Survey on Effect of Multimodal Interface on Senior Citizen

Aleena Susan Mathew[1], Vidya .N[2]

[1] M.Tech in Computer Science and Engineering
Sree Buddha College of Engineering , Elavumthitta
Kerala 689625
[2] Assistant Professor of Computer Science and Engineering
Sree Buddha College of Engineering , Elavumthitta
Kerala 689625

Abstract:
Multimodal interface is designed within CAMI in which an Artificial Intelligent ecosystem integrates the main functionalities of AAL (Ambient Assisted Living) systems for senior citizen, which are its target users to fulfill their needs. It supports numerous languages. It can process both gesture and speech commands. It must work on different devices and adapt to any screen size. The interface is developed using HTML5, JavaScript, CSS3 and integrates Google Speech Service along with other services.

Keywords: Multimodal Interface, Elderly People, Speech Recognition, Gesture Recognition.

1. Introduction

Population ageing is not only accompanied by multiple social behavior and lifestyle changes, but also by a massive pressure on social services and healthcare systems. At the same time, number of care givers is decreasing and well-being costs is increasing. This paper is presenting a multimodal interface designed within CAMI in which an artificial intelligent ecosystem incorporates the main functionalities of AAL systems, such as health monitoring, fall detection, home monitoring and automation, supervised physical exercises, activity planner, and the use of a robotic platform. The ecosystem integrates a multilingual interface which can process not only English speech inputs but also Romanian, with the possibility to add other languages. At the same time, the interface has the ability to be displayed different languages and to recognize some gestures as user commands. The design of the interface respects the needs of senior citizen, which are its target users. It ensures an easy access for the elderly and their caregivers to the above functionalities of the system [1].

Multimodal interaction systems support the recognition of natural forms of human language and behavior through the use of recognition-based technologies. Multimodal interfaces are generally planned to deliver natural and efficient interaction.

There are many advantages for multimodal interfaces: natural interaction, flexible use of input and output modes, enhanced robustness to interface by reducing errors, so on.

Oviatt's ''Ten Myths of Multimodal Interaction'' (Oviatt, 1999) [2] offers useful insights for those researching and building multimodal systems, with a few especially apropos:

- Myth: If you build a multimodal system, users will interact multimodally.
- Myth: Multimodal input involves simultaneous signals.

- Myth: Multimodal integration involves redundancy of content between modes.
- Myth: Enhanced efficiency is the main advantage of multimodal systems.
- Myth: Individual error-prone recognition technologies combine multimodally to produce even greater unreliability.

Reeves et al. (2004) [3] defined the following guidelines for multimodal user interface design:

- Multimodal systems should be designed for the broadest range of users and contexts of use.

- Designers should support the best modality or combination of modalities anticipated in changing environments.
- Designers should take care to address privacy and security issues in multimodal systems.
- Multimodal interfaces should adapt to the needs and abilities of different users, as well as different contexts of use. Individual differences can be captured in a user profile and used to determine interface settings.
- Provide good error prevention and error handling; make functionality clear and easily discoverable.

2. Related Works

Traditional human-machine interfaces have always represented a barrier for the acceptance of new devices by non-technical people in general and by elderly or people with special needs in particular.

2.1 Traditional Interfaces

Mouse and keyboard were the most used input interfaces for user-machine interaction during the end of the last century and the very beginning of the present one.

In a study conducted by Kevan etal. [4], they aimed to determine whether computers can be helpful to elderly persons residing in a long-term care facility, by teaching them how to perform basic tasks on the computer.

A study by Chaparro et al. [5] suggests that the aging population (particularly men) may face greater difficulty using an input device that relies on motions of the wrist, since they have a limited range of motion.

As we have seen in different studies, the traditional interfaces are not easy to use for new users, particularly when they are elderly.

2.2 Multi – touch Interfaces

Multi-touch interfaces use a touch sensing surface to recognize the presence of one or more points of contact.

In a study conducted by Werner et al. [6], he selected 11 seniors with no previous internet or PC experience and evaluated the general usability and acceptance of a selected tablet. The results of the study show high acceptance and satisfaction rates among the user group and hence suggest a future focus on the development of tablet based applications for seniors. The authors argue that tablets are an easy way to step into the digital world.

Loureiro et al. [7], analysed different aspects of 8 touch-based tabletop interfaces for the elderly.

They concluded that touch produces natural, direct, and perceptive way of interaction with a device allowing easier human-computer interaction for elder users.

2.3 Gesture Interfaces

Gesture recognition is one of the most natural and intuitive ways of interacting. Gesture recognition used for computers to understand human body language, interpreting those gestures via mathematical algorithms.

Hassani et al. [8] developed an assistive robot which helps elderly people perform physical exercises. The score of effort, ease, anxiety, performance and attitude was very high. Participants were very positive about the use of gestures.

3. CAMI Interface

Multimodal Interface proposed in this paper is designed with CAMI AAL project. CAMI is an artificial intelligent ecosystem [9]. Compared to other types of human-machine interactions, multimodal interactions offer users a more natural way of interacting with the machine through several distinct tools for input and output of data that enrich the interaction between the system and its users.

