



SIGNON

SignON

**Sign Language Translation Mobile Application and Open
Communications Framework**

Deliverable D6.6 – SignON Market Analysis



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Acronyms

The following table provides definitions for acronyms and terms relevant to this document.

Acronym	Definition
ADA	Americans with Disabilities Act
AI	Artificial Intelligence
App	SignON Communication and Translation Mobile Application
ASL	American Sign Language
ASR	Automatic Speech Recognition
AT	Assistive Technology
AVMSD	Audio-Visual Media Services Directive
BSL	British Sign Language
CoE	Council of Europe
DHH	Deaf or Hard of Hearing
DL	Deep Learning
DoA	Description of the Action
EAA	European Accessibility Act
EUD	European Union of the Deaf
GA	Grant Agreement
GDPR	General Data Protection Regulation
IS	International Sign
ISL	Irish Sign Language
LHR	Linguistic Human Rights

LSE	Spanish Sign Language (Lengua de Signos Española)
MT	Machine Translation
NGT	Sign Language of the Netherlands (Nederlandse Gebarentaal)
SignON	Both the service and this project (GA 101017255)
SL	Sign Language
SLR	Sign Language Recognition
UDHR	Universal Declaration of Human Rights
UI	User Interface
UNCRPD	United Nations Convention on the Rights of Persons with Disabilities
VGT	Flemish Sign Language (Vlaamse Gebarentaal)
WAD	Web Accessibility Directive
WFD	World Federation of the Deaf
WHO	World Health Organisation
WP	Work Package

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Executive Summary

This report introduces the SignON next-generation, user-centred co-created Sign Language Machine Translation service, and an analysis of its intended markets and policy context. The initial core potential users of SignON are people who use sign language as their first language, their family, friends and co-workers, as well as interpreters, NGOs, the scientific community, regulators, policy makers and external service providers. In section 3.3 these are estimated to be 2.5 million users in the EU and 10 million globally.

1. Introduction

As the digital transformation of society accelerates, the use of mobile devices and applications can significantly improve the daily life of citizens. Leveraging on multidisciplinary expertise drawing on knowledge from both the technological and human sciences, novel technologies, such as automatic translation as well as speech and sign recognition and synthesis, can offer inclusive human-centric solutions facilitating communication between deaf, hard of hearing people and hearing people¹.

SignON will be such a novel mobile application translating between spoken and signed languages (SL) for people who are deaf or hard of hearing, particularly with languages that are under-resourced (such as Irish). The project is leveraging the current state-of-the-art in translation between all official spoken and sign languages of the EU Member States and associated countries for efficient and effective use on mobile devices. The project is exploring how end-users can best interact and cooperate with the application and how the system adapts to users in real-life conditions and prevents unintended gender bias in translation. The resulting SignON mobile application will be open source, robust, cost-effective, and validated across a wide spectrum of users.

SignON is an EU Horizon 2020 Research and Innovation project (<https://signon-project.eu>) that is researching and developing the SignON communication service that uses machine translation (MT) to translate between sign and spoken languages. This service will facilitate the exchange of information among Deaf and Hard of Hearing (DHH), and hearing individuals. In this user-centric and community-driven project the Partners are tightly collaborating with European DHH communities to (re)define use-cases, co-design and co-develop the SignON service and application, assess the quality and validate their acceptance. The ultimate objective is the fair, unbiased and inclusive spread of information and digital content in European society.

The SignON App will have a lightweight interface. The SignON Framework of services, however, will be distributed on a cloud platform where the computationally intensive services will be executed. The project is initially targeting Flemish Sign Language (VGT), Sign Language of the Netherlands (NGT), Irish Sign Language (ISL), British Sign Language (BSL) and Spanish Sign Language (LSE), and English, Irish, Dutch and Spanish spoken languages. However, SignON will eventually incorporate machine learning (ML) capabilities that will allow (i) learning new signed and spoken languages; (ii) style-, domain- and user-adaptation and (iii) automatic error correction, based on user feedback.

¹ <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/ict-57-2020>

This report is the first output of the project’s task T6.4 “Sustainable Exploitation of the SignON Services and Mobile Apps”, which introduces the SignON next-generation Sign Language Machine Translation (SL MT) service and an analysis of its intended markets. While SignON will benefit everyone, its initial core market of potential users are people who use SL as their first language, their family, friends, and co-workers, as well as interpreters, NGOs, the scientific community, regulators, policy makers and external service providers, estimated to be 2.5 million in the EU and 10 million globally.

2. SignON Mobile App Service

SignON will be an advanced Mobile App and Framework service that translates signed languages (SLs) into spoken languages and vice versa. It paves the way for a new era in which not only spoken languages but also SLs will be accessible through automated translation, for everyone. SignON's mission is to optimise communication for DHH and hearing people, facilitating communication between all. When using SignON, those unable to hear will be able to access online and offline services, video chats and search engines in their native languages. SignON will be online and mobile.

As described in the project's Description of Action (DoA), the SignON SL Translation App will be intuitive and easy-to-use, interfacing with the cloud-based SignON platform where the computationally intensive tasks of the SignON Framework will be executed.

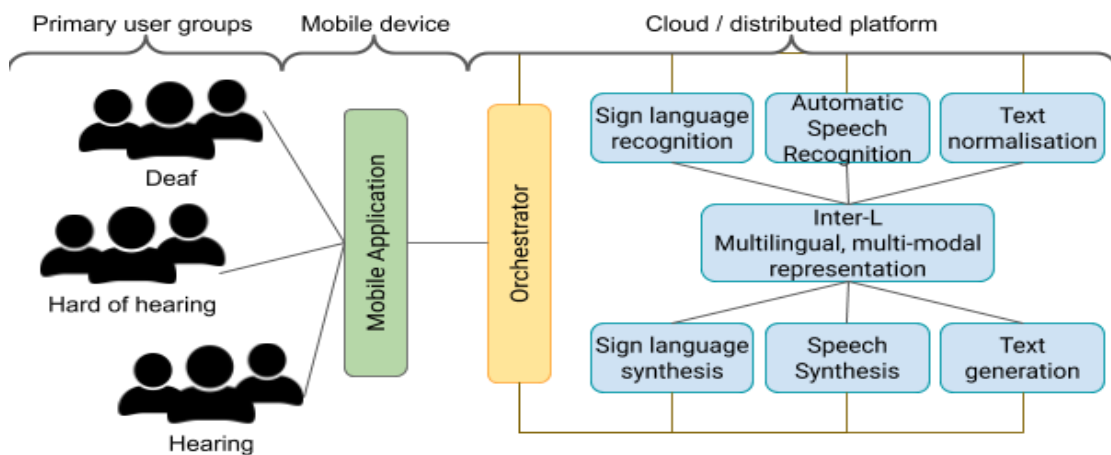


Figure 1 SignON Translation Communication App and Service

The SignON communication and translation mobile application will run on standard modern smartphone and tablet devices and Operating Systems, using their existing cameras, other input sensors and user interfaces. In line with User Experience Design and Design Thinking², the project is using an Agile DevOps approach³ with iterative fast prototypes to enable users to become actively involved in the co-creation process of its functional specification and its co-development (through formative evaluation in WP1) from early in the project. The co-creation approach ensures wide uptake, improved SL detection and multilingual speech processing on mobile devices for everyone as the SignON service will be a smart phone application running on standard modern devices.

² As described in D1.4 "First Technical Requirements & User Research (UX design) Report", June 2021

³ <https://devops.com/how-to-combine-devops-and-agile/>

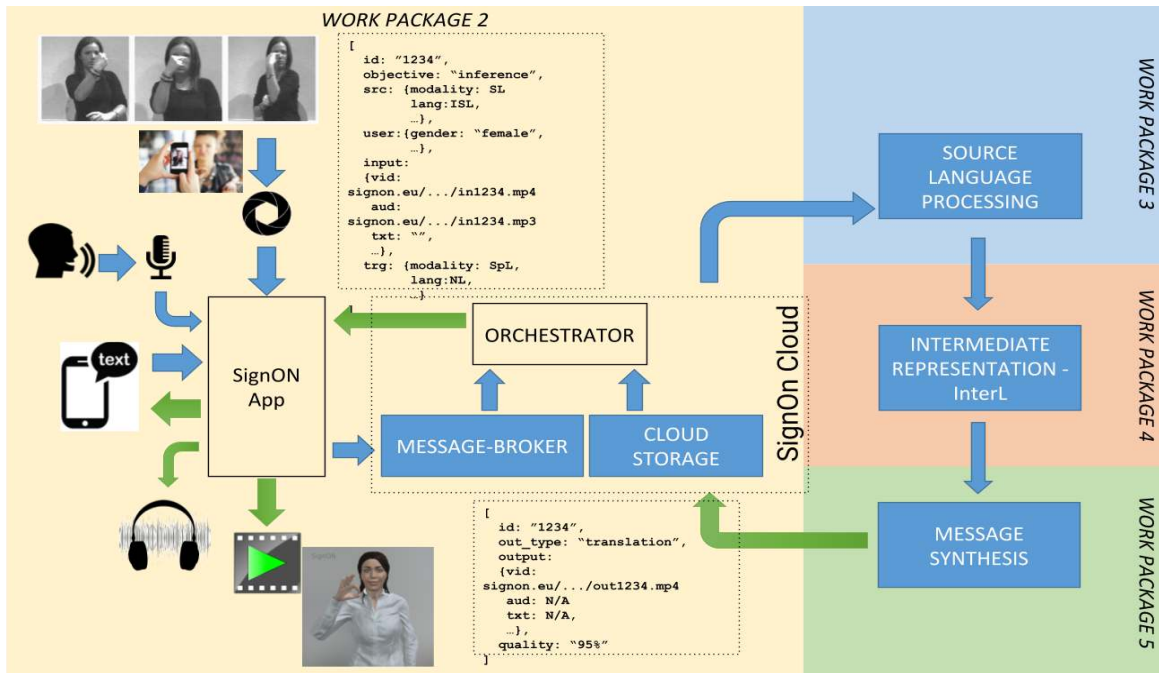
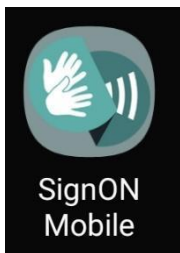


Figure 2 SignON Framework Services



The current initial fast-prototype SignON Mobile App is simple but powerful, running on Android and Apple phones. It provides text/speech translations and an idea of how SL translation might look in the future. This evolving prototype demonstrates early SignON features, so that users can start to see, hold and feel something tangible and provide realistic inputs on what they need, and for the developers to get an appreciation of the realities of the mobile app platform and cloud requirements. This prototype is being iteratively improved based on the user-driven feedback of WP1 (using an iterative DevOps approach).

