A Route Planner Interpretation Service for Hard of Hearing People

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Abstract. The advancement of technology over the past fifteen years has opened many new doors to make our daily life easier. Nowadays, smart phones provide many services such as everywhere access to the social networks, video communication through 3G networks and the GPS (global positioning system) service. For instance, using GPS technology and Google maps services; user can find a route planner for traveling by foot, car, bike or public transport. Google map is based on KML which contains textual information to describe streets or places name and this is not accessible to persons with special needs like hard of hearing people. However, hearing impairment persons have very specific needs related to the learning and understanding process of any written language. Consequently, this service is not accessible to them. In this paper we propose a new approach that makes accessible KML information on android mobile devices. We rely on cloud computing and virtual agent technology subtitled with SignWriting to interpret automatically textual information on the map according to the user current position.

Keywords: Android, SignWriting, Cloud Computing, Virtual Agent, Google map, GPS.

1 Introduction

In the world, there are around 70 million people with hearing deficiencies (information from World Federation of the Deaf `http://www.wfdeaf.org/`). Most of them prefer to communicate with sign language rather than with words [11] because they have many difficulties related to the learning process [8]. Consequently, all services based on textual information are not accessible to them. In our context, we focused on the route planner information based on the Google map service. We use this service to find a route planner for traveling by foot, car, bike or public transport. However, the Google map service[1] gives us the route information as textual form

[1] KML is a file format used to display geographic data in an Earth browser such as Google Earth, Google Maps, and Google Maps for mobile.

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(as shown in Figure1) to be used by developers to place markers, to draw the route path on the map and to give us the route planner as audio indication. Consequently, hearing impairment persons cannot use this kind of services.

In order to make this service accessible to the hearing impairment persons, we built a solution that allows android devices users to use a route planner based on sign language interpretation. In this context, this paper presents a new approach that allows an automatic interpretation of the KML route planner information using sign language. We rely on virtual agent technology [1] as artificial signer with a SignWriting [9] subtitling for automatic interpretation of textual information.

This paper is organized as follow: the next section is dedicated to the previous works. The section 3 is devoted to describe the benefits of our automatic sign lan-guage interpretation service. In section 4, we describe our contribution, the approach used and the architecture of our system. Finally, we give a conclusion and some perspectives.

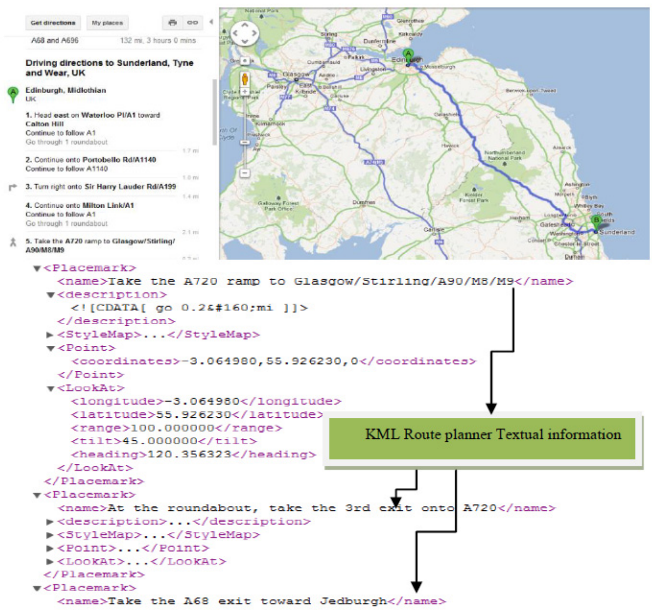

Fig. 1. Part of KML route planner information from Edinburgh to Sunderland United Kingdom.

