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Title: HomePortal – A Universal Home Environment for Individuals who are Blind or Have Visual Impairments.

Technical Abstract

Ironically people who are blind or have visual impairments that should benefit the most from technology, have great difficulty in interacting with modern home appliances and electronics. This is primarily due to a combination of a lack of accessible features, device complexity, or the lack of a centralized strategy. Current strategies do not incorporate reminders, the possible fixed income status of the individual, or warnings of potential safety issues, such as appliances may have been left on and unattended too long.

Without the necessary supports, the growing aging in place trend could be compromised as age-related vision loss grows with the longer life expectancy and aging of the boomer generation.

This project will demonstrate the technical merit, feasibility and cost effectiveness of combining commercially available modules, smartphone and tablet technology with an innovative approach and state-of-the-art software to deliver a universal console system. HomePortal will provide a seamless and interface to low cost modules and components and remove barriers in the home.

Specific Phase I objectives include: 1) determine end user requirements, 2) develop a proof-of-concept prototype of the system, and 3) evaluate of the utility of the prototype with actual elderly individuals who represent a cross-section of functional limitations.

Anticipated Results and Implications of the Approach

This project targets a population that has been under-served by existing technology. The built in natural support mechanisms promote independence, enhance self-esteem, and create opportunities for self-direction in a respectful, non-invasive approach. Activities of daily living can be accomplished with less assistance and without compromising safety.

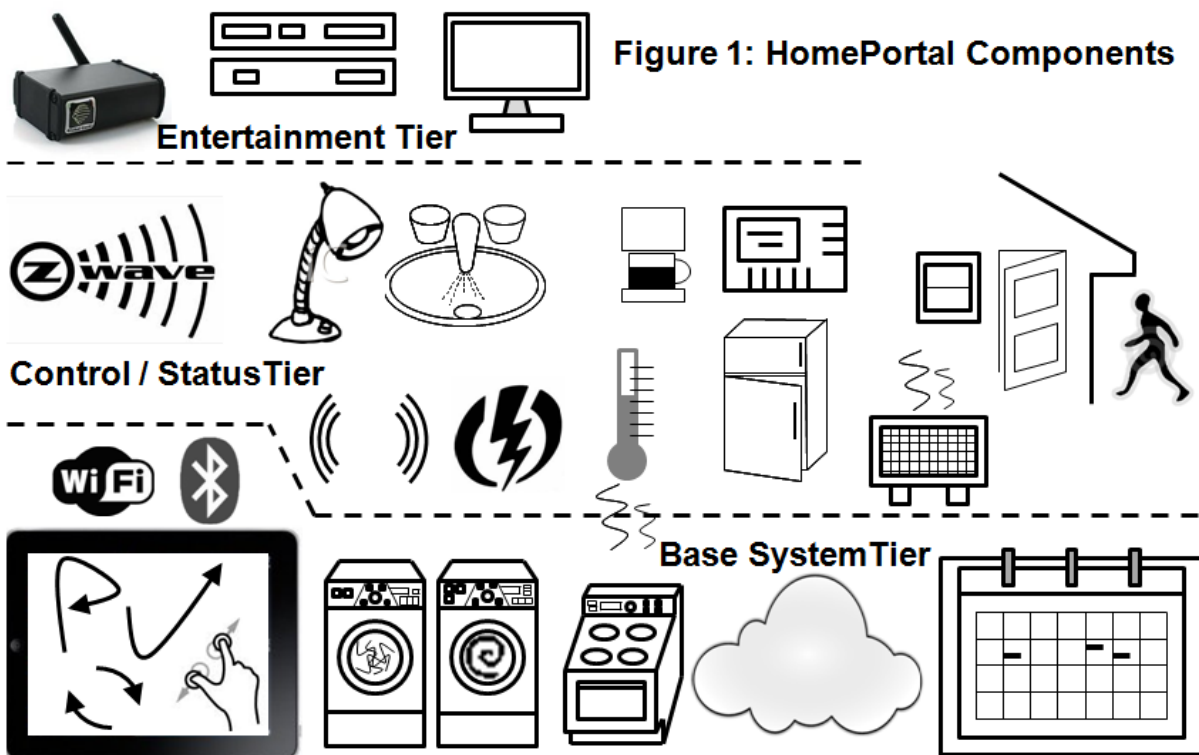
Potential Commercial Applications

The potential commercial applications of the HomePortal system are substantial due to the large pent up demand because this system is lower cost, provides an accessible and seamless interface enabling them to more fully and independently interact with their home environment. Nearly 11 Million Americans are classified as having a visual impairment of which 2.3 Million have a profound visual impairment. This research and development will result in an affordable product following a successful Phase I and Phase II.