While the final SignON App will be functionally very rich, as discussed above, the current fast prototype SignON App was demonstrated on Android with the following 3 major elements of the SignON Framework:

- SignON Mobile App Input Functions,
- SignON Platform and Framework Services,
- SignON Mobile App Output Functions

As follows:

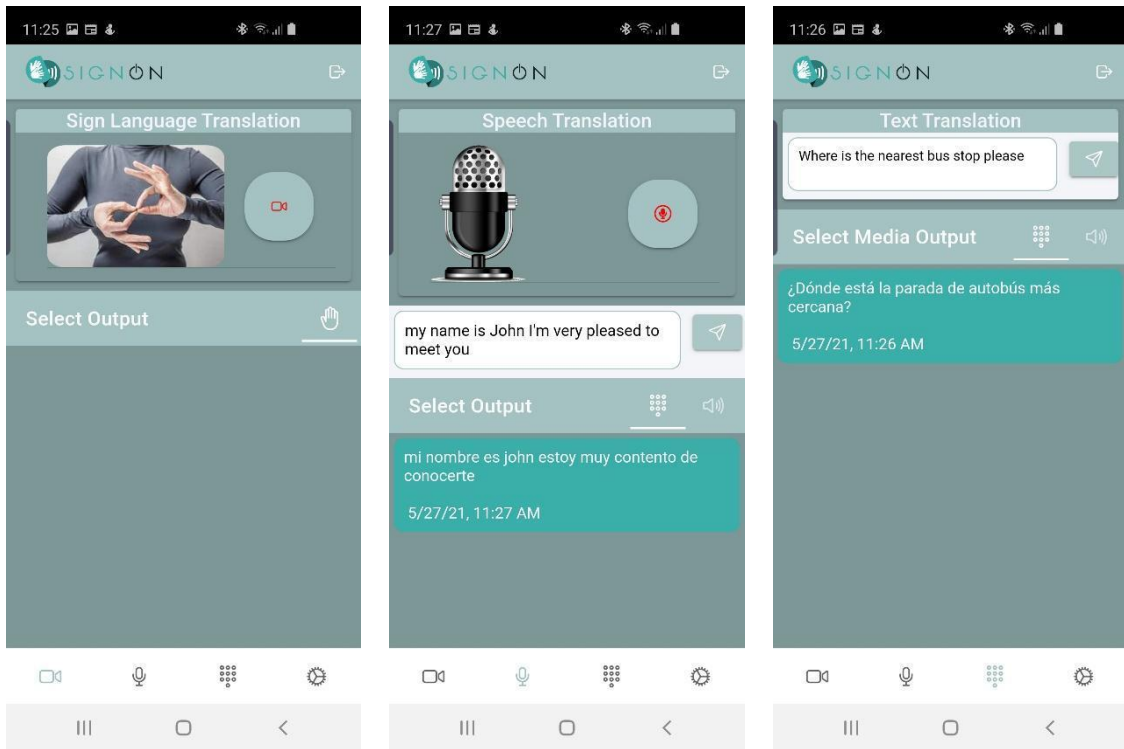


Figure 3 SignON Mobile App Translation Screens

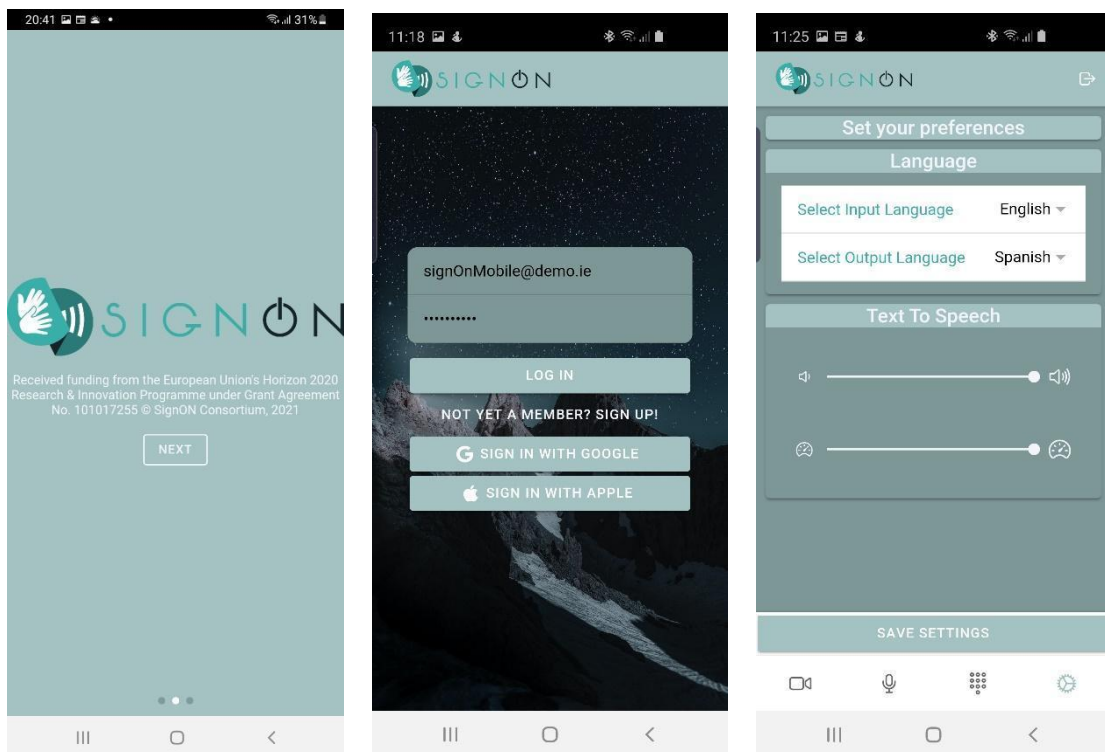


Figure 4 SignON Mobile App User Preferences

Based on users’ requirements and feedback to date⁴, the functionality of the SignON Mobile App will be as follows:

SignON App Features	User Technical Requirements
A. User’s Mobile Device	<ol style="list-style-type: none"> 1. The SignON App must be easy and intuitive to use, simple but powerful, to run on standard modern phones and tablets. 2. The SignON Mobile App will be free and easily downloadable by users from the Google Play Store for Android phones and tablets, and from the Apple App Store for iPhones and iPads. 3. All the SignON Mobile App’s user’s inputs and outputs will be on a single mobile user device to communicate in-person with people nearby. 4. Future versions may work with a messaging app (such as WhatsApp) on the same user device, to facilitate communication with people who are not present at the time. 5. The user’s Mobile Device must have broadband data internet access for the App to operate using the SignON Framework cloud-based services. <ol style="list-style-type: none"> a. Future versions may provide limited off-line operation, such as a user selectable vocabulary of Signing GIFs, if requested by users.
B. System Performance	<ol style="list-style-type: none"> 1. Translation/conversion will be a unidirectional operation with users taking turns to input their messages of up to 30 seconds. <ol style="list-style-type: none"> a. Users may choose to store messages on their own device, but messages will not be retained by the Framework cloud system. Data privacy and protection will be explicitly stated to the user. b. Video, audio or text streaming will not be provided. 2. Translation/conversions and user login/authorisations should: <ol style="list-style-type: none"> a. Respond within 2 seconds – with a maximum of 5 seconds for SL-to-SL translations to enable effective user communications. b. Provide user-acceptable accuracy for 75% of users. 3. Users should have at least a 75% average satisfaction rating with the overall operation of the SignON service. 4. The SignON App will automatically and securely login and authorise the user to the SignON Framework services, after a one-time short and simple manual user setup and authorisation.
C. User Preferences	<ol style="list-style-type: none"> 1. The SignON App will provide one-tap user-selectable translation and conversion between any combination of: <ol style="list-style-type: none"> a. Flemish Sign Language (VGT), Sign Language of the Netherlands (NGT), Irish Sign Language (ISL), British Sign Language (BSL) and Spanish Sign Language (LSE). b. English, Irish, Dutch and Spanish spoken languages. 2. The App will provide, and retain, user selectable <ol style="list-style-type: none"> a. default personalised options for the User Interface, App text languages and favourite settings. b. UI display, audio and text options, including contrast and SL avatar customisation.
D. Sign Language Translation	<ol style="list-style-type: none"> 1. User SL Input <ol style="list-style-type: none"> a. No additional special attachments or special lighting will be required for capturing SL input. The App will automatically adapt to input ambient light conditions, within the limits of the user’s device. b. User-selectable use of either selfie or forward-facing device video camera live, or a pre-recorded video. c. SLR accuracy and operation to be acceptable to 75% of users: <ol style="list-style-type: none"> i. Accommodating both formal and informal styles. ii. Covering regional signs, age variation & fingerspelling.

⁴ See D1.4 “First Technical Requirements & User Research (UX design) Report”, June 2021

	<ul style="list-style-type: none"> iii. Recognising emotion (through facial expression and signing style). iv. Attending to specific SL grammar. d. Future versions may include a user option to add new signs, or have SignON learn them through repeated use of certain signs. e. Should perform better than the SignAll automatic translation of ASL to English for all of SignON’s supported SLs. <p>2. User SL output</p> <ul style="list-style-type: none"> a. A user acceptable and customisable 3D virtual signer, which focuses on linguistic accuracy. This means accurate hand forms, hand and finger movements, body movement, posture, the right speed and facial features such as showing the right emotion, lip movement, eyebrows and eye gaze. Apart from this, the avatar must be user customisable to gender, skin colour, and contrasting colours in clothing and background. b. Have a user option to include message text to confirm and correct the accuracy of the avatar’s signing. c. Overall performance should be better than the SiMAX avatars.
<p>E. Speech and Text Translation</p>	<ul style="list-style-type: none"> 1. For normal and atypical, formal and informal, speech. 2. User preselection, and an option for automatic detection of the user’s input text and speech languages. 3. Indicate visually that speech is being recorded and played back (for DHH users). 4. User option to store conversation message texts on the user’s device. 5. Future versions may translate/answer phone calls, interpret emotions and ambient background noise, and use symbols or simple text. 6. Overall performance should be better than Google Translate.

Table 1 User technical requirements of the SignON Mobile App

2.1 Users Benefits from the SignON Machine Translation System

The SignON service will bridge the gap between the Deaf⁵ community, people who are hard of hearing⁶ (including people with implants), hearing people (including family members, friends, and co-workers of Deaf people), industry partners and policy maker user groups and promote inclusion of

⁵ Concerning the Use of deaf/Deaf: EUD doesn’t make a distinction anymore between D and d because the identity is too complex to be reduced into a binary definition. See p. 12 of “The Legal Recognition of Sign Languages: Advocacy and Outcomes Around The World”, by Maartje de Meulder, Joseph J. Murray and Rachel L. McKee, Jun 2019, Multilingual: Title Detail The Legal Recognition of Sign Languages by Maartje De Meulder (<https://www.multilingual-matters.com/page/detail/?k=9781788923996>), which states “Researchers working with deaf communities have sought to highlight the fact that deaf people are not merely people with different audiological status, but also people who use sign language and have been seen to create cultural communities within their larger societies. For the past four decades, researchers used the term “deaf” to signify people with a hearing loss who do not sign and “Deaf” to mean members of a sign language using community. A number of researchers are currently moving away from the practice of using the term “Deaf” for signing deaf people and “deaf” for non-signing deaf people, instead preferring to use only “deaf”. They see this dichotomy as an oversimplification of what is an increasingly complex set of identities and language practices, which are impossible to represent with a simplified binary (Kusters et al.,2017). In the Introduction and Epilogue of this volume, the editors have followed this practice of only using “deaf” to refer to individual deaf people. Individual chapter authors were informed about this current practice and then given the choice to use only “deaf” or also “Deaf”. Some decided to continue to use capitalized “Deaf” in some instances, with reasons ranging from adhering to earlier practice to acknowledgement of the wishes of deaf communities in their countries, in which “Deaf” is still widely used”

⁶ Kätsyri, J. (2015): A review of empirical evidence on different uncanny valley hypotheses: support for perceptual mismatch as one road to the valley of eeriness, *Frontiers in Psychology*, 6, art.390.

the Deaf community into society by providing an open source and scalable solution for real-time translation between SL, text and speech in the languages.

The business benefits of SL MT go beyond demonstrating Corporate Social Responsibility (CSR), which in itself is considered as an asset within many companies, as follows:

- The SignON App will provide accessible communication for Deaf and Hearing signers and non-signers in every-day communicative situations, in order that both parties can feel at ease, expressing themselves in their first and preferred language.
- The SignON application could be used and personalised in the case of a formal dialogue between a Deaf (signer) and Hearing (non-signer), where one is an expert in the topic of communication, and the other is not.
- SignON will facilitate communication between a Deaf person using speech and a Hearing person using atypical speech recognition, translation to SL and signed through the SignON avatar.
- SignON will provide text to SL translation for media broadcasting, so that information can be broadcast in a timely manner to all members of society, including Deaf society. However the quality of signing must be as good as a human signer.
- Will translate SL to speech and/or text.
- Will translate speech or text to SL.
- Will support multi-lingual and multi-modal UI options.
- Will be used on any mobile device or smartphone that has a camera and internet connection.
- Will accommodate third party modules, enhancements and languages.
- Will support being trained to translate any sign or spoken language.

