Sign Language Translation Mobile Application and Open Communications Framework

Deliverable 7.1: Interim Progress Report

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Overview: This report provides an accurate detailed description of the work carried out in this project in the period (M1-M9).

Revision History

Version #	Implemented by	Revision Date	Description of changes
V0.1	Aoife Brady	01/09/2021	First Draft
V1.0	Aoife Brady	28/09/2021	Implemented the recommended changes

Approval Procedure

Version #	Deliverable Name	Approved by	Institution	Approval Date
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V0.1	D7.1	Olatz Perez de Viñaspre	UPV/EHU	22/09/2021
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V0.1	D7.1	Santiago Egea Gómez	UPF	21/09/2021
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V0.1	D7.1	Anthony Ventresque	NUID UCD	23/09/2021
V0.1	D7.1	Henk van den Heuvel	RU	17/09/2021
V0.1	D7.1	Catia Cucchiarini	TaalUnie (NTU)	24/09/2021
V0.1	D.7.1	Myriam Vermeerbergen	KU Leuven	26/09/2021
V0.1	D7.1	Frankie Picron	EUD	20/09/2021
V0.1	D7.1	Mirella De Sisto	TiU	22/09/2021

Acronyms

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

Acronym	Definition
<acronym>	<definition>
DHH	Deaf and Hard of Hearing
DoA	Description of Action
WP	Work Package
MT	Machine Translation
UI	User Interface
SLR	Sign Language Recognition
ASR	Automatic Speech Recognition
SL	Sign Language/s

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1. Executive Summary

People who are deaf or hard of hearing (DHH) not only face the challenge of interacting with hearing people in real-life situations but are often excluded from accessing information in society which is often communicated in an auditory modality (audio announcements, videos with no captions, etc.). The EU-funded SignON project aims to develop a mobile application that will translate between different European signed and spoken languages. The application, lightweight software running on a standard mobile device, will interact with a cloud-based distributed framework dedicated to these computationally heavy tasks. The application and the framework will be designed through a co-creation approach where DHH and hearing users will work together with the SignON researchers and engineers to build a solution that suits all user types. Furthermore, it will be built for easy adaptability to other languages (signed and spoken) and modalities. Ultimately, the application will promote equitable exchange of information among all European citizens. This project will run over three years from January 2021 to December 2023, and at the time of writing this report, we are almost 9 months into the execution of the project. In this report, we present the progress made to date, the challenges faced and the solutions that were used to achieve our objectives.

2. Introduction

The SignON Consortium consists of seventeen members from five different countries, with the required track record and expertise to achieve the objectives of the project. The members of the consortium are shown in Table 1. The first nine months involved setting up the logistics of running the project, hiring people to work on the various work packages (WPs) when needed and working out the various communication channels to be used in the execution of the project. The consortium learned how to work together and this allowed for significant progress to be made to the work programme, with seventeen deliverables submitted to the EU on time and Milestone 1 reached. This has allowed us to make inroads into our objectives which are described in the next section.

No	Name	Short Name	Country
1	Dublin City University	DCU	Ireland
2	Fincons Group AG	FINCONS	Switzerland
3	Stichting Instituut Voor De Nederlandse Taal	INT	Netherlands
4	Universidad Del País Vasco / Euskal Herriko Unibertsitatea	UPV/EHU	Spain
5	The National Microelectronics Applications Centre Ltd	MAC	Ireland
6	Universitat Pompeu Fabra	UPF	Spain
7	Technological University Dublin	TU Dublin	Ireland
8	The Provost, Fellows, Foundation Scholars & the College of the Holy & Undivided Trinity of Queen Elizabeth Near Dublin (Trinity College Dublin)	TCD	Ireland
9	De Vlaamse Radio En Televisieomroeporganisatie NV	VRT	Belgium
10	Universiteit Gent	UGent	Belgium
11	Vlaams Gebarentaalcentrum VZW	VGTC	Belgium
12	University College Dublin, National University of Ireland, Dublin	NUID UCD	Ireland
13	Stichting Katholieke Universiteit	RU	Netherlands
14	Nederlandse Taalunie	TaalUnie (NTU)	Netherlands
15	Katholieke Universiteit Leuven	KU Leuven	Belgium
16	European Union of the Deaf AISBL	EUD	Belgium
17	Stichting Katholieke Universiteit Brabant	TiU	Netherlands