2 Previous Works

Up today, there are many works for people with special needs. For example, a mobile navigation and orientation system for blind users in a Metrobus Environment [7]. This is a mobile assistant to spatially locate and orient passengers of a Metrobus system in the city of Mexico. In our context, we are interested on hearing impairment people. However, most of previous works on sign language interpretation are based on two main techniques: pre-synthesized animation and generated animation. The first one relies on motion capture pre-recorded animation using avatar technology or video interpretation [4 - 5]. For example, Mathsigner or DIVA framework [2], are based on pre-recorded animation using virtual agent technology. This approach depends on expensive material to build signs and decreases the user interactivity to create new signs according to the chosen community. Also there are some works deployed on mobile phones which use video support such as ASL dictionary application or sign language idioms application on android OS which includes 70 idioms/phrases and sentence examples in American Sign Language to teach sign language.

The second one consists on automatic and real-time generation of animations. In this area there are some works as eSIGN, signSMITH [10]. ESIGN (see Fig1B) is based on synthetic signing works by sending motion commands in the form of written codes for the Avatar to be animated. SignSMITH provides a gesture builder to create signs with elementary movement. In general, these works are not dedicated to interpret automatically written text on mobile devices. In other words, there are no mobile services which provide an automatic sign language interpretation of textual information as the route planner. Consequently, if we want to interpret the route planner information, we must purchase dedicated devices such as GPS Ranger gadget. This gadget provides a GPS touring in American Sign Language ASL; it allows a way finder and directional information in Austin, Texas based on video support. This kind of gadget is expensive and depends on specific sign language interpretation such as ASL. Therefore, for example French or Arabic hearing impairment persons cannot use this kind of devices.

3 The Benefits of Our Automatic Sign Language Interpretation Service

Our automatic sign language interpretation service is based on WebSign project developed on our laboratory. This is a Web application that relies on virtual agent technology to interpret automatically written text to sign language. However, this approach uses a dictionary of words and signs saved on Sign modeling language SML format (as shown on Figure 2b) [6]. The SML is created to describe the gesture sequence and to create signs to be saved on dictionary. The dictionary can be made in an incremental way by users who propose signs corresponding to words. The originality of our approach is the collaborative approach used to enrich our multiple-community dictionary.

3.1 Multi-community Approach

As the primary communication means used by members of deaf community, sign language is not a derivative language. It is a complete language with its own unique grammar [3]. However, some specific words are interpreted differently from community to another. Consequently, if users share a global dictionary the interpretation lost the truth information meaning. To resolve this problem, we introduced the concept of community. A community is a group of users that can build and share a common sign language dictionary. User can create his signs on his own community and he can share signs with others.

3.2 Collaborative Approach

Our service relies on a collaborative approach to enrich dictionary. Using this strategy, every user can contributes in the creation of new signs according to his region. Our aim is to cover all route planner information in the map. Consequently, we make available a path finder service based on sign language interpretation that allows hard of hearing persons to navigate on the mobile phone map. The creation process of signs is based on WebSign interface. User can create his sign through our web interface [6]. As shown in Figure2a, we rely on virtual agent technology to create animation in SML format.