SignON will also impact academic research, industry innovation and business progression through its state-of-the-art advancements in real-time SL linguistics, Sign Language Recognition (SLR), Natural Language Processing (NLU), ASR (Automatic Speech Recognition, including atypical speech), MT and 3D avatar technology, and their underpinning fundamentals. The platform and its constituent tools will offer an alternative vision for the governance and values of SL translation and will be publicly available to end-users in the form of a mobile app for real-time translation. SignON will establish a new vision for SLR and translation to different EU languages and foster communication, exchange of information, business creation, learning and knowledge acquisition with an inclusive and open society, and offer a real-time service co-created by the user.

The initial core potential users of SignON are people who use sign language as their first language, their family, friends, and co-workers, as well as interpreters, NGOs, the scientific community, regulators, policy makers and external service providers.

3. Sign Language Machine Translation Market Analysis

Over 5% of the world’s population have ‘disabling’ hearing loss (432 million adults and 34 million children)⁷. The WHO estimates that by 2050 over 700 million people – or one in every ten people – will have disabling hearing loss⁸.

A person who is not able to hear as well as someone with normal hearing – hearing thresholds of 20 dB or better in both ears – is said to have hearing loss. Hearing loss may be mild, moderate, severe or profound. It can affect one ear or both ears, and leads to difficulty in hearing conversational speech or loud sounds. 'Hard of hearing' refers to people with hearing loss ranging from mild to severe. People who are hard of hearing usually communicate through spoken language and can benefit from hearing aids, cochlear implants and other assistive devices as well as captioning⁹. 'Deaf' people mostly have profound hearing loss, which implies very little or no hearing. They often use SLs for communication¹⁰.

3.1 Sign Languages (SL)

SL is a way of communicating using gestures of the hands, arms, head, shoulders, torso and parts of the face, mainly used by DHH people and hearing people in their environment. SLs are unique and independent of spoken languages. According to the Convention on the Rights of Persons with Disabilities, "sign language is inseparable from Deaf people's human rights. Without sign language, Deaf people are not equal". According to the World Federation of the Deaf (WFD) there are around 72 million people worldwide who use sign language¹¹.

There are between 138 and 300 different types of SL used around the world today¹². The number is not known with any confidence; new SLs emerge frequently through creolisation and de-novo (and occasionally through language planning)¹³. In some countries, such as Sri Lanka and Tanzania, each school for the Deaf may have a separate language, known only to its students and sometimes denied by the school; on the other hand, countries may share SLs, although sometimes under different

⁷ “Computing for deaf people: The race to teach sign language to computers”, *Economist*, 6th March 2021. www.economist.com

⁸ “Deafness and hearing loss”, WHO Factsheet, April 2021, [Deafness and hearing loss \(who.int\)](https://www.who.int/news-room/factsheets/detail/deafness-and-hearing-loss)

⁹ Now available as mainstream videoconferencing services e.g. [Viewing closed captioning and live transcription – Zoom Help Center](#) and [Use live captions in a live event \(microsoft.com\)](#)

¹⁰ “Deafness and hearing loss”, WHO Factsheet, April 2021, [Deafness and hearing loss \(who.int\)](https://www.who.int/news-room/factsheets/detail/deafness-and-hearing-loss)

¹¹ [International Day Of Sign Languages 2020: Facts And Human Rights Of Sign Language Users \(ndtv.com\)](#)

¹² [Sign Language Alphabets From Around The World - Ai-Media creating accessibility, one word at a time.](#)

¹³ [List of sign languages - Wikipedia](#)

names (e.g. Croatian and Serbian, Indian and Pakistani). Deaf SLs also arise outside educational institutions, especially in village communities with high levels of congenital deafness, but there are significant SLs developed for the hearing as well, such as the speech-taboo languages used in aboriginal Australia.

SLs can be grouped as follows:¹⁴

- Deaf sign languages, which are the preferred languages of Deaf communities around the world; these include village sign languages, shared with the hearing community, and Deaf-community sign languages.
- Auxiliary sign languages, which are not native languages but sign systems of varying complexity, used alongside spoken languages. Simple gestures are not included, as they do not constitute language¹⁵.
- Signed modes of spoken languages, also known as manually coded languages, which are bridges between signed and spoken languages

One in a thousand persons in the EU (approximately half a million DHH persons) communicates in one of 31 national or regional SLs as their first language¹⁶.

3.2 SignON Target Groups

The SignON Mobile App and Framework services are targeting 5 User groups.

Primary:

1. Deaf community (signers): Members of European Deaf communities, who identify as a linguistic and cultural minority group and use an SL as their primary or preferred way of communication. Some might use hearing aids or cochlear implants.
2. Deaf and Hard of Hearing people (non-signers): People who are Deaf or Hard of Hearing, but do not identify themselves as members of a Deaf community necessarily. They use a spoken

¹⁴ As listed at [List of sign languages - Wikipedia](#)

¹⁵ For International Sign (IS), the EUD has stated in a position paper, that IS “is sometimes also referred to as an auxiliary language where meaning has to be negotiated between signers. IS Signers reportedly use a set of signs from their own national sign language mixed with highly iconic signs that can be understood by a large audience. Additionally, grammatical features that are thought to be common among (Western) sign languages are drawn upon. This can be classifiers, role-play, and general non-manual features, among others. It has therefore been said that IS is more of a language than a typical pidgin”. [International Sign | European Union of the Deaf \(eud.eu\)](#)

¹⁶ [Sign languages in the EU \(europa.eu\)](#)

language as their primary and preferred way of communication. Some might use hearing aids or cochlear implants.

3. Hearing People related to Deaf people or the Deaf community: Hearing people with a connection to a Deaf community and SLs. Involves hearing family, colleagues or relatives of Deaf people, students in interpreting classes or people with a general interest in sign languages.

Secondary:

4. Sign Language interpreters: Deaf and hearing SL interpreters. Hearing interpreters are mostly late SL learners, although a smaller percentage of this group is CODA (child of a deaf adult). Deaf interpreters mostly interpret from and to their national SL, or other SLs.
5. Scientific Community, NGOs, Regulators, Policy Makers, and external Service Providers, Clients and Investors: People with a scientific, political or economic link to this project, in a wide range of domains, including MT, NLP, language resources, speech technologies, SL linguistics, Deaf studies, etc.

3.3 Market Size

The number of Europeans (not only EU) “with a hearing impairment great enough to adversely affect their daily lives”¹⁷ is 16%, just under 1 in 6. In the EU, there are 34.4 million adults with a disabling hearing loss. Globally, there are 468 million people with disabling hearing loss. This is over 5% of the world's population; 34 million of these are children. There are more than 70 million Deaf people who use an SL as their first language or mother tongue.¹⁸ So the need and market potential for the SignON Mobile Application and Service is huge, while it's a free and open-source Framework, APIs and platform will enable profound innovation and integration of third-party products and enhancements in the years ahead.

The core potential users for SignON are people who use SL as their first language, their family, friends, and co-workers, as well as interpreters, NGOs, the scientific community, regulators, policy makers and external service providers. These hearing users are assumed to be an average of 4 per DHH person. So, in Europe, where about 85% of people have access to a mobile device and internet that can run the SignON service¹⁹, there are about 2.5 million potential users of the SignON SL MT

¹⁷ European Federation of Hard of Hearing People. [Hearing Loss: The Statistics 2015](#) 12 p.

¹⁸ https://en.wikipedia.org/wiki/List_of_sign_languages

¹⁹ [GSMA | The Mobile Economy Europe 2018 - The Mobile Economy](#)

system. While globally, 53% of people have mobile Internet access²⁰, but perhaps just 5% to 10% are modern devices that can run SignON, so there are about 10 million potential users of SignON.

3.4 Machine Translation (MT)

Machine translation (MT) is a core technique for reducing language barriers [for spoken languages]. Although MT has come a long way since its inception in the 1950s, it still has a long way to go to successfully cater to all communication needs and users. When it comes to the Deaf community, MT is in its infancy²¹.

The rapid technological and methodological advances in deep learning (DL), and in AI in general, that have been seen in the last decade, have not only improved MT, the recognition of image, video and audio signals, as well as the understanding of language, and the synthesis of life-like 3D avatars, etc., but have also led to the fusion of interdisciplinary research innovations that lays the foundation of automated translation services between signed and spoken languages.

3.5 Sign Language interpretation Market

Currently, human interpreters are the main medium for signed-to-spoken, spoken-to-signed and signed-to-signed language translation. The availability and cost of these professionals is often a limiting factor in communication between signers and non-signers.

There are approximately 10,000 trained SL interpreters in the EU Member States²², of which around 5,500 are working regularly. Unfortunately, these numbers are approximate due to different registration systems throughout the EU. An SL interpreter could for example still be registered, although they are long retired or are currently working in a different position, or taking a leave of absence. Furthermore, there are many interpreters working who are not automatically registered with the State system because they are not fully qualified yet or because registering does not provide an incentive to the interpreter's work.

According to estimates by the various Deaf Associations in their countries, there are about 800,000 Deaf SL users in the EU. When comparing the number of registered SL interpreters to the number of Deaf SL users in the EU, one can see that on average there is 1 SL interpreter to 200 Deaf SL users.

²⁰ [10 Internet Statistics Every Marketer Should Know in 2021 \[Infographic\] \(oberlo.com\)](#)

²¹ [AT4SSL @MTSummit2021 \(google.com\)](#)

²² Wheatley, M. & Pabsch, A. (2012). Sign Language Legislation in the European Union - Edition II. Brussels: EUD, [Sign Language Legislation in the European Union - Edition II ebook | European Union of the Deaf \(eud.eu\)](#)

This number however, is not representative across all EU Member States. In Finland for example there are just over 8 SL users to 1 SL interpreter, whereas in Romania there are an estimated 754 Deaf SL users to 1 SL interpreter. Only 8 countries are above the average amount, the rest are considerably lower than average. 13 countries have between 60 and 200 SL users per interpreter. The second lowest ratio can be found in Denmark, (13:1), closely followed by Sweden (17:1). The Scandinavian countries are therefore the countries with the lowest ratios by far. Portugal has the second highest ratio with 600:1, closely followed by Germany (400:1). In general, it can be said though, that there is a north-south divide and a west-east divide, although the existence of SL legislation also has a role to play, as can be seen with the Luxembourg ratio of 200:1.

3.6 Sign Language Translation Market

SL translation technologies are limited in the same way as spoken language translation. None can translate with 100% accuracy. In fact, SL translation technologies are far behind their spoken language counterparts. Where spoken languages are articulated through the vocal tract, SLs are articulated through the hands, arms, head, shoulders, torso and parts of the face. This multi-channel articulation makes translating SL very difficult. An additional challenge for SL MT is the fact that there is no formal written format for SLs. There are notation systems, but no writing system has been adopted widely enough, by the international Deaf community, that it could be considered the 'written form' of a given SL. Sign Languages then are recorded in various video formats. There is no gold standard parallel corpus that is large enough for SL MT, for example²³.

SignON is a next generation solution for automated sign language translation that can help improve the lives of 70-100 million people whose native language is SL. The SignON project assures participation in the social development of the Deaf community within the hearing world without harming their culture and identity. At the same time the project offers a significant and scalable market advantage both by selling our service and by unlocking new service markets for Deaf people. In the USA alone, the SL translation market is over €2B²⁴, and the growth potential of services that are not yet accessible for the Deaf is impressive.

Globally over 70 million people are Deaf and 700 million are Hard of Hearing, resulting in a global shortage of SL interpreters. The lack of easily available interpreters makes services expensive and

²³ [Machine translation of sign languages - Wikipedia](#)

²⁴ [SignAll | Social Enterprise | F6S Profile](#)

difficult to access²⁵. SignON will be an inexpensive and user-friendly solution that will significantly improve the inclusion of DHH to the society.

SignON will be an inexpensive and user-friendly solution that will significantly improve the inclusion of DHH to the society. While much market analysis is based on mainly prior studies from a hearing framework, rather than the domain of "deaf studies" (by deaf researchers for example), the SignON App and Services are being co-created, co-developed and driven by the needs of potential users and expectations of deaf signers and academics to always ensure the deaf perspectives²⁶. For instance, inclusion does not automatically mean the use of SL-interpreters²⁷, even though audio-visual media services are part of the potential market, deaf people generally don't want SL avatars for television programs²⁸.