Table 1: Partners in the SignON Consortium

3. Overview of Project Objectives for M1-M9

The SignON Project started with the aim of fulfilling six objectives, towards the overall aim of developing a solution to help to bridge the communication gap between DHH and hearing people by the provision of an accessible translation service. These are summarised below:

1. **Co-creation workflow and community**: A co-creation workflow will be established for: (i) the identification, collection and analysis of existing practices, translation requirements, needs and gaps, as well as the production of user requirements, performance indicators and recommendations to drive the development of the SignON framework, service and application; and (ii) an ongoing feedback loop from DHH and hearing stakeholders back to the consortium to ensure user responses are woven into the ongoing plans for the project, expectations are met and issues related to diversity and bias are explicitly addressed.

2. **SignON Framework and Mobile application**: (i) Design, development and release of the free, open-source SignON Framework and SignON smartphone application for effortless access to Machine Translation (MT) between signed and spoken languages, i.e. the SignON service; and (ii) Each user will be unrestricted by the source and target modalities and languages and can choose their preference via the mobile app's user interface (UI).

3. **Automated recognition and understanding of signed and spoken/written language input**: To facilitate recognition and understanding of signed and spoken/written language input SignON will encapsulate: (i) Sign Language Recognition (SLR), handling lexical and productive signs as well as fingerspelling; (ii) Advanced Automatic Speech Recognition (ASR) tuned to the user, the topic and the context, responding to atypical speech from DHH speakers.

4. **A language independent meaning representation (InterL)**. Design and develop a language independent meaning representation to facilitate the encoding and decoding of input/output messages: (i) language- and modality-specific Natural Language Understanding (NLU) layers capable of capturing the meaning of the input message; (ii) a vector space, symbolic or hybrid meaning representation of the input message and its context; (iii) procedures for mapping from NLU to Language Independent Meaning Representation and from Language Independent Meaning Representation to Generation modules.

5. **Sign, speech and text synthesis**: (i) SignON will convert a sign language (SL) specific syntactic-semantic representation in the target SL via a 3D virtual signer. The 3D virtual signer will be driven by a real-time computational system translating the syntactic-semantic representation into a suitable timed list of specific signs in the target SL to be played (planner) and a real-time computational system that visually renders the list generated by the planner into web-based virtual signer animations. This real-time computation system fixes potential conflicts while providing continuity and smooth transitions of the animations (realiser); (ii) SignON will convert language specific representations into surface text in the appropriate register, taking special care to avoid linguistic bias; and (iii) Protocols will be defined for connecting to external, cloud-based text-to-speech service and synthesis of speech based on surface text.

6. **A wide range of supported languages and extensibility of the framework**: (i) Through a phased development cycle, we aim to provide support for the following SLs: Irish Sign Language (ISL), British Sign Language (BSL), Flemish Sign Language (VGT), Dutch Sign Language (NGT) and Spanish Sign Language (LSE) as well as the English, Irish, Dutch and Spanish spoken languages. The support of these languages is driven by the expertise of the consortium members and aims to showcase the applicability and usefulness of the SignON framework; (ii) Develop a system that is **flexible**, i.e. can accommodate different user requirements and preferences, and **extensible**, i.e. new languages (signed and spoken) can be integrated and the support of existing ones can be updated.

3.1. Tasks and Objectives

- WP1: The work conducted in the first 9 months of this project revolved around tasks T1.1, T1.2, T1.3, T1.4 and T1.7. These tasks involve assessing the available, up-to-date literature and communicating with stakeholders. The main objective is to define the initial specifications for the SignON framework, service and application.

