of all actions from participants and supplied prompts. The two primary potential commercial markets for SMART-prompt are 1) families in need of finding cost-effective options to either help their loved one age-in-place, or return to an aging-in-place condition from failed experiments with institutions, and 2) assisted or independent living centers that want to reduce costs. The market acceptance is expected to be high due to the pent up demand and cost-effective offering.