²⁵ [SignAll | Social Enterprise | F6S Profile](#)

²⁶ See SignON D1.1 "Case studies and evidence analysis" & D6.1 "SignON Communication and Dissemination Plan", Mar 2021 at [Public Deliverables | SignON Project \(signon-project.eu\)](#)



²⁷ [Jorn #notoavatars why is there a resistance from the deaf communities_04/11/21.mp4 - Google Drive](#)

²⁸ <https://researchportal.unamur.be/en/publications/sign-language-interpreting-services-a-quick-fix-for-inclusion>

4. Sign Language Machine Translation Options Currently Available

The machine translation (MT) of SLs has been possible, in a limited fashion, since 1977, when a research project successfully matched English letters from a keyboard to ASL manual alphabet letters which were simulated on a robotic hand²⁹. These technologies translate SLs into written or spoken language, and written or spoken language to SL, without the use of a human interpreter. SLs possess different phonological features than spoken languages, which have created obstacles for developers. Developers use computer vision and machine learning (ML) to recognise specific phonological parameters and epenthesis unique to SLs, and speech recognition and natural language processing allow interactive communication between hearing and DHH people³⁰.

The following table is an overview of the typical SL MT options that are currently available:




Company	Type	Pro	Con	Cost
 SIGNALL <small>31</small>	MT	<ul style="list-style-type: none"> No interpreter required. Uses latest AI and ML tools. 	<ul style="list-style-type: none"> Requires PC & multiple sensors. Current array is unwieldy and expensive. Currently, only caters for ASL and English 	Priced on consultation.
 MOTIONSAVVY <small>32</small>	MT	<ul style="list-style-type: none"> No interpreter required. Compact off-the-shelf hardware & integrates with other systems. 	<ul style="list-style-type: none"> Solely for ASL & English. Sophisticated ML. 	No longer operating. Company ceased trading in 2019.

²⁹ [Machine translation of sign languages - Wikipedia](#)

³⁰ [Machine translation of sign languages - Wikipedia](#)

³¹ ["SignAll. We translate sign language. Automatically"](#) SignAll is an automatic SL translation system provided by Dolphio Technologies in Hungary. The team is "pioneering the first automated sign language translation solution, based on computer vision and natural language processing (NLP), to enable everyday communication between individuals with hearing who use spoken English and deaf or Hard of Hearing individuals who use ASL". The developer of the device is deaf and the rest of the project team consists of many engineers and linguist specialists from both deaf and hearing communities. The technology has the capability of incorporating all five parameters of ASL, which help the device accurately interpret the signer. SignAll has been endorsed by many companies including Deloitte and LT-innovate and has created partnerships with Microsoft Bizspark and Hungary's Renewal.

³² MotionSavvy (["MotionSavvy UNI: 1st sign language to voice system". Indiegogo](#)) was the first sign language to voice system. The device was created in 2012 by a group from Rochester Institute of Technology / National Technical Institute for the Deaf and "emerged from the Leap Motion accelerator AXLR8R."

Gnosys ³³	MT	<ul style="list-style-type: none"> • Latest AI and ML technologies. • SL to text & speech. 	<ul style="list-style-type: none"> • No information on the start-up company, Evalk. 	Not defined.
 SiMAX ³⁴	Avatar	<ul style="list-style-type: none"> • Excellent quality avatars, including lip sync, & emotional expressions. • Uses a learning database of previous translations. 	<ul style="list-style-type: none"> • Translation process requires manual editing. 	Priced on consultation.
 Hand Talk ³⁵	Avatar	<ul style="list-style-type: none"> • Website plugin. • SL dictionary App. • Well branded. 	<ul style="list-style-type: none"> • Libras (Brazilian Sign Language) only • Basic Avatar. 	Priced on consultation.
 Sogou ³⁶	Avatar	<ul style="list-style-type: none"> • Excellent Sogou Vocational & Media³⁷ Avatar. • Language-centric AI for 85% accuracy. 	<ul style="list-style-type: none"> • Sometimes avatar uses mouthing & sometimes not • China Common Sign Language only. 	Seems to be only used internally by Sogou.

³³ A Netherlands-based start-up developed this AI powered smartphone app for deaf people, which it says offers a low-cost and superior approach to translating SL into text and speech in real time. The easy-to-use innovative digital interpreter dubbed as “Google translator for the deaf and mute” works by placing a smartphone in front of the user while the app translates gestures or sign language into text and speech. The app, called GnoSys, uses neural networks and computer vision to recognise the video of the SL speaker, and then smart algorithms translate it into speech. Affordable and always available interpreter services are in huge demand in the deaf community. said Konstantin Bondar, Co-Founder & CTO of Evalk, the company which developed the app, www.expresscomputer.in/artificial-intelligence-ai/new-ai-powered-app-translates-sign-language-into-speech-in-real-time/29739/ -




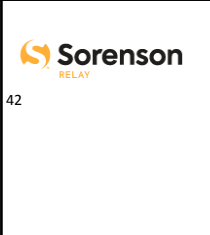
³⁴ Translates texts into SL. In many ways, embedded in videos or as an independent clip for websites, for example. SiMAX creates a translation proposal with SL experts. The software uses a learning database in which all previous translations are stored, <https://simax.media>, see also [Austria – signtime GmbH - Zero Project](#) pilot project of the European Language Grid (ELG), <https://www.european-language-grid.eu>

³⁵ Won awards around the world, the Hand Talk app is a SL dictionary of Libras (Brazilian Sign Language). Makes websites more accessible with a Libras translation plugin. www.handtalk.me

³⁶ [Sogou Launched World's First AI Sign Language News Anchor - May 18, 2021](#)
[Sogou uses biometrics to develop AI news anchor for hearing impaired | Biometric Update.](#)

Xiao Cong is a a 3D digital avatar and the latest upgrade and a breakthrough of Sogou Vocational Avatar, iterated from the transformative 3D AI news anchor. It stands out with life-like digital effects, highly comprehensible and widely accepted mannerism of presenting the sign language. Based on Sogou's leading AI technologies such as 3D digital modeling, multi-modal recognition and synthesis, facial recognition and animation and transfer learning, Xiao Cong is able to intelligently imitate hand gestures, facial expressions, lip movements, and mannerism of the sign language system. In addition, with integration of the China Common Sign Language Dictionary, Xiao Cong can immediately generate sign language broadcast video with 85% accuracy rate. Thus effectively help the hearing impaired to overcome language obstacles and achieve effective information transmission.

³⁷ See for instance “China Media Group Launches AI-Powered Sign Language Anchor for 2022 Beijing Winter Olympics” at <https://www.youtube.com/watch?v=Ma1wwZRzc9M>

	Avatar	<ul style="list-style-type: none"> ● Excellent use of Epic Games Meta Humans. ● Fast SL access to emergency messages through API calls. ● Actively working with the signing community. 	<ul style="list-style-type: none"> ● The Kara process is not real-time. ● Requires motion-captured pre-recorded animations & equipment. ● English text and audio inputs only. 	Priced on consultation.
	Translate children's books into SL	<ul style="list-style-type: none"> ● Translates into 14 different SLs 	<ul style="list-style-type: none"> ● Cannot translate SL to text as person speaks ● Limited number of book translations available (5 per each local SL). ● Difficult app to navigate: Not user friendly or intuitive⁴⁰. 	Free mobile App
	VRS (Video Relay Services)	<ul style="list-style-type: none"> ● Person-to-Person translation 	<ul style="list-style-type: none"> ● Expensive to purchase devices. ● High Bandwidth required for mobile client and only works using WiFi or mobile connection. ● Z5 app only available on Apple devices 	Free to download Z5 Mobile if DHH. Additional devices (i3, Z-70 and firefly) POA
	VRS	<ul style="list-style-type: none"> ● Person-to- Person translation 	<ul style="list-style-type: none"> ● Works with Apple devices and 'most' Android devices. ● Hearing callers may receive long distance charges from their phone company ● Available to US customers only. 	App free to download but you must apply for a ntouch account. US Only customers.

³⁸ <https://www.kara.tech> - Kara provides many hyper-realistic sign language avatars (digital humans), which are responsible for translating a variety of media content such as video, audio or text into a signed language. Their high fidelity faces and emotional expressions give them the ability to be fully expressive and engaging - easily connecting with the audience. They can preside at the bottom of any screen or on any device, interpreting any content into a signed language. To enable 24/7 digital availability of SL access for scenarios such as emergency messaging, Kara uses a set of pre-recorded motion captured animations. This is worked on by a team of Deaf people with animators to ensure all cultural aspects are being met and respected.

³⁹ StorySign is a free mobile app that aims to help deaf children read by translating the text from selected books into sign language. Through the power of AI and augmented reality, StorySign brings these books to life and helps deaf children enjoy storytime as every child should, <https://consumer.huawei.com/ie/campaign/storysign>, <https://play.google.com/store/apps/details?id=com.storysign.storysign&hl=en> IE

⁴⁰ <https://play.google.com/store/apps/details?id=com.storysign.storysign&hl=en> IE

⁴¹ <https://www.zvrs.com/> Launched across the USA in 2000, it was developed by and for DHH individuals as one of many services available from a nonprofit human services agency in Sioux Falls, South Dakota. It was the first organisation to commercially develop and perfect video relay applications for DHH consumers, spawning a booming video relay services (VRS) industry

⁴² [SVRS - Sorenson](https://www.sorenson.com/), Sorenson connects people by delivering trusted products and services, which include video relay and in-person, on-demand interpreting for people who are Deaf and use American Sign Language. As the leading provider of ASL interpreting services, they are passionate about communication and are committed to quality and innovation.



 <small>43</small>	VRS	<ul style="list-style-type: none"> Person-to- Person translation 	<ul style="list-style-type: none"> Android users experience lots of difficulties so not compatible with all devices. Caters for ASL, English & Spanish 	CONVO VRS free to download.
 Sign Now ⁴⁴	VRS	<ul style="list-style-type: none"> Person-to- Person translation. Free for deaf users. Social start-up that provides on-demand SL services. 	<ul style="list-style-type: none"> Developed as a quick & simple App for emergency situations. Cannot translate SL to text as person speaks. 	Must apply for a B2B or B2G business account.

Table 2 Current SL MT Options

Other SL MT projects and systems, include EASIER (SignON’s “sister” project)⁴⁵, and others such as:

- ProDeaf⁴⁶
- SignAloud⁴⁷
- Kinect Sign Language Translator⁴⁸

⁴³ A Deaf-owned VRS company - technology is often developed on the basis of spoken language – they offer a different perspective: universal communication solutions that just feel right, [Convoo Communications \(convorelay.com\)](http://convorelay.com),

⁴⁴ Home | Sign Now. The Sign Now app is a service-based technology that connects the deaf community and sign language interpreters. They offer a variety of video call options including call-back, on-demand and pre-scheduled calls, all with minimum clicks involved. And the highlight - it is free for the deaf community with their B2B & B2G business models. Following extensive and in-depth research, they have refined and determined the needs of their deaf users.

⁴⁵ [EASIER – Intelligent Automatic Sign Language Translation \(project-easier.eu\)](http://EASIER – Intelligent Automatic Sign Language Translation (project-easier.eu)) – “sister” to SignON that will:

- Exploit a robust data-driven sign language recognition engine.
- Utilise a signing avatar engine that produces easy-to-understand signing and integrates information on affective expressions and coherent prosody.
- Incorporate MT technology capable of dealing with a wide range of languages and communication scenarios (far beyond the restricted weather report and post office use cases demonstrated to date).