- WP2: The tasks that were covered in these 9 months are T2.1 and T2.2. Task T2.1 has been completed with the delivery of D2.1 in M3 and D2.2 in M8. Within these tasks we started developing our framework - first a common repository was created to host the implementation (D2.1), next the framework was designed following input from stakeholders (gathered in WP1) and feedback from the partners (D2.2).

- WP3: The work on the recognition side (within WP3) in this first part of the project was spread over all of the tasks: T3.1, T3.2, T3.3, T3.4 and T3.5. The first objective was to collect data to be used for model training and evaluation purposes (T3.1). This is an ongoing task. INT has implemented an infrastructure for collecting and organising data and sharing this data with the rest of the consortium. With the other tasks, initial work has been conducted on sign and spoken language recognition (T3.2 and T3.4) and understanding (T3.3 and T3.5).

- WP4: The main focus within these 9 months was the InterL-E and the related routings for converting from and to it. These are covered in tasks T4.1, T4.2, T4.4 and T4.6. The main objective in these first months was to develop and experiment with the InterL-E and to implement the routines for training and inference. These were achieved and deliverables D4.3, D4.6 and D4.11 were submitted. Finally, as result of in-progress research, the UPF team published a paper presenting the preliminary experiments on text to gloss NMT at 14th Workshop on Building and Using Comparable Corpora[1].

- WP5: The work within WP5 involves tasks T5.1, T5.2, T5.3 and T5.4. In these 9 months we focused on the initial implementation of the virtual character and the definition of the sign language lexicons. The latter was achieved within deliverable D5.4.

- WP6: We have conducted work on tasks T6.1, T6.2 and T6.3. We have commenced work on task T6.4 (starting in month M9). Task T6.1 has been concluded with the submission of deliverable D6.1. In this work package we mainly focused on defining our communication and dissemination strategy (presented in D6.1) and reaching out to our potential stakeholders through events (such as the AT4SSL workshop), social media (Twitter, LinkedIn, Facebook) as well as via our website (www.signon-project.eu).

- WP7: Continuous and ongoing work on all tasks has been conducted within WP7: T7.1, T7.2, T7.2, T7.3, T7.4 and T7.5. The objective is to establish and maintain a stable collaboration environment that will ensure the success of this project. We thus prepared and delivered a quality assurance plan (D7.2), a risk mitigation plan (D7.3), a data management plan (D7.8) and a data transfer agreement (D7.9).

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[1] https://www.researchgate.net/publication/354237714_Syntax-aware_Transformers_for_Neural_Machine_Translation_The_Case_of_Text_to_Sign_Gloss_Translation

- WP8: This work package has been completed with the delivery of D8.1 which accomplished task T8.1. It aimed to prepare the protection of personal data report (POPD) which was delivered in M6.

- WP9: Within the Ethics work package, we have been working on all tasks T9.1, T9.2, T9.3 and T9.4. We have worked towards establishing ethical and collaboration guidelines and informing our stakeholders as well as our partners.

4. Detailed Progress Report per Work Package

The work to be conducted in SignON has been divided up into nine work packages, in order to ensure a clear and well-organised distribution of tasks, and to facilitate an orderly and timely execution of the project goals.

The goals and scope of each Work Package are laid out in detail in the Grant Agreement (GA), including a list of the specific tasks that belong to them. The main aims of the nine Work Packages can be summarised as follows:

- **Work Package 1 (Co-creation and User Response)**, led by the European Union of the Deaf (EUD), will engage with potential users to co-design and co-develop the SignON framework and application and will lay out a roadmap of KPIs to guide their development. Through openness, fairness and gender equality we will also establish a user community with hands-on experience with realistic expectations towards the SignON service.

- **Work Package 2 (SignON Service and Mobile App)**, led by FINCONS GROUP AG, will encapsulate the technical activities of designing and developing the SignON framework that will incorporate components delivered through WP3, WP4 and WP5 and the SignON mobile app. The framework and the app will be free and open-source to allow for easy adoption and evolution during and after the life cycle of the project. WP2 is also concerned with the instantiation and utilisation of the cloud-based platform and the creation of a repository for storing and organising collected data.

