ISSN: 2321-7782 (Online)
Volume 2, Issue 12, December 2014
International Journal of Advance Research in Computer Science and Management Studies
Research Article / Survey Paper / Case Study
Available online at: www.ijarcsms.com

Real Time Sign Language Interfacing System

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Abstract: Sign languages are as capable of expressing human thoughts and emotions as traditional (spoken) languages. The distinctive visual and spatial nature of sign languages makes it difficult to develop an interfacing system as a communication medium platform for sign language users.

This paper targets this problem by presenting some explorations in the areas of computer graphics, Interface design, and human–computer interaction with emphasis on software development and implementation. We propose a real time sign language interfacing system, as a working platform, that can be used to create virtual human body parts, simulate virtual gestures, and construct, manage, and edit sign language linguistic parts. It is expected that the system and the results presented in this paper would provide an example for the future sign language "editor".

Keywords: Graphical User Interfaces, human gesture simulation, interactive system.

I. INTRODUCTION

SIGN languages have been proven linguistically to be natural languages just as capable of expressing human thoughts and feelings as traditional languages are. The visual and spatial nature of sign languages contributes to the lack of "editors" in such languages. The current writing systems, while making full use of various suggestive 2-D icons or phonetic symbols, are indirect, unnatural transcriptions, and transformations of the 3-D expressions inherent in sign languages. This symbol representation for a sign language is, in fact, like a text encoding of spatial contents.

To address these problems, we draw from computer graphics and human–computer interaction, specifically human body modeling, user interface design, and software implementation, to develop a framework of a sign language interfacing system. Considering biomechanics, a virtual human body is first constructed as a set of functional body components. Using the virtual body and focusing on the creation of natural hand configurations and the application of body joint motion constraints, virtual gestures are created by controlling the movements of the functional components. From the virtual gestures, sign language linguistic parts (LPs) can be constructed by using the Movement-Hold model.

A graphical user interface supports the operations of gesture generation and editing, gesture database management, and creation, editing, storage, and retrieval of sign language LPs. Under the Fedora Core of Red Hat Linux operating system, sEditor is implemented in C++ and OpenGL and uses the Coin3-D graphics library (an Open Inventor clone). The GUI interface is implemented using the Qt API and C++. It also can run in the VMware Virtual environment under Windows 7. sEditor is designed to support constructing, managing, and editing virtual gestures.

From these signing components, first sign language linguistic components, then phonemes, and, finally, sentences can be created. To support other linguistic components, components may be stored and retrieved from sign language databases.

II. Related Work

An early interactive system analysed and modelled the complex hand and arm movements of sign language [4]. Through the reconstruction and manipulation of actual sign movements, this system was designed to convey American Sign Language (ASL) essential grammatical information using line drawing. The dictionary of the ASL on linguistic principles (DASL), now the multimedia dictionary of the American Sign Language(MM-DASL), presents ASL signs in full motion(video of ASL entries), enabling users to search for words by entering English words or ASL pronunciation criteria. Live-action video clips with graphical user interfaces support sign language studies. For example, Sign Stream is a multimedia database tool designed to facilitate ASL linguistic and computer vision research on visual-gestural language. Data from native signers are collected with video collection equipment, and users can enter annotation information into data distinct fields. The video clips and associated linguistic annotations are available in multiple formats for ASL studies and gesture analysis.

One example concerns the design of an online web browser for the deaf community. It provides hyperlinks within video in a sign language-based text optional web environment. Today, lifelike virtual human figures can be constructed. Human avatars can imitate human actions and even facial expressions. All the body joints and featured parts (such as eyebrows or mouth), represented as various parameters, are controlled in their motions, allowing the creation of virtual gestures. The use of virtual human figures in sign language studies is a popular approach. However, Frishberg provide framework concepts and Ong and Ranganath provide sign language gesture issues (with respect to modelling transitions between signs, modelling inflectional processes, and related concerns) to inform virtual signing systems.

Human avatars (i.e., virtual human bodies) may provide advantages over videos of native signers. However, current systems are limited because the LPs (the sign language phonemes, words, and sentences) are fixed and the lexicons are limited. Therefore, the users cannot create new sign language “words” or “phrases.” To target this issue, sEditor is an “open” platform for different sign languages with user interfaces for the creation and management of sign language LPs (from phonemes to sentences). To produce more natural hand configurations, the hand shapes (the most important sign language parameters) generated by sEditor incorporate hand biomechanical constraints. sEditor serves as a sign language “word” editor prototype with which sign language users can “write” in their languages like a regular text editor for spoken languages.

III. Proposed System

As the web has developed it has become a place where people interact. They post opinions, modify and enhance each other’s contributions and share information. All of this is currently done via the medium of text. Dicta-Sign researched ways to enable communication between Deaf individuals through the development of sign language based human-computer interfaces (HCI). It has researched and developed sign recognition and synthesis engines that have brought these emergent technologies significantly closer to authentic signing. These advances have been demonstrated via sign language-aware Web 2.0 interfaces, combining work from the fields of:

- Sign language recognition.
- Sign language animation via avatars.
- Sign language resources.
- Sign language model development.

IV. Conclusion

The outcomes have justified the initially set goals with a project demonstrator that is a Sign-Wiki prototype; showcasing the potential of sign language exploitation in Web 2.0. Other project outcomes include:

- A parallel multi-lingual corpus for four national sign languages – German, British, French and Greek (DGS, BSL, LSF and GSL respectively).
- A multilingual dictionary of 1000+ signs of the four project sign languages,
- A continuous sign language recognition system that achieves significant improvement in terms of coverage and accuracy and also has researched the novel directions of multimodal sign fusion and signer adaptation,
- A language generation and synthesis component, covering in detail the role of manual, non-manual and placement within signing space,
- Annotation tools which incorporate these technologies providing access to the corpus and whose long term utility can be judged by the up-take by other sign language researchers,
- Three bidirectional integrated prototype systems which showcase the utility of the system.

ACKNOWLEDGEMENT

With immense pleasure, we are publishing this paper as a part of the curriculum of M.E. Computer Engineering. It gives us proud privilege to complete this paper work under the valuable guidance of Principal for providing all facilities and help for smooth progress of paper work. We would also like to thank all the Staff Members of Computer Engineering Department, Management, friends and family members, Who have directly or indirectly guided and helped us for the preparation of this paper and gives us an unending support right from the stage the idea was conceived.

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