⁴⁶ ProDeaf (WebLibras)(["ProDeaf". prodeaf.net](http://ProDeaf)) is computer software that can translate both text and voice into Portuguese Libras (Portuguese Sign Language) "with the goal of improving communication between the deaf and hearing." There is currently a beta edition in production for American Sign Language as well. The original team began the project in 2010 with a combination of experts including linguists, designers, programmers and translators, both hearing and deaf. The last update of the app was in June 2016, but ProDeaf has been featured in over 400 stories across the country's most popular media outlet ["ProDeaf Tradutor para Libras on the App Store". App Store](http://ProDeaf Tradutor para Libras on the App Store)). The application cannot read sign language and turn it into word or text, so it only serves as a one-way communication. Additionally, the user cannot sign into the app and receive an English translation in any form, as English is still in the beta edition. (Machine translation of sign languages - Wikipedia)

⁴⁷ SignAloud is a technology that incorporates a pair of gloves made by a group of students at University of Washington that transliterate American Sign Language (ASL) into English (<http://lemelson.mit.edu/winners/thomas-pryor-and-navid-azodi>).

The gloves have sensors that track the users hand movements and then send the data to a computer system via Bluetooth. The computer system analyses the data and matches it to English words, which are then spoken aloud by a digital voice (["These Gloves Offer A Modern Twist On Sign Language". NPR.org](http://These Gloves Offer A Modern Twist On Sign Language)). The gloves do not have capability for written English input to glove movement output or the ability to hear language and then sign it to a deaf person, which means they do not provide reciprocal communication (["Non manual markers in American Sign Language \(ASL\)". www.lifepprint.com](http://Non manual markers in American Sign Language (ASL))), (Machine translation of sign languages - Wikipedia)

⁴⁸ Kinect Sign Language Translator - Since 2012, researchers from the Chinese Academy of Sciences and specialists of deaf education from Beijing Union University in China have been collaborating with the Microsoft Research Asian team to create Kinect Sign Language Translator (Xilin, Chen (2013). ["Kinect Sign Language Translator expands communication possibilities" \(PDF\). Microsoft Research Connections. Archived from the original\(PDF\)](http://Kinect Sign Language Translator expands communication possibilities)). The translator consists of two modes: translator mode and communication mode. The translator

- VISICAST, an EU Fifth Framework project⁴⁹
- eSIGN, an EU eContent project⁵⁰
- CWASA signing avatars⁵¹
- ROSETTA, a French PPP project
- ⁵²The American Sign Language Avatar Project at DePaul University⁵³
- The Raymond Avatar from the IRISA lab⁵⁴
- MoCapLab's SL motion-capture⁵⁵ in collaboration with Gallaudet University⁵⁶
- Naert, Larboulette & Gibet⁵⁷ present a survey, tabulation and comparison of existing SL Avatars. This and other related sources are discussed in sections 2-3 of SignON deliverable D5.3 "Interactive Co-creation Web-based Platform for Learning from User Input"⁵⁸.
- The Sign Translate bi-directional multilingual SL translation app for desktop and mobile open source project⁵⁹
- The Fingerspelling.xyz app that teaches and corrects hand positions in real-time to make it easier for people to learn the ASL alphabet⁶⁰
- State-of-the-art body and hand tracking systems such as Mediapipe⁶¹ and Ultraleap⁶²

mode is capable of translating single words from sign into written words and vice versa. The communication mode can translate full sentences and the conversation can be automatically translated with the use of the 3D avatar. The translator mode can also detect the postures and hand shapes of a signer as well as the movement trajectory using the technologies of machine learning, pattern recognition and computer vision. The device also allows for reciprocal communication because the speech recognition technology allows the spoken language to be translated into the sign language and the 3D modeling avatar can sign back to the deaf people (Zhou, Ming. "[Sign Language Recognition and Translation with Kinect](#)" (PDF). *IEEE Conference*). The original project was started in China based on translating Chinese Sign Language. [Machine translation of sign languages - Wikipedia](#))

⁴⁹ http://www.visicast.cmp.uea.ac.uk/Visicast_index.html

⁵⁰ <http://www.visicast.cmp.uea.ac.uk/eSIGN/index.html>

⁵¹ CWASA (CWA Signing Avatars) is a virtual signing system that synthesises natural SL performance using virtual human characters. CWASA supersedes the earlier JASigning and SiGMLSinging system developed during the ViSiCAST and eSIGN projects. Further development took place as part of the Dicta-Sign project. CWASA is based on HTML5 using JavaScript and WebGL, see https://vh.cmp.uea.ac.uk/index.php/CWA_Signing_Avatars and <http://vhg.cmp.uea.ac.uk/tech/jas/vhg2021/SiGML-Player-gui.html>

⁵² <https://rosettaccess.fr>

⁵³ Aims to enable automatic translation of English into ASL. They are currently developing tools for generating ASL animation in response to spoken English. Their avatar, named "Paula" for DePaul University, can portray all linguistic parameters of ASL. Paula has earned high marks for clarity and naturalness from users fluent in ASL, <http://asl.cs.depaul.edu/>

⁵⁴ <http://lsf.irisa.fr/>

⁵⁵ Investigates the natural temporal patterning in ASL using mocap data and animation. The goal is to create signing avatars without compromising the prosody and fluency in ASL storytelling. It has produced an original ASL nursery rhyme through The Motion Light Lab at Gallaudet University and using MocapLab's SL motion capture technology. <https://www.mocaplab.com/news/mocaplabs-sign-language-technology-gallaudet-university>

⁵⁶ [Gallaudet University - What you do here changes the world!](#)

⁵⁷ Lucie Naert, Caroline Larboulette, Sylvie Gibet, "A survey on the animation of signing avatars: From sign representation to utterance synthesis", *Computers & Graphics*, 92, 76-98, 2020, <https://doi.org/10.1016/j.cag.2020.09.003>

⁵⁸ [Public Deliverables | SignON Project \(signon-project.eu\)](#)

⁵⁹ <https://github.com/sign-language-processing/sign-translate> and <https://sign.mt>

⁶⁰ <https://www.dezeen.com/2021/08/27/fingerspelling-xyz-app-learn-sign-language-alphabet-design>

⁶¹ <https://google.github.io/mediapipe/solutions/pose.html>

⁶² <https://www.ultraleap.com/tracking/>

- An alternative approach is automated lip-reading from Liopa Technology⁶³, a start-up company that is using a Deep Neural Network and Viseme Analysis to provide its LipRead Visual Speech Recognition platform⁶⁴.

The following table is a comparative analysis of SignON with its major competitors:

Features / Products	SignON	Gnosys ⁶⁵	SignAll ⁶⁶	Motion Savvy ⁶⁷	Hand Talk ⁶⁸	SiMAX ⁶⁹	Story Sign ⁷⁰
Translates sign language to text as person speaks	Yes	Yes	Yes	Yes	No	No	No
Translates sign language to speech as person signs	Yes	No	No	No	No	No	No
Translates speech or text to sign language in real time	Yes	No	No	No	Yes	Text input only	Text input only
Supports multi-lingual and multi-modal UI options	Yes	No	No	No	No	No	Fixed modality only
Can be used on any mobile device or smartphone that has a camera and internet connection	Yes	Yes	No – requires 3 web cameras & a depth sensor	No – uses a very expensive external device	Yes	Yes	Yes
Can accommodate third party modules, enhancements and languages	Yes, through its open Framework and APIs	No – it's closed & proprietary	No – it's closed & proprietary	No – it's closed & proprietary	Partially, has input APIs for data & websites	No – it's closed & proprietary	No
Can be trained to translate any sign language	Yes - using its ML Algorithms	Yes using motion capture data	Complicated due to data issues	No – old technology	No - Libras and ASL only.	Yes - but requires human-in-the-loop editing	No - only by its developer

Table 3 SignON compared to its competitors

⁶³ <https://liopa.ai>

⁶⁴ <https://liopa.ai/technology>

⁶⁵

www.expresscomputer.in/artificial-intelligence-ai/new-ai-powered-app-translates-sign-language-into-speech-in-real-time/29739/

⁶⁶ www.signall.us see also

<https://www.signall.us/newsroom/ace-asl-the-ai-powered-sign-language-app-from-signall-is-now-available-on-android> and

<https://www.theverge.com/2021/9/21/22684485/snap-lenses-fingerspell-american-sign-language-deaf>

⁶⁷ <https://www.ctdinstitute.org/library/2017-08-25/motionsavvy---uni-tablet-review>

⁶⁸ www.handtalk.me

⁶⁹ <https://simax.media>

⁷⁰ <https://consumer.huawei.com/ie/campaign/storysign>

The SignON next-generation communication service will be a free, open source smart phone application running on standard modern mobile devices with a cloud-based framework of services for conversion between video (capturing and understanding SL), audio and text and initial translation between Irish, British, Dutch, Flemish and Spanish SLs and English, Irish, Dutch and Spanish spoken languages. However, SignON will incorporate sophisticated ML capabilities that will allow

- (i) Learning new sign, text and spoken languages;
- (ii) Style-, domain- and user-adaptation
- (iii) Automatic error correction, based on user feedback

Successful delivery of the SignON services rely on the ability of the partners to build and maintain strong relationships with the DHH community and other potential customers and users, mainly through WP1 and the project's active dissemination work, with support from the consortium partners who are looking to use EU and National initiatives to achieve the breadth of contacts required.

5. Sign Language Machine Translation Policy Context

As the digital transformation of society accelerates, the use of mobile devices and applications can significantly improve the daily lives of citizens. Leveraging multidisciplinary expertise drawing on knowledge from both the technological and human sciences, novel technologies, such as automatic translation as well as speech and sign recognition and synthesis, could offer inclusive human-centric solutions facilitating communication between people who are deaf, hard of hearing and hearing⁷¹.

With the widespread ratification of the UN Convention on the Rights of Persons with Disabilities; legislative measures are now more focused on enabling Deaf people to access their environment on an equal basis with others. This increasingly includes the provision of SL legislation. Most EU Member States now have some form of recognition of its SL, which can be found at all levels of legislation, ranging from constitutions to disability laws, educational acts and language laws, as well as separate SL acts⁷².

The right to a SL interpreter in employment or education is an accessibility right that is only granted to a specific group, namely the Deaf. This does not constitute discrimination against other groups, as they do not need this ‘reasonable accommodation’ to participate fully and equally. Different rights that are necessary for Deaf people to become citizens. Deaf people form part of a group that is not easily categorised and whose rights are therefore to be described in several different ways⁷³.

Inherent to the work of the European Union of the Deaf (EUD) is the belief that the right to SL is a basic Human Right. *“Sign language users, similarly, with national minorities, are in need of specific targeted and coherent protection regarding their language and all human rights. National and/or regional sign languages are the mother tongues of deaf sign language users across the EU and the world. The right to sign language in itself is a human right, but access to sign language is also essential for the fulfilment of other basic human rights, such as the right to equal education, information or to a fair trial. Without early access to sign language programmes and/or educational systems that foster the acquisition of the national and/or regional sign language(s) (and the national written language), deaf children will not be able to enjoy their basic human rights as children or later*

⁷¹ <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/ict-57-2020> the Horizon 2020 call that is funding this SignON project.

⁷² Much of this subsection is adapted from Wheatley, M. & Pabsch, A. (2012). Sign Language Legislation in the European Union - Edition II. Brussels: EUD, [Sign Language Legislation in the European Union - Edition II ebook | European Union of the Deaf \(eud.eu\)](#)

⁷³ Wheatley, M. & Pabsch, A. (2012). Sign Language Legislation in the European Union - Edition II. Brussels: EUD, [Sign Language Legislation in the European Union - Edition II ebook | European Union of the Deaf \(eud.eu\)](#)

in their adult life. EUD therefore advocates that the right to sign language is an essential prerequisite to ensure full and equal citizenship for all deaf people.”⁷⁴

However, a recent report⁷⁵ highlights the difficulties that native SL users still face in the EU, especially for minority SLs such as Irish Sign Language (ISL)⁷⁶. In Ireland, the Irish Sign Language (ISL) Act 2017⁷⁷, which established ISL alongside Irish and English as an official language, places a statutory duty on all public bodies to provide free interpretation of all statutory entitlements and services. Most public bodies (52%) indicated they were either not aware of the ISL Act (32%) or were not aware of their responsibilities under the Act (20%). Among its key findings, the report states that since ISL became an official language, users have experienced only minimal changes in their access to a wide range of services; there is a significant lack of awareness of ISL in the public sector; and there are “discrepancies” between the experiences of service users compared to the outlook of public bodies and departments, “especially in education”. Widespread availability of the SignON App and Framework services should greatly facilitate addressing such SL issues.