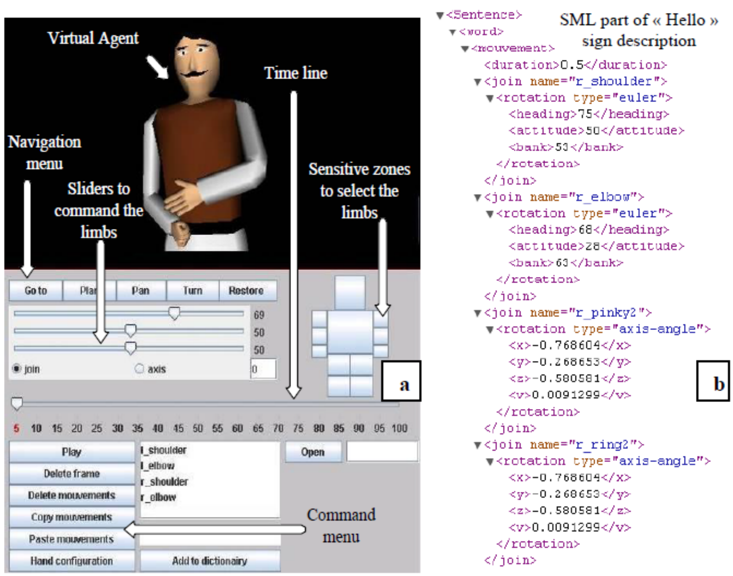

Fig. 2. (a) Web tool to create signs (b) SML description

3.3 Mobile Solution

The route planner service relies primarily on mobility. For this reason we built a mobile service that allows a real time route planner interpretation. This service allows a current position localization using Global Positioning System GPS. User introduces his destination using our input SignWriting interface (as shown in Figure3) and the system generates the route planner interpretation based on virtual agent subtitled with SignWriting.

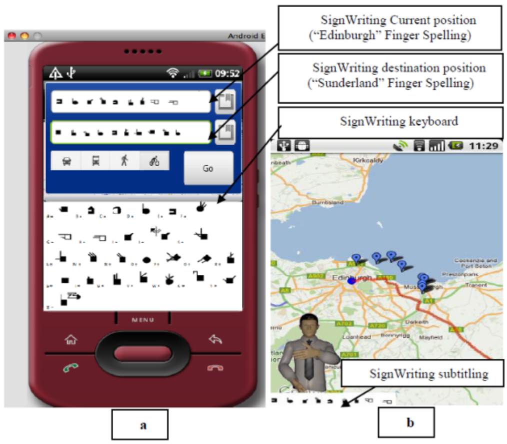

Fig. 3. (a) The SignWriting input interface (b) The route planner interpretation interface on the map

4 Our Contribution

In order to create a route planner interpretation system, we have developed first a web service. The aim of this service is to ensure interaction between the mobile client and our interpretation server. Second, we have implemented a mobile solution on Android OS that provides an accessible and easy to use interface. Figure 4 shows our system architecture.

4.1 Architecture

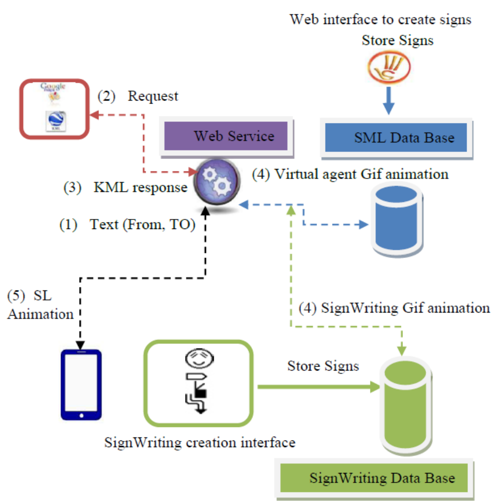

Fig. 4. Our system architecture

4.2 Web Service Interpretation System

Our approach relies on a web service interpretation system using cloud computing technology and android client application. Cloud computing refers to the on-demand provision of computational resources (data, software) via a computer network, rather than from a local computer. This approach is adapted to be used by minimal computational resource. Users or clients can submit task to our service provider without knowing either the location or the type of background processing.

In our context the computational resource are dedicated to sign language computational processing. However, our service depends mainly on 3D rendering and this kind of processing is closely related to CPU computing power. As shown in Figure 4, this approach gives us opportunity to use mobile device as a client and to take advantage of computing power offered by this service. However, the idea is based on textual information extracted from KML file. The android client detects automatically the user current position using GPS. User introduces the destination address in SignWriting format to be converted in textual information and submitted to our web service. This service sends a request to the Google map web service to obtain the KML file. The received response will be parsed and generated as a GIF animation format subtitled with SignWriting. The generation process is based on the conversion of SML animation to GIF 3D rendering format. However, the output animation will be sent to the client as a GIF animated file which integrates the sign language virtual agent interpretation subtitled with SignWriting. Figure 4 shows also that user can create signs using Web Sign and SignWriting creation interfaces to be stored in data bases.