Description / Explanation of the proposed concepts and proposed prototype design

This project extends the capabilities of CreateAbility’s Independence Keeper system to help support people with no vision or low vision.

Figure 1 (below) is intended to illustrate a vision of how the HomePortal system could support a variety of user scenarios for helping them interact with their home’s appliances and electronics in the accomplishment of typical ADLs. Three different tiers of configurations are available: the Base System shown on the bottom of Figure 1, the Control / Status Tier, and the Entertainment Tier. This enables consumers to only buy what they need, and then add new capability when they need it.



The bottom left-hand corner of Figure 1 shows the interactive universal console app that runs on a tablet or smartphone with integrated camera, mic, speaker, high-contrast color touch-screen and wireless networking. New smartphones, such as the iPhone (4S or greater) and the iPad 2, as well as their Android equivalents (version 4.0 or greater) have integrated WiFi, Bluetooth, cameras, screen readers, text-to-speech, and voice recognition—all of which allow for new amazing ways to interact with these mobile devices. An Internet connection is required.

Navigation of the user interface can be via voice recognition (no vision) or gesturing (low vision), such as the pinch zoom (to magnify a section of the screen, the two-finger rotor (to change settings), the “P” symbol for programming a series of actions into a macro, and the swoosh checkmark, to agree or select a setting. The imagery can also be presented as high

contrast. The dryer, washer and oven shown across the bottom illustrates that the on-board camera could be used to take pictures of the appliance's control panel if the user is confused about how to control the appliance. This image is then undetectably sent to CCI's cloud computer for recognition. The answers are beamed back and the instructions on how to proceed are then presented to the user, in the way they prefer.

The user can also set a future appointment or reminder using their voice, which is automatically recognized and stored in the calendar.

The proposed design is superior to current electronic monitoring or remote control methodologies employed that typically incorporate video monitoring [20]. Conversely, HomePortal is focused on creating a respectful, non-intrusive series of natural supports [21].

For the appliances, a small holding tray or arm, such as the kind used to mount tablet computers to wheelchairs, is used to hold a tablet computer in front of the SVD of the appliance. A high contrast version of the appliance's SVD is displayed on the tablet, but the application (working in concert with the cloud, real time) has processed the image and performed an optical character recognition on the information displayed. As the user moves their finger across the touchscreen on the tablet, haptic feedback in the form of a vibratory pulse will be felt by their finger as they reach a section that is a button or label. As they hold their finger on this on-screen 'button' the meaning of this button is spoken to the user. This permits the user to explore the SVD of the device, as they move their finger across the tablet's display.

When the user reaches the button that they wish to select, they tap on the tablet which tells the app on the tablet to guide the user's finger into this actual button position on the appliance's SVD.

Additional modules can be added by the user to accomplish additional tasks by adding more capability (such as via Z-wave sensors and control modules), as illustrated in the middle Control / Status Tier (of Figure 1). If the user wanted notification when the dryer or washing machine had completed its cycle a vibration or electrical appliance module could be added (shown directly over the appliances).

Similarly, the combination temperature/motion detector would enable the system to notify the user if the stove was hot and unattended too long. Counter-clockwise from here, modules would detect the status of: refrigerator door, space heater, outside motion, door, window, thermostat, coffee pot, water flow, and various appliances. These modules communicate with the tablet via a wireless stationary BaseStation that also acts as a 'WiFi to Z-wave' Bridge. The top entertainment tier shows how a WiFi-to-infrared control module could be positioned in the general area of electronic appliances (as it has multiple high power IR emitters so that it is insensitive to aiming issues), enabling the seamless control of the cable box, DVD, TiVo/DVR, and TV.

During the preliminary investigation, CCI discovered that on many home electronics components, sequences of infrared commands (such as arrow up, arrow up, arrow left, select, play) can eliminate the need for on-screen menus.

Though this multi-phase project will culminate with a fully functional commercial solution that will work with many appliances, in Phase I, CCI will specifically focus on elements necessary to support the pilot study evaluation with actual study participants from this population.