

## Background

In 2008, The Center for Disease Control and Prevention estimated that by 2030, the proportion of the U.S. population aged 65 or older will double to approximately 71 million people [1]. In this population, one of the key health concerns is undiagnosed depression which adversely affects quality of life and can lead to other illnesses, disabilities, and greater risk for death [1]. Loneliness and social isolation are associated with depression in the older adult population [3]. The Distant Narratives project is a system designed to facilitate personal relationships through communication of presence. The project design incorporates visual and haptic feedback which is transmitted and received from three separate locations via wireless internet connection. The project allows older adults to have frequent casual interactions with friends and family, thereby reducing the sense of isolation and improving overall mental health.

## Design Development

To create a functioning prototype for this project, a design process was implemented which included a set of steps allowing for research, testing, and review [2]. At the start of the process, a map of topics and sub-topics was created to identify key issues associated with the project. Topics were organized within two main areas of research: technology including effectiveness of design, and issues related to isolation and healthy aging. A review of sources from publications and journals provided information to guide development. Resources included information on distance communication, the use of technology and design of interactive systems for older adults, health issues for this population, and projects with similar design issues and uses of technology to Distant Narratives. The research resulted in a set of guiding premises in the areas of design aesthetics, functionality, psychology, and technical issues. To inform visual design including form and function, mood board were created based on research into a variety of projects and media which

incorporated similar elements as Distant Narratives. Two design concepts were created using Google Sketchup software. These concepts showed implementations of the system in a home setting, providing a visualization of the system components and a proposed setup in this type of space. A design direction was chosen which incorporated elements of the two design concepts and featured projected video and a fan activated by a motion sensor. A user triggers the activation of the system by moving within the range of the motion sensor. The system captures video of the user from a camera and sends this visual information to the other two systems while simultaneously sending data to activate a fan at the same remote locations. The incorporation of LED lights as an indicator of remote presence was also part of this design although it was not included in the final prototype implementation. A user scenario was created using Sketchup to provide visualizations of a proposed implementation in the home. After the design direction and installation were set, a list of technical components was created along with a development schedule for the project prototype.

In the next phase of development, a mock up configuration of the project parts was created and tested. This included two sets of computers with Processing software, arduino electronic interface with associated software for communicating with Processing which controlled the sending and receiving of video along with reading data from an infra-red motion sensor and activating a 5 volt fan which created an airflow indicated by the movement of fabric positioned in front of the fan. The movement of this fabric created a visual indicator related to the state of the fan. Video was sent to an LCD projector for output. Once the system was tested and operational, a box with fabric covering was created to house the components for the system. The system with two working stations was shown at an open house demo. This first demo provided a test of the system and feedback which guided adjustments for a second demo one week later. The two demonstrations featured the operation of the system in a configuration which situated both system boxes at the same location in close proximity. Technical and design choices were evaluated and the feedback of viewers was collected informally. These tests and feedback will be addressed in future revisions of the project design.

## Technical Specifications

The system designed and developed for Distant Narratives is comprised of the following elements:

Mac Mini Computers (OS 10.4, 10.5 running on a PowerPC process and OS 10.6 running on an Intel processor)

Software: Processing 1.2.1 and Arduino 0022

Arduino Duemilanove with ATmega 168, and 368 with USB connection to computer  
multiple LED lights in a strip configuration

EverCool 5V fan

microsoft web cam

Fabric for fan and camera enclosure with light fabric strips in front of fan

Sharp IR motion sensor 2Y0A700K (longer range) and GP2Y0A02YK

LCD projector

## Future Research Questions and Proposed Methodology

Prototype systems were designed and developed for Distant Narratives and shown at open houses during the spring. These demonstrations provided an opportunity to evaluate the design of the system and gather feedback from people who had not previously seen the project. Future research areas to address include technical issues along with design concerns related to effectiveness of the system, and usability. The use of video is problematic because the sending and receiving of video data packets over a network does not allow for a consistent playback of video and is prone to numerous issues which effect frame rate, quality and scale. Possible solutions include replacing

video with single frame images which could be sent at a regular interval, for example, once every 60 seconds. Long range motion sensors were not as effective as shorter range IR sensors. These need to be further evaluated for the best solution which will provide reliable data with as little interference noise as possible. The use of fabric strips placed in front of the fan to indicate the motion of air was not as effective as intended and alternate solutions need to be evaluated. To keep components as small as possible and to lessen the amount of heat generated by electronic parts, a smaller LCD project will be tested in the system. The Mac Mini computer works well and is a good size to fit in the the box structure; the more recent version with Intel processors is more effective in communicating with the arduino than the older systems with PowerPC processor; therefore, the more recent version should be used or a computer with similar capabilities could be tested.

To this point, the Distant Narratives system has not been tested on the intended users of the system, older adults and their friends and family. The system has not been deployed into a setting consistent with the living situations of this audience. Because of this, there are several areas of investigation which will be explored in the future. Understanding the effectiveness of the design is a key area for research. By testing the system with the intended audience and gathering their feedback, data can be collected to measure the effectiveness of the system and provide information that will allow for design revisions. Another area of investigation is in the usability of the system for older adults. Gathering information from older adults will measure the success of the system and may result in design changes and an improved system which meets the needs of the intended users.

To gather feedback from older adults, a pilot study can be designed and implemented. This study will be created to gather feedback from older adults in a setting which allows them to use the system in coordination with a second user who is part of the project development. Creating a study environment which simulates the installation and use of the system in the home will provide subjects with an opportunity to engage the system and generate data which can be used to inform

design and development . The system could be installed at the Aware Home at Georgia Institute of Technology which would allow for testing in a controlled environment. A number of subjects, ten to fifteen, can be included in the pilot study. Subjects will be given a set of instructions to create a standardized set of interactions with the system. During use and after a period of time interacting with the system, a developer will ask a series of questions aimed at gathering information which will be used to measure effectiveness and usability of the system. Questions will cover the following areas:

- User control and interaction based on movement and sensing.
- Effectiveness of feedback in the system, visual and haptic.
- Flexibility of the design related to impairments common in older adults including reduced mobility, diminished mental and physical abilities.
- Effectiveness of system to address issues of isolation leading to depression.
- Degree of customization allowed by the design to allow for variety of home settings.
- General feedback from older adults, likes and dislikes in current design implementation.

The most important audience to gather data from is older adults, but it is also important to measure the feedback from friends and family who would also be users of Distant Narratives. Including this segment of the audience in a study could provide secondary information which would inform design of the project and implementation in the home.

The design and development for Distant Narratives which lead to the demonstration of the system was a first step in realizing the design concept. Further work on the project will require a research

study or other mechanism which provides feedback from the intended users of the system.

works cited

1. Center for Disease Control and Prevention. Healthy Aging. Preserving Function and Improving Quality of Life Among Older Americans. Available from <http://www.cdc.gov/nccdphp/publications/aag/aging.htm>; last modified February 12, 2008.
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3. Hawthorne, G. Measuring Social Isolation in Older Adults: Development and Initial Validation of the Friendship Scale. Social Indicators Research (2006) 77: 521-548.