4.3 Android Client

We developed a mobile client application under android operating system. This application uses mainly the GPS service to detect the current user position. As shown in figure 4, our application interprets the route planner information received from our service using HTTP protocol. We use the Google map technology to draw the path from the current to destination position. Our sign language interpretation changes according to the current user position.

The virtual agent allows a real time interpretation of the nearest next position to in-form user that he must turn right or left etc. Our application allows also a finger spelling interpretation of places name if there is no sign language translation. Furthermore, this solution chooses automatically the community according to the local mobile phone language and offers a virtual agent interpretation subtitled with SignWriting to improve the translation meaning.

5 Conclusion and Future Works

In this paper we presented a system to make a route planner information accessible to hard of hearing persons with low English literacy. This system is based on a real time interpretation service that allows a virtual agent interpretation subtitled with sign writing. We showed that our solution offers the possibility to create signs from our WebSign interface and SignWriting interface. We have tested this system in our laboratory and we have succeeded to introduce a set of signs in the dictionary according to some places in Tunisia. During the evaluation of our work, we have seen that we need to add other signs and some new functionalities. In particular, we can improve the 3D rendering quality. Also we can optimize the HTTP interactions between the mobile solution and the web service to reduce the bandwidth use. In future work, we will focus on improvement of the virtual character quality to support facial and body expression and we will develop other client versions on other mobile operating systems such as Iphone OS and Black Berry OS.

References

1. Albert, L.H.: Web 2.0 and Virtual World Technologies: A Growing Impact on IS Education. Journal of Information Systems Education 20(2), 137–144 (2009)
2. Annelies, B., Jean-Paul, S., Jean-Claude, M., Cyril, V.: Diva, une architecture pour le support des agents gestuels interactifs sur internet. Technique et Science Informatiques 29(7), 777–806 (2010)
3. Bouchard, D.: Sign Languages & Language Universals: The Status of Order & Position in Grammar. Sign Language Studies 91, 101–160 (1996)
4. Dreuw, P., Stein, D., Deselaers, T., Rybach, D., Zahedi, M., Bungeroth, J., Ney, H.: Spoken Language Processing Techniques for Sign Language Recognition and Translation. Technology and Disability 20(2), 121–133 (2008)
5. Efthimiou, E., Fotinea, S., Hanke, T., Glauert, J., Bowden, R., Braffort, A., Collet, C., Maragos, P., Goudenove, F.: DICTA-SIGN: Sign Language Recognition. In: The Representation and Processing of Sign Languages: Corpora and Sign Language Technologies (CSLT 2010), Valletta, Malta, pp. 172–178 (May 2010)
6. Jemni, M., Elghoul, O.: A System to Make Signs Using Collaborative Approach. In: Miesenberger, K., Klaus, J., Zagler, W.L., Karshmer, A.I. (eds.) ICCHP 2008. LNCS, vol. 5105, pp. 670–677. Springer, Heidelberg (2008), doi:10.1007/978-3-540-70540-6_96
7. Mata, F., Jaramillo, A., Claramunt, C.: A mobile navigation and orientation system for blind users in a metrobus environment. In: Tanaka, K., Fröhlich, P., Kim, K.-S. (eds.) W2GIS 2011. LNCS, vol. 6574, pp. 94–108. Springer, Heidelberg (2010), doi:10.1007/978-3-642-19173-2_9
8. Marschark, M., Harris, M.: Success and failure in learning to read: The special case of deaf children. Journal: Reading Comprehension Difficulties: Processes and Intervention, 279–300 (1996)
9. Official SignWriting web site, `http://www.signwriting.org`
10. Official Sign Smith web site, `http://www.vcom3d.com`
11. Wheatley, M., Pabsch, A.: Sign Language in Europe. In: 4th Workshop on the Representation and Processing of Sign Languages: Corpora and Sign Language Technologies, LREC, Malta, pp. 251–255 (2010)