

# Bidirectional Sign Language Translation System - bookstall

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**Abstract.** *Currently, there is a huge difficulty in the deaf community to establish direct communication between people or to obtain information, and with the advance of technology, new methods have emerged to make their daily lives easier, a concrete case is VirtualSign. However, this technology needs to be implemented in different areas. The main objective of this project is the development of an inclusive application, to be implemented in a bookstall, where it is possible to make bidirectional translations of texts into sign language and vice versa. The creation of this application uses VirtualSign technology as a sign language recognition system, for this task a camera is used to capture movements and the respective screen to clearly present the respective information. It will serve for better integration of the deaf community. The project developed here was based on the suggestion of Professor Paula Escudeiro and in cooperation with GILT/ISEP. In summary, this project aims to develop an application for a bookstalls that allows bidirectional translations between texts and sign language. It uses VirtualSign technology for sign language recognition. The application aims to improve the integration of the deaf community.*

**Keywords.** Inclusive application, bookstall, sign language, VirtualSign, hearing impairment

# 1 Introduction

The project, documented in this report, was developed as part of the Thesis/Dissertation/Internship (TMDEI) curricular unit, in the Master's degree in Computer Engineering, in the specialization area of Graphics and Multimedia Systems, at the Superior Institute of Engineering in Porto. It tries to improve the inclusion of the deaf community in a bookstall environment using VirtualSing technology.

Since currently, according to data provided by the Portuguese Association of the Deaf (APS), there are about 30,000 deaf people who have the ability to communicate through Portuguese Sign Language (LGP). Its use may facilitate this community in some day-to-day operations such as ordering a book or an article, for example.[1]

## 1.1 Problem

With the evolution of technology in recent years, customer service has improved significantly with the integration of new emerging technologies. However, the needs of a small but significant population of hard-of-hearing individuals are often overlooked in these advancements.

Unfortunately, many individuals in the general population are unfamiliar with LGP, which makes communication difficult for those who rely on it. This lack of understanding can have significant consequences, as it can make everyday activities like acquiring a book or communicating with others challenging and time-consuming. While some hard-of-hearing individuals can read and write, this is not always a feasible alternative.

The use of sign language, on the other hand, is not that simple. Just like phonetic languages have differences between them, there are numerous variations among different sign languages, including different ways of expressing meaning through various gestures in LGP.

To overcome this issue, it's crucial to promote greater awareness and understanding of LGP among the general population. Educational programs and initiatives can be introduced to help people learn the language and communicate more effectively with hard-of-hearing individuals.

It's essential to recognize that sign language is not a universal language, and different countries and regions have unique sign languages with their own grammar and syntax. Likewise, LGP has its nuances and subtleties that are not always understood by those who are not familiar with it.

Therefore, it's crucial to consider the needs of hard-of-hearing individuals when designing new technologies and customer service systems. By incorporating features like captioning, interpreting, and voice recognition software, companies can create a more inclusive environment that caters to everyone's needs.

We must strive to create a world that is more inclusive for hard-of-hearing individuals. This includes recognizing the importance of LGP as a language and incorporating features that make communication easier for everyone. By doing so, we can ensure that no one is left behind and that everyone can access the same opportunities and experiences.

## 1.2 Objective

This project aims to address a gap in terms of social inclusion for the deaf community in a bookstore. The intention is to develop an application for this context. The application will use VirtualSign[5] to interpret gestures captured through a camera and data collected from a glove,

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in order to present the transmitted message in text format. Additionally, the inverse process will be developed so that users who do not know LGP can also communicate with other users.

### 1.3 Existing restrictions

Throughout this project, we may encounter problems, in this specific case, monetary problems due to the high cost of hardware components required for gesture recognition.

Another restriction is that this system is not portable. To improve the system's functionality and performance, it will always be necessary to introduce new gestures to train the system, thus reducing the number of translation errors that may occur.

## 2 Research on the Deaf Population

At the moment, it is not possible to determine with great accuracy the exact number of people who have this type of limitation, but it is possible to get an idea that the number of cases has been decreasing, perhaps also due to advances in technology in the medical sector as well as in early prevention. We can verify through the 2001 Census, 84,172 hearing-impaired individuals were registered. However, these data are not specific to the cause of the disability, whether it is due to health, age, or accidents.[2]

### 2.1 About VirtualSign

As previously mentioned, this is a bidirectional translation system that works automatically and in real time between text and sign language. It can be used in different situations, however, the necessary equipment for its correct functioning and possible improvements in the gesture library should be considered.[3] The application's operation is very simple regarding the translation of text to sign language. The program will check the text and make a reproduction through an animated avatar.[4] In the reverse translation process, the application will recognize the gestures made by the user through a camera (Kinect) and smart gloves. After this process, the information is presented in text format.

### 2.2 Kinect

The Kinect[6] is a device developed by Microsoft, initially developed for the X-Box 360 console. With this device, it became possible to detect and interpret user movements. It has an RGB camera, a monochrome camera, and an infrared sensor, what makes it possible to recognize a 3D scene and thus recognize all movements in the scene. However, the device is not prepared for sign language recognition, and therefore other devices are needed. The camera does not support face recognition, which is also a crucial tool in sign language.

### 2.3 Smart gloves

These gloves serve to capture hand and finger movements. The gloves are equipped with various sensors, such as accelerometers, which will interpret all movements made. Currently, these devices have some problems, such as the time it takes to put them on, and the price, which can vary considerably depending on the material used.

## 3 Conclusion

In conclusion, this project highlights the need for greater inclusivity for the hard-of-hearing community, particularly those who use LGP to communicate. The lack of awareness and understanding of LGP in the general population can create significant barriers for those who rely on it, making everyday activities challenging and time-consuming. To address this issue, educational programs and initiatives can be introduced to promote greater awareness and understanding of LGP.

Moreover, incorporating features such as captioning, interpreting, and voice recognition software in new technologies and customer service systems can create a more inclusive environment that caters to everyone's needs. This project aims to contribute to this effort by developing an application using VirtualSign to interpret LGP gestures and present them in text format, making it easier for hard-of-hearing individuals to communicate in a bookstore environment. By recognizing the importance of LGP as a language and designing technologies that cater to the needs of hard-of-hearing individuals, we can create a world that is more inclusive for everyone.

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