5.1 Human Rights

The Universal Declaration of Human Rights (UDHR)⁷⁸ accords rights to “all peoples and all nations” (Preamble), giving human rights precedence over the power of the State. It is claimed to be the most universal document⁷⁹, having been translated into more than 380 languages⁸⁰. It was seen as a large success at the time considering many parties from many different nations and cultures voted for it in the UN General Assembly until it was finally adopted and proclaimed on 10 December 1948⁸¹.

The Declaration grants rights “without distinction of any kind, such as race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth or other status” (Article 2). This is a very strong principle of equality that applies to everyone even if he or she does not use the official or majority language of any given country, such as Deaf people using SL. Although it is not

⁷⁴ EUD 2019 Impact Report, https://www.eud.eu/files/6416/0620/4605/EUD_IR_2019_Low_3.pdf

⁷⁵ National Disability Authority (NDA) report to Government on the operation of the Irish Sign Language (ISL) Act, 2021, <https://nda.ie/isl> and <https://www.irishexaminer.com/news/arid-40722807.html>

⁷⁶ [Irish Sign Language \(irishdeafcommunity.ie\)](https://www.irishdeafcommunity.ie)

⁷⁷ <https://www.irishstatutebook.ie/eli/2017/act/40/enacted/en/html>

⁷⁸ <http://www.ohchr.org/EN/UDHR/Pages/Introduction.aspx>

⁷⁹ Office of the High Commissioner on Human Rights OHCHR (2012), Universal Declaration of Human Rights. Available at: <http://www.ohchr.org/EN/UDHR/Pages/Introduction.aspx>

⁸⁰ Although these 300 languages cover a large number of people in the world, UDHR has not yet been translated into any sign languages and therefore limits Deaf sign language users’ access to the document.

⁸¹ <http://www.un.org/rights/50/carta.htm>

legally binding because it is not a treaty body, it nonetheless inspired other human rights documents and legislative measures⁸².

According to the World Federation of the Deaf (WFD) and the Swedish National Association of the Deaf's survey⁸³, the most important human rights for Deaf people are the recognition of the national SLs and access to them, along with access to bilingual education⁸⁴ and SL interpreters, as well as general access to information and public services, including courts. Legal protection at national but also at European and international level can ensure these rights.

5.2 Minority Rights

Article 2 of the Treaty on the European Union states that *'the Union is founded on the values of respect for human dignity, freedom, democracy, equality, the rule of law and the respect for human rights, including the rights of persons belonging to minorities.'*⁸⁵

Deaf individuals can be seen as part of a minority group, the Deaf community. The UDHR grants rights to individuals (individual rights); in contrast to minority rights instruments, which provide for groups (collective rights). To effectively safeguard members of minority groups they require protection at both individual and collective level. Several instruments combine these two rights systems and grant rights to individuals forming part of these minority groups. An example is the Framework Convention for the Protection of National Minorities (FCNM)⁸⁶ of the Council of Europe (CoE), which protects "persons belonging to national minorities" allowing them to enjoy the freedoms and exercise the rights enshrined in the Framework Convention "individually as well as in community with others" (Section I, Article 3).

A minority tailored to the Deaf community, can be defined as follows: *"A minority is a group of individuals sharing common ethnic, religious, or linguistic characteristics. They are numerically inferior to the rest of the population of a given State and to belong to a minority shall be a matter of individual choice."*

⁸² Such as, for example, the UN Convention on the Rights of Persons with Disabilities (UNCRPD) or other national legislation.

⁸³ World Federation of the Deaf & Swedish National Association of the Deaf (2009). Deaf People and Human Rights. Report compiled by: Hilde Haualand Colin Allen. Available at:

<http://www.wfdeaf.org/wp-content/uploads/2011/06/Deaf-People-and-Human-Rights-Report.pdf>

⁸⁴ With Gallaudet University being a definitive example, <https://www.gallaudet.edu>

⁸⁵ [C_2012326EN.01001301.xml \(europa.eu\)](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:2012326EN.01001301.xml)

⁸⁶ [Framework Convention for the Protection of National Minorities \(coe.int\)](https://www.coe.int/t/t09/Convention_for_the_Protection_of_National_Minorities/Framework_Convention_for_the_Protection_of_National_Minorities.coe.int)

Although Deaf Communities are often described as a culturo-linguistic minority⁸⁷, it is important to note that the situation of Deaf people is more complex than that. On the one hand they are at the intersection of human rights and language rights, and on the other hand they can also claim disability rights. Nonetheless, under the given definition Deaf people form part of a linguistic minority in their respective countries. Therefore, this minority, its members and the national SLs need to be safeguarded and protected by legal measures in the same way as other national minorities. It has to be noted however, that protection under the minority framework might not be the best way to defend the rights of Deaf people in practice, as often the disability system is much more advanced and has more financial stability than the minority movement.

5.3 Linguistic Human Rights

National minorities and their languages need special protection regarding their language and human rights. In this context Skutnabb-Kangas⁸⁸ speaks of the concept of Linguistic Human Rights (LHR), as a combined rights approach. Considering that the national SLs can be seen as the mother tongues of Deaf people, they can also claim LHRs according to Skutnabb-Kangas' definition.

LHRs as described by Skutnabb-Kangas are a combination of language rights⁸⁹ and human rights. Any right that a person or a group holds in relation to their mother tongue, or also other languages can be considered a language right. By contrast, LHRs are only those rights, which are “necessary to satisfy people’s basic needs”⁹⁰. This is for example the right to one’s mother tongue, including the right to maintain and positively identify with that language. It is, however, not an LHR to learn a foreign language unless one’s mother tongue is different to the State or official language(s) of the country one lives in. Then, it is a necessary right (as opposed to an enrichment-oriented right) to learn that language. This is also the case for Deaf people. Not only should they be allowed to learn the national SL, learning of the national (spoken) language, albeit in its written form, should also be facilitated.

Among “deaf people of the world, a signed language is their natural language because it is based on vision (a seeing language)” and provides “the greatest accessibility for everyone in terms of ease of learning, acquisition, use, comfort, and success.”⁹¹ Such SLs need to stay part of the curriculum at all

⁸⁷ See Ladd, P. (2003). *Understanding Deaf culture: In Search of Deafhood*. Clevedon: Multilingual Matters.

⁸⁸ Skutnabb-Kangas, T. (2000). *Linguistic Genocide in Education – or Worldwide Diversity and Human Rights?* Mahwah, New Jersey: Erlbaum Associates.

⁸⁹ Language rights are often also referred to as linguistic rights (see Skutnabb-Kangas 2010).

⁹⁰ Skutnabb-Kangas, Tove (2010). *Language Rights*. In: J Jaspers, J-O Östman & J Verschueren (Eds.). *Society and Language Use*. Amsterdam: John Benjamins Publishing Company, pp. 212-232.

⁹¹ [Language, Culture, and Community in Teacher Education - Google Books](#)

times to facilitate understanding and learning of the written form of the surrounding language. Being taught in the SL is not sufficient; the language also needs to be taught as a subject to ensure the best possible competency. This is especially important for Deaf people, as they often do not have an adult language model in their families.

5.4 UN Convention on the Rights of Persons with Disabilities

The United Nations Convention on the Rights of Persons with Disabilities (UNCRPD⁹²) is generally considered the first human rights instrument of the 21st century and is one of the most important documents in the fight for equality of Deaf and disabled people across the world. It was adopted in 2006 and entered into force from 3 May 2008. The UNCRPD is the first UN treaty document that can be signed and ratified by regional bodies. In January 2011 the European Union ratified the Convention (though not its Optional Protocol⁹³) and embodied it in the Charter of Fundamental Rights of the European Union⁹⁴, which it actively protects and promotes in programmes such as “The EU Citizens, Equality, Rights and Values” programme (CERV)⁹⁵.

There are currently nine core international human rights treaties, ranging from racial discrimination to women’s rights, children’s rights, and civil and political rights, etc⁹⁶. The UNCRPD is the only international instrument specifically protecting the rights of persons with disabilities, the world’s largest minority, estimated to be 15% of the world’s population, or over 1 billion people⁹⁷. It is also the first international treaty to mention SL in its main text, therefore explicitly safeguarding the rights of SL users.

The UNCRPD is highly relevant for Deaf people in all areas of life, even if the text does not mention SL explicitly in every article. The word ‘sign language’ is mentioned in five articles throughout the Convention. Most notably, it is included in the definition for language in Article 2: “Language includes spoken and signed languages”. This means that every time the Convention mentions the word ‘language’ it automatically includes sign languages. Article 9 on Accessibility aims to “enable persons

⁹² [Convention on the Rights of Persons with Disabilities \(CRPD\) | United Nations Enable](#). The Convention can also be accessed in International Sign at: <http://www.wfdeaf.org/human-rights/crpd>.

⁹³ [OHCHR | Optional Protocol to the Convention on the Rights of Persons with Disabilities](#)

⁹⁴ [EU Charter of Fundamental Rights | European Commission \(europa.eu\)](#)

⁹⁵ https://ec.europa.eu/info/sites/default/files/1_en_annexe_acte_autonome_part1_v8.pdf

⁹⁶ For a list of the human rights treaties see:

<http://www.ohchr.org/EN/ProfessionalInterest/Pages/CoreInstruments.aspx>.

⁹⁷ World Health Organization WHO (2011). World Report on Disability, WHO: Geneva. Available at: http://whqlibdoc.who.int/publications/2011/9789240685215_eng.pdf

with disabilities to live independently and participate fully in all aspects of life” (Article 9(1) UNCRPD) by asking State Parties to take appropriate measures, such as the provision of sign language interpreters.

Overall, the Convention is the single most important legal document granting human rights to all Deaf and disabled persons, ensuring the needs of SL users are fully considered. State Parties that ratified the Convention must change their laws accordingly to match its regulatory content. Although there remains a large amount of work to be done to achieve all those rights in practice, the Convention is nonetheless a significant tool in demanding and ensuring full and equal rights for Deaf SL users.

5.5 Union of Equality: Strategy for the Rights of Persons with Disabilities

The EU Strategy for the Rights of Persons with Disabilities 2021-2030⁹⁸ intends to tackle the diverse challenges that persons with disabilities face. It aims to progress in all areas of the United Nations Convention on the Rights of Persons with Disabilities, both at EU and Member State level. The goal is to ensure that persons with disabilities in Europe, regardless of their sex, racial or ethnic origin, religion or belief, age or sexual orientation:

- o enjoy their human rights,
- o have equal opportunities,
- o have equal access to participate in society and economy,
- o are able to decide where, how and with whom they live,
- o can move freely in the EU regardless of their support needs,
- o no longer experience discrimination.

The strategy explicitly addresses the provision of SL services by the Commission, ensuring SL availability when people move to another Member State for work, studies or other reasons, and delivering information and communication in SL for all EU citizens when exercising their rights to participate in the democratic process⁹⁹. In addition, the Commission will provide training for staff and support learning of interpretation in International Sign, to increase the accessibility of all its publications, notably of EU law and policies, and across its audiovisual communications and graphic design services as well as of its publications and events, including where relevant SL interpretation.

⁹⁸ "Union of Equality: Strategy for the Rights of Persons with Disabilities 2021-2030", Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions, COM(2021), March 2021, [Publications catalogue - Employment, Social Affairs & Inclusion - European Commission \(europa.eu\)](#)

⁹⁹ Which the SignON App and Framework services will very much assist and help to enable.

5.6 European Union Legislation

Sign languages are not only protected at UN level but there are also various documents and initiatives at European Union level that aim to safeguard the rights of Deaf people. These range from resolutions to reports and parliamentary recommendations. While they are often not legally binding, there is however a trend at EU level to make the SLs of Europe more visible at events and in the public arenas. The European Commission for example acknowledges them as an “important part of Europe’s multilingual diversity”¹⁰⁰.