3.1 Voice Recognition

For conveying thoughts easier and faster, verbal communication is more useful. Using vocal method, carries various kinds of information. To solve the problem of speech recognition, mostly based on acoustic models designed via Hidden Markov Models and on language models that correspond to a specific language.

3.2 Gesture Recognition

Using mathematical algorithms, gesture recognition allows machines to interpret and understand human body language. To achieve this, recognition devices that have capability of motion acquisition have been employed. Apart from these devices, computer vision can be applied by using video capture and data processing to detect user's movements. Kinect is an example of such a device that has motion analysis capability. It provides RGB data, depth maps, and 3D skeletal data indicating the most important 20 body joints. The proposed gesture module detects hands gestures.

The recognition of the gestures is performed by the SIFT algorithm (scale-invariant feature transform) described in [10], which extracts multiple features from the trajectory image, such as shape and

orientation. After extracting all the features, an Euclidean distance metric approach is used to compare the extracted data against a database that contains predefined gestures associated with their specific features, in order to generate the corresponding text of the identified gesture, which represents the gesture name and determines the user's command.

4. Conclusion

The modern era of technology seems to be beneficial to almost all sections of human life. Since senior citizens are facing technical difficulties to interact with the technology, this paper brings a solution to this problem. This paper discusses the existing interfaces for the senior citizens. There are two types of interfaces developed : Unimodal and Multimodal interfaces. Since unimodal interfaces doesn't provide a natural way of interaction hence a multimodal interface is introduced. Multimodal interfaces are user friendly, platform independent, scalable and robust. This system aims to provide a support for the elderly people to fulfill their daily activities.

This modal can be enhanced by applying more error prevention methods. This modal can be designed according to the user preferred languages and also by providing more gesture and voice commands.

References

[1] Imad Alex Awada, Irina Mocanu, Adina Florea and Bogdan Cramaiuc , "Multimodal Interface for Elderly People ", 21st International Conference on Control Systems and Computer Science, pp. 536-541,2017

[2] Oviatt, S., 1999. Ten myths of multimodal interaction. Commun. ACM 42 (11), 74– 81

[3] Reeves, L.M., Lai, J., Larson, J.A., Oviatt, S., Balaji, T.S., Buisine, S., Collings, P., Cohen, P., Kraal, B., Martin, J.-C., McTear, M., Raman, T.V., Stanney, K.M., Su, H., Wang, Q.Y., 2004. Guidelines for multimodal user interface design. Commun. ACM 47 (1), 57–59

[4] Namazi, K. H. and M. McClintic (2003). Computer use among elderly persons in long-term care facilities. Educational Gerontology 29(6), 535–550

[5] Chaparro, A., M. Rogers, J. Fernandez, M. Bohan, S. Choi, and L. Stumpfhauser. Range of motion of the wrist: implications for designing computer input devices for the elderly. Disabil Rehabil 22(13-14), 633–7.

[6] Werner,F.,K.Werner,andJ.Oberzaucher(2012). Tablets for seniors-an evaluation of a current model (ipad). InR.Wichertand B.Eberhardt (Eds.), Ambient Assisted Living, Advanced Technologies and Societal Change, pp. 177–184. Springer Berlin Heidelberg

[7] Loureiro, B. and R. Rodrigues (2011). Multi-touch as a natural user interface for elders: A survey. In Information Systems and Technologies (CISTI), 2011 6th Iberian Conference on, pp. 1–6.

[8] Znagui Hassani, A., B. Dijk, G. Ludden, and H. Eertink (2011). Touch versus in-air hand gestures: Evaluating the acceptance by seniors of human-robot interaction. In D. Keyson, M. Maher, N. Streitz, A. Cheok, J. Augusto, R. Wichert, G. Englebienne, H. Aghajan, and B. Krse (Eds.), Ambient Intelligence, Volume 7040 of Lecture Notes in Computer Science, pp. 309–313. Springer Berlin Heidelberg.

[9] Active and Assisted Living Program: CAMI (AAL-2014-1-087) Official Website: www.camiproject.eu – accessed on: 2017-02-19.

[10] Alba Ribó, Dawid Warchoá and Mariusz Oszust, "An Approach to Gesture Recognition with Skeletal Data Using Dynamic Time Warping and Nearest Neighbour Classifier", I.J. Intelligent Systems and Applications, Vol. 6, pp. 1-8, 2016.

Author Profile

Aleena Susan Mathew received her Bachelor's Degree in Computer Science and Engineering from Sree Buddha College Of Engineering, Ayathil, Elavumthitta, P.O. Pathanamthitta, kerala, India in May 2017. She is currently pursing Master's Degree in Computer Science and Engineering in Sree Buddha College of Engineering, Kerala, India.

Vidya .N received her Bachelor's Degree in Computer Science and Engineering from Sasurie College Of Engineering, Anna University, India in April 2017 and Master's Degree in Computer Science and Engineering from Coimbatore College Of Engineering and Technology, Anna University, India in May 2010. She is a lecturer in the Department of Computer Science and Engineering, Sree Buddha College of Engineering, Ayathil, Elavumthitta P.O. Pathanamthitta, Kerala, India.