The European Parliament (EP) recognise that SLs, being an element of Europe's linguistic diversity, need to be supported by language technology¹⁰¹. In the digital era, language barriers represent a major challenge preventing European citizens and businesses from fully benefiting from a truly integrated Europe. These barriers particularly affect the less educated and older population, as well as speakers of smaller and minority languages, thus creating a notable language divide. Language barriers have a profound effect on (1) cross-border public services, (2) fostering a common European identity, (3) workers’ mobility, and (4) cross-border e-commerce and trade, in the context of Europe’s Digital Future¹⁰². Language technologies are crucial for the construction of a fair and truly integrated European Union, that need to be addressed with institutional policies, research policies, industry policies, market policies and public service policies¹⁰³.

Debates in the European Parliament (EP) are rendered in SL for those Members who need it¹⁰⁴. Since the ratio of SL users to interpreters varies among Member States, as does the quality of interpretation, in 2016 the EP adopted a resolution on professional SL interpreters,¹⁰⁵ and backed the introduction of international SL interpretation for all plenary debates¹⁰⁶.

The European Languages Day on 26 September is devoted to the variety of languages spoken by EU citizens. However, not all people can speak or hear others speaking. Some use SL, which

¹⁰⁰ European Commission (2012). Europe: a continent of many sign languages. at: http://ec.europa.eu/languages/languages-of-europe/sign-languages_en.htm

¹⁰¹ [Sign languages in the EU \(europa.eu\)](http://europa.eu/sign-languages)

¹⁰² [Shaping Europe’s digital future | Shaping Europe’s digital future \(europa.eu\)](http://europa.eu/shaping-digital-future)

¹⁰³ “Language equality in the digital age - Towards a Human Language Project”, DG European Parliament Research Services (DG EPRS). Study IP/G/STOA/FWC/2013-001/Lot4/C2 March 2017, [EPRS_STU\(2017\)598621_EN.pdf \(europa.eu\)](http://eprs-stu(2017)598621-en.pdf)

¹⁰⁴ [Sign languages in the EU \(europa.eu\)](http://europa.eu/sign-languages)

¹⁰⁵ European Parliament resolution of 23 Nov 16 on sign languages and professional sign language interpreters, <http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-%2f%2fEP%2f%2fTEXT%2bTA%2bP8-TA-2016-0442%2b0%2bDOC%2bXML%2bV0%2f%2fEN&language=EN>

¹⁰⁶ <http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P8-TA-2016-0132+0+DOC+XML+V0/EN&language=EN>

policymakers consider in the context of the rights of people with disabilities, or as a linguistic minority right. The United Nations has launched the International Day of Sign Languages, which was celebrated for the first time on 23rd September 2018¹⁰⁷.

5.6.1 Sign Language Resolutions

The first important European document to mention SL was issued by the European Parliament in 1988: the “Resolution on Sign Languages for the Deaf” (Doc A2-302/87¹⁰⁸), which was reiterated in 1998 in a slightly modified version (OJ C 379, 07/12/1998 P. 0066¹⁰⁹). This had become necessary, as the first resolution did not have the desired political effect¹¹⁰. Both resolutions take a very broad view and recognise that SLs are often the “only means of communication” (Preamble B) Deaf people have, asking for the legal recognition of SLs in the EU Member States¹¹¹. The 1998 resolution also refers to the inaccessibility of information and the lack of qualified SL interpreters. Although the legal situation has changed, as mentioned above, the interpreter situation still varies greatly among the Member States and all countries still experience a lack of readily available and highly trained and qualified SL interpreters.

The SL resolutions at the European Parliament, such as the 2016 Resolution on Sign Languages brought forward by MEP Helga Stevens¹¹², were a useful step forward but many of the points and claims put forward in 1998 are still relevant today. They illustrate the fact that a lot of groundwork needs to be done until Deaf SL users can enjoy rights on an equal footing with others.

5.6.2 Mobility Report & Brussels Declaration

In recent years, the European Parliament has given disability more visibility and has included SL in a number of documents. This is not only due to the joint efforts of the European Union of the Deaf and the first Deaf Member of the European Parliament (MEP), Dr. Ádám Kósa¹¹³ but also the launch of the ‘European Disability Strategy 2010-2020: A Renewed Commitment to a Barrier-Free Europe’¹¹⁴. The Disability Strategy mentioned SL once in its chapter on participation: “The Commission will work to

¹⁰⁷ [Sign languages in the EU \(europa.eu\)](http://signlanguagesintheeu.europa.eu)

¹⁰⁸ <http://www.ciemen.org/mercator/bulletins/47-09.htm>

¹⁰⁹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:51998IP0985:EN:HTML>

¹¹⁰ Krausneker, V. (2003). Has Something Changed? Sign Languages in Europe: the Case of Minorised Minority Languages. In: Deaf Worlds, 19/2, pp. 33-46.

¹¹¹ The 1998 Resolution speaks of only four countries having legally recognised their sign languages.

¹¹² <https://www.eud.eu/news/european-parliament-voted-resolution-sign-language-and-sign-language-interpreters/>

¹¹³ <http://kosaadam.hu/en>

¹¹⁴ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0636:FIN:EN:PDF>

[...] explore ways of facilitating the use of sign language and Braille in dealing with the EU institutions”.

MEP Kósa’s own initiative Report on the Mobility and Inclusion of People with Disabilities and the European Disability Strategy 2010-2020 (“Mobility Report”¹¹⁵), which was adopted by most MEPs at the European Parliament in Strasbourg on 25 October 2011, mentions SL explicitly and refers to the European Parliament resolutions on SL. It does not only call on the EU Member States to recognise its national SLs but also mentions the accessibility of information, in particular with regards to subtitling, and free online communication tools and SL services.

Most notably, the report mentions the so-called “Brussels Declaration on Sign Languages in the European Union”¹¹⁶ in its article 105. It asks the Commission to recognise SLs as official languages in accordance with the Brussels Declaration. The 2010 Declaration is a document drawn up by EUD, advocating the rights of Deaf people across Europe. Although originally not a legally binding document, the inclusion in the Mobility Report has given it political relevance that might eventually lead to full legal recognition. The Declaration was signed at the European Parliament in Brussels on 19 November 2010, coinciding with EUD’s “Implementation of Sign Language Legislation” conference and the launch of the first edition of the “Sign Language Legislation in the European Union” publication. The 2010 Declaration calls on the EU and its Member States to recognise the national SL, give SL users the right to learn a SL and provide SL interpretation services. It outlines the need for accessible education and urges the EU and its Member States to also provide appropriate solutions for families to learn SL, ensuring equal opportunities and full participation.¹¹⁷

5.6.3 European Accessibility Act

As mentioned above, the European Union has ratified the UNCRPD, and just as in the individual countries, it also needs to find a way to implement the text to fulfil its obligations under the Convention. This has been done in the European Accessibility Act (EAA)¹¹⁸ which aims to improve the functioning of the EU internal market for accessible products and services by removing barriers created by divergent legislation. This facilitates the work of companies and brings benefits for persons with disabilities and elderly people in the EU. The Act follows in the footsteps of the US and

¹¹⁵ <http://www.europarl.europa.eu/sides/getDoc.do?type=REPORT&reference=A7-2011-0263&language=EN>

¹¹⁶ http://www.eud.eu/uploads/brussels_declaration_English.pdf

¹¹⁷ http://www.eud.eu/Brussels_Declaration-i-305.html.

¹¹⁸ “Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the approximation of the laws, regulations and administrative provisions of the Member States as regards the accessibility requirements for products and services COM/2015/0615 final - 2015/0278 (COD)”, 2/12/2015, <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2015:0615:FIN>

its Americans with Disabilities Act (ADA)¹¹⁹. The EAA is however only applicable to the internal market and does not follow general anti-discrimination legislation. The EU co-legislators adopted the EAA directive in April 2019. It mainly applies to the private sector and was published in the Official Journal on 7th June 2019.

After consulting with stakeholders and experts on accessibility and considering the obligations deriving from the UN Convention on the Rights of Persons with Disabilities¹²⁰ the Commission identified the following products and services should be addressed by the EAA, as having the highest risk of being concerned with diverging accessibility requirements across the EU countries:¹²¹

- o computers and operating systems
- o ATMs, ticketing and check-in machines
- o smartphones
- o TV equipment related to digital television services
- o telephony services and related equipment
- o audio-visual media services such as television broadcast and related consumer equipment
- o services related to air, bus, rail and waterborne passenger transport
- o banking services
- o e-books
- o e-commerce

Many of these are directly relevant to SignON and its users.

The aim of the EAA is that all users benefit from: (a) more accessible products and services in the market, (b) accessible products and services at more competitive prices, (c) fewer barriers when accessing education and the open labour market and (d) more jobs available where accessibility expertise is needed. Businesses benefit from: (a) common rules on accessibility in the EU, leading to costs reduction, (b) easier cross-border trading and (c) more market opportunities for their accessible products and services. The accessibility requirements of the EAA are the same as under the EU Web Accessibility Directive (WAD)¹²² that establishes accessibility requirements for the websites and mobile applications of European public sector bodies, which public sector bodies need to start applying from 23 September 2019. However, enforcement is very different in both directives,

¹¹⁹ <http://www.ada.gov/pubs/adastatute08.pdf>

¹²⁰ <http://ec.europa.eu/social/main.jsp?catId=1138&langId=en>

¹²¹ <https://ec.europa.eu/social/main.jsp?catId=1202>

¹²² Directive (EU) 2016/2102 of the European Parliament and of the Council of 26 October 2016 on the accessibility of the websites and mobile applications of public sector bodies (OJ L 327, 2.12.2016, p. 1).

with the EAA stressing the European CEN standard 17161 on accessibility¹²³ following Design for All.¹²⁴, and the WAD does not require SL..¹²⁵

The EAA establishes common European accessibility requirements for numerous digital products and services but excludes the obligations to make transport, buildings and household appliances more accessible for people with disabilities. Importantly for the Deaf community, the EAA now obliges Member States to make the single European emergency number, 112, accessible to everyone in the EU. Common accessibility requirements in the EAA dictate how to make 112 accessible for everyone, including deaf persons across the EU. Ensuring accessibility to 112 for the Deaf community is vital¹²⁶. Moreover, the EAA supports the public procurement of accessible products and services, and public authorities will be obliged to only procure accessible products, services and facilities.

5.6.4 Anti-Discrimination Directive

The so-called Anti-discrimination Directive¹²⁷ was proposed by the European Commission in July 2008 and while it does not explicitly mention SL it is nonetheless a potentially ground-breaking document for the Deaf community. It asks for equal treatment of persons irrespective of certain characteristics, such as age, disability or sexual orientation outside the employment area. The proposal aims to complement the existing EC legal framework that so far only applies to employment, occupation and vocational training¹²⁸ by prohibiting discrimination on grounds of, for example, disability and offers a minimum level of protection within the EU.

¹²³ The result of Commission standardisation mandate 473, See <https://www.cencenelec.eu/standards/topics/accessibility/pages/designforall.aspx>, and <http://www.edf-feph.org/newsroom/news/first-ever-european-standard-design-all>

¹²⁴ As reported at the 5th WADEX Meeting on 21/05/2019, see <https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupMeetingDoc&docid=33205>

¹²⁵ [L_2016327EN.01000101.xml](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:2016327EN.01000101.xml) (europa.eu)

¹²⁶ EUD 2019 Impact Report, https://www.eud.eu/files/6416/0620/4605/EUD_IR_2019_Low_3.pdf

¹²⁷ Proposal for a Council Directive on implementing the principle of equal treatment between persons irrespective of religion or belief, disability, age or sexual orientation, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52008PC0426:EN:NOT>

¹²⁸ Directive 2000/43/EC of 29 June 2000 implementing the principle of equal treatment between persons irrespective of racial or ethnic origin, OJ L 180 of 19.7.2000, p.22 and Directive 2000/78/EC of 27 November 2000 establishing a general framework for equal treatment in employment and occupation, OJ L 303 of 2.12.2000, p. 16.

The Directive has the full backing of the European Parliament¹²⁹ and could have far-reaching consequences for Deaf people, particularly with regards to so-called ‘reasonable accommodation’¹³⁰ and sanctions on grounds of disability.

Overall, it can be noted that SL legislation at EU level is mainly grounded in the European Community’s ‘soft law’, i.e. “have no legal force but are persuasive”¹³¹. Legally binding European legislation such as a strong and comprehensive Antidiscrimination Directive that forces Member States to adopt far-reaching equality measures would be good.

5.6.5 Council of Europe

The Council of Europe (CoE) does not have supranational powers; it is an institution of co-operation based on the European Convention on Human Rights. The ratification of the document is a prerequisite for joining the CoE and for example prohibits the discrimination in the enjoyment of the rights and freedoms secured by the Convention.

SL is mentioned explicitly in a Council Recommendation from 2003 Concerning the Protection of Sign Languages in the Member States (Rec 1598 (2003))¹³². It postulates the rights of SL users recalling an earlier Recommendation on the Rights of National Minorities¹³³. Hereby, the Parliamentary Assembly recommends that the Committee of Ministers “consider drafting an additional protocol to the European Charter for Regional or Minority Languages (ECRML 1992¹³⁴) incorporating sign languages into the charter, among the non-territorial minority languages”.

Two major publications were initiated following the recommendation regarding the protection of SLs: Timermans’ (2005)¹³⁵ overview of SLs in the CoE Member States and Krausneker’s (2008)¹³⁶ needs analysis regarding the protection and promotion of sign languages and the rights of their users.

¹²⁹ European Parliament (2012). Press Release. European Parliament backs new anti-discrimination directive. Available at:

<http://www.europarl.europa.eu/sides/getDoc.do?language=en&type=IM-PRESS&reference=20090401IPR53200>

¹³⁰ According to the Americans with Disabilities Act, ‘reasonable accommodation’ is: “any change in the work environment or in the way things are customarily done that enables an individual with a disability to enjoy equal employment opportunities.” (see 29 C.F.R. pt. 1630 app. § 1630.2(o) (1997)).

¹³¹ Storey, T. & Turner C. (2008). *Unlocking EU Law*. Malta: Hodder Education., p.61

¹³² <http://assembly.coe.int/documents/adoptedtext/ta03/erec1598.htm>

¹³³ Council of Europe Parliamentary Assembly. Recommendation 1492 (23 January 2001). Rights of national minorities. Accessible at: <http://assembly.coe.int/documents/adoptedtext/TA01/EREC1492.htm>

¹³⁴ <http://conventions.coe.int/Treaty/en/Treaties/Html/148.htm>

¹³⁵ Timermans, N. (2005). *The Status of Sign Languages in Europe*. Strasbourg: Council of Europe Publishing.

¹³⁶ Krausneker, V. (2008). *Report on the Protection and Promotion of Sign Languages and the Rights of their Users: Needs Analysis*. Strasbourg: Council of Europe Publishing.

5.6.6 Audio-Visual Media Services Directive

The revised Audio-Visual Media Services Directive (AVMSD), which entered into force in December 2018, significantly improved Article 7 on the accessibility of audio-visual media services. The AVMS directive of 2010 only called upon Member States to encourage media service providers in their country to ensure that their services were gradually made accessible to persons who are deaf, hard of hearing, blind or partially sighted, but it did not create any obligations. The revised AVMSD sets out the legal obligation for Member States to ensure that public and commercial TV channels, as well as video on-demand platforms (such as HBO and Netflix), make their services continuously and progressively more accessible to persons with disabilities through proportionate measures.

The recital of the revised AVMSD dictates that the means to achieve the accessibility of audio-visual media services include, but are not limited to, the provision of SL, subtitling for the DHH, spoken subtitles and audio description. Regarding emergency information which is made available to the public through audio-visual media services, the revised AVMSD obliges Member States to ensure that such information is provided in a manner which is accessible to persons with disabilities¹³⁷.

The revised AVMSD dictates that Member States must ensure that media service providers report on a regular basis to the national regulatory authorities or bodies on the implementation of the measures that make their services more accessible to persons with disabilities. Member States will also have to report to the European Commission on the implementation of such measures by the 19th December 2022 and then every three years thereafter. Furthermore, Member States are obliged to designate a single accessible contact point to provide information and to receive complaints from viewers regarding accessibility.

5.7 National Sign Language Legislation

The legal recognition of SLs differs widely in various countries. In some jurisdictions (countries, states, provinces or regions), a SL is recognised as an official language; in others, it has a protected status in certain areas (such as education). Although a government may stipulate in its constitution (or laws) that a "signed language" is recognised, it may fail to specify *which* SL; several different SLs may be commonly used¹³⁸.

¹³⁷ EUD 2019 Impact Report, https://www.eud.eu/files/6416/0620/4605/EUD_IR_2019_Low_3.pdf

¹³⁸ See Tupi, Eeva (2019): Sign Language rights in the framework of the Council of Europe and its member states. Helsinki: Ministry for Foreign Affairs of Finland, and Lorraine Leeson and Beppie van den Bogaerde (2020) (What we don't know about) Sign Languages in Higher Education in Europe: Mapping Policy and Practice to an analytical framework. In Darquennes, J., Du Plessis, Th. & Soler, J. (Eds). Mapping Policy and Practice to an

The most frequently used framework for the legal recognition of SLs, has been adopted and further developed by the World Federation of the Deaf¹³⁹. 40 countries have various levels of legal recognition of SLs¹⁴⁰.

Extending legal recognition is a major concern of Deaf culture. Symbolic recognition does not guarantee an improvement in the lives of SL users, and it has been argued that SLs should be supported not merely as an accommodation for the disabled, but as a communication medium in language communities. SignON will greatly help with this.

The legal systems in the various EU member States are as diverse as the legal status of its SLs, which are recognised and mentioned across a large range of different pieces of legislation: from constitutional recognition, to separate SL acts, or no reference at all. Constitutional reference to SL is not uniform, however: Finland safeguards the rights of those who use SL and need SL interpretation, whereas Portugal asks the government to ensure educational policies include SL to ensure equal access to education. Austria and Ireland recognise their national SLs (Austrian Sign Language (ÖGS) and Irish Sign Language (ISL)¹⁴¹) as official languages and Hungary defends Hungarian Sign Language as part of Hungarian culture. Most other EU countries have mentioned or recognised their SL in a separate SL law, an educational law, or a disability law. All countries have in common that recognition was only achieved through the continuous efforts of Deaf organisations (National Associations of the Deaf, NADs) and Deaf individuals.

All of these policies and initiatives over the coming years indicate a very significant and active opportunity for the SignON Framework, App and services to have a major impact and also provide exploitation opportunities for the outcomes of the project. It is planned to actively address funding opportunities to scale-up and extend the SignON components and concepts for smart products and services in Europe's Digital Future¹⁴², when the system has been proven and the SignON Framework, App and services will be available for widespread use.

analytical framework', Language diversity management in higher education, Yearbook Sociolinguistica (De Gruyter). pp31-56.

¹³⁹ ["The Legal Recognition of National Sign Languages | WFD"](#)

¹⁴⁰ [Legal recognition of sign languages - Wikipedia](#). Legal recognition of SLs can also be usefully considered under 5 categories: (a) constitutional recognition, (b) recognition by means of general language legislation, (c) recognition by means of a SL law or act, (d) recognition by means of a SL law or act including other means of communication, and (f) recognition by legislation on the functioning of a national language council. See Maartje De Meulder, The Legal Recognition of Sign Languages (SLS, Vol. 15, No. 4, Summer 2015) (gallaudet.edu), http://gupress.gallaudet.edu/SLS_DeMeulder2.pdf

¹⁴¹ Though, as noted above, in Ireland there is still a significant lack of awareness of ISL in the public sector and users have experienced only minimal changes in their access to a wide range of services, <https://nda.ie/isl> and <https://www.irishexaminer.com/news/arid-40722807.html>

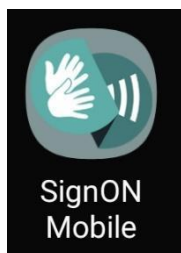
¹⁴² [Shaping Europe's digital future | Shaping Europe's digital future \(europa.eu\)](#)

6. Conclusions and Recommendations

This report is the first output of the project’s task T6.4 “Sustainable Exploitation of the SignON Services and Mobile Apps” that introduces the SignON user-centred co-created next-generation Sign Language Machine Translation service and an analysis of its intended markets and policy contexts. The initial core market of potential users for SignON are people who use SL as their first language, their family, friends and co-workers, as well as interpreters, NGOs, the scientific community, regulators, policy makers and external service providers, estimated to be 2.5 million in the EU and 10 million globally.

SignON will be an advanced Mobile App and Framework service that translates SLs into spoken languages. It paves the way for a new era in which not only spoken languages but sign languages will be accessible through automated translation for everyone. SignON's mission is to improve communications between all DHH and Hearing people.

SignON will be a free, open source application and framework for conversion between video (capturing and understanding SL), audio and text and translation between sign and spoken languages. To ensure wide uptake, improved sign language detection and synthesis, as well as multilingual speech processing on mobile devices for everyone, the SignON service will be a smartphone application running on standard modern devices.



The current fast-prototype SignON Mobile App is simple but powerful, running on Android and Apple phones, it provides text/speech translations and how SL translation might look in the future. This evolving prototype allows users to give their feedback to the developers of what they would like the SignON App to do for them in the future. The current prototype demonstrates these early SignON features, so that users can start to see, hold and feel something tangible and provide realistic inputs on what they need, and for the developers to get an appreciation of the realities of the mobile app platform and cloud requirements.

Globally over 70 million people are Deaf and 700 million are Hard of Hearing, resulting in a global shortage of SL interpreters. The limited number of easily available interpreters can make services difficult to access. SignON is an inexpensive and user-friendly solution that has the potential to significantly improve the inclusion of DHH and Hearing people¹⁴³.

¹⁴³ However, SignON is very clear that the availability of appropriately qualified interpreters would not make them cheaper! If anything, SL interpreters are under-appreciated cost-wise vis-a-vis other trained professionals!. We avoid a binary (and false!) comparison of either 'expensive human interpreter' or 'cheap

The right to SL is a basic Human Right. SL can be found at all levels of legislation, ranging from constitutions to disability laws, educational acts and language laws, as well as separate SL acts. SLs are not only protected at UN level but there are also various documents and initiatives at EU level that aim to safeguard the rights of Deaf people. These range from resolutions to reports and parliamentary recommendations. While they are often not legally binding, there is however a trend at EU level to make the SLs of Europe more visible at events and in the public arenas. The current EU Strategy for the Rights of Persons with Disabilities 2021-2030 explicitly addresses the provision of SL services by the Commission, ensuring SL availability when people move to another Member State or participate in the democratic process. In addition, the Commission will provide training for staff and support learning of interpretation in International Sign, to increase the accessibility of all its publications, notably of EU law and policies, and across its audiovisual communications and graphic design services as well as of its publications and events, including, where relevant, SL interpretation.

The legal recognition of SLs differs widely in various countries. In some jurisdictions (countries, states, provinces or regions), a SL is recognised as an official language; in others, it has a protected status in certain areas (such as education). Although a government may stipulate in its constitution (or laws) that a "signed language" is recognised, awareness can be low, and many users have experienced only minimal changes in their access to a wide range of services. Widespread availability of the SignON App and Framework services should greatly facilitate addressing such SL issues.

All of these policies, strategies and initiatives over the coming years, indicate a very significant and active opportunity for the SignON Framework, App and services to have a major impact in Europe's Digital Future¹⁴⁴, and also provide exploitation opportunities for the outcomes of the project.

machine solution'. We understand there is a nuanced continuum where the human expertise and skill of interpreters is essential versus contexts where SignON's MTSL will suffice and can do a job well.

¹⁴⁴ [Shaping Europe's digital future | Shaping Europe's digital future \(europa.eu\)](#)