- **Work Package 3 (Source Message Recognition, Analysis and Understanding)**, led by Ghent University (UGent), will research and develop efficient methods for recognition and analysis of the input message in the source language: (i) SLR, (ii) ASR for typical and atypical speech and (iii) input and recognised text analysis and processing through a set of NLU pipelines. The outcomes

of the involved research and development will be components for SLR, ASR and NLU, which will be adaptable (to the user and the use-case). The work will be conducted in parallel, and led by different partners, in order to achieve a synchronous delivery of source message understanding of both spoken and sign languages in accordance with the DesignForAll methodology.

- **Work Package 4 (Transfer and Interlingual Representation),** led by Tilburg University (TiU), will formulate and implement a multimodal and multilingual intermediate representation - InterL - to bridge sign and spoken languages handled in the project as well as the transformation processes from and to InterL. It will start with two different representations - a symbolic one and a representation based on embeddings - that will be merged into a hybrid representation.

- **Work Package 5 (Target Message Synthesis),** led by Universitat Pompeu Fabra (UPF), is devoted to real-time target message synthesis in sign and spoken languages. A personalisable 3D virtual signer to convey the translated message in the target SL will be developed. This will be co-designed with and verified by the users (WP1). WP5 will also encapsulate the work for written language synthesis and normalisation based on the representation in InterL (WP4). Thereafter this text will serve as the basis for the synthesis of spoken language through a commercial text-to-speech platform. WP5 will also deliver a pipeline for sending the target message to the user through the SignON app (WP2).

- **Work Package 6 (Communication, Dissemination and Exploitation)**, led by Vlaams Gebarentaalcentrum VZW (VGTC), aims to raise awareness on the outcome of the project. SignON will offer innovative opportunities to exploit and promote its results and WP6 will develop business plans and advance exploitation for the project, including joint and individual opportunities, maximising opportunities for the dissemination of project results and ensuring effective communication procedures are in place. The project will draw on significant media networks and established contacts to promote awareness, adoption, and further development of the SignON services and application.

- **Work Package 7 (Coordination and Management)**, led by Dublin City University (DCU) as coordinator of the project, will manage and coordinate the overall project with WP leaders managing their own work-packages and contributing to project management (meetings, reviews, reports). DCUs extensive experience in managing and collaborating in multidisciplinary research

as well as experience in organising multidisciplinary research-industry events will ensure smooth and productive work throughout the project.

- **Work Package 8 (Ethics requirements)**, led by Dublin City University (DCU), will set out the 'ethics requirements' that the SignON project must comply with.

- **Work Package 9 (Ethics)**, led by Trinity College Dublin (TCD), will oversee and coordinate all ethical aspects of the project and provide ethical guidelines and protocols for identification and recruitment of participants. It will also ensure all consortium members abide by the EU Code of Research Integrity and provide support and advice to members of the community as well in terms of the use of their personal data.

4.1 Work Package 1

4.1.1 Introduction

Through WP1, we are engaged in working with potential users to develop the SignON framework and define KPIs to ensure that we develop as much as possible to meet the realistic needs and expectations of a growing user community composed of potential users.

4.1.2 Work Package Objectives (M1-M9)

WP1 (Co-creation and user response) will be dedicated to involving potential users in the SignON co-development and co-design process and setting up Key Performance Indicators (KPIs) to guide progress during the SignON project. During this process, the user community is expected to grow gradually and serve as feedback to the technical partners while attaching importance to gender equality and openness. Therefore, the work of WP1 from M1 to M36 is essential.

The overall objectives of WP1 are :
- Identification, collection and analysis of existing practices, translation requirements, needs and gaps in current software solutions and services, as well as to produce recommendations and performance indicators to bootstrap and support the development of the SignON service, framework and application.
- Establish an effective continuous communication between DHH and hearing stakeholders on the one hand and the consortium on the other, in order to define requirements for the SignON

services, framework and application and to ensure these are woven into the ongoing plans for the project.

- Ensure that SignON addresses relevant use-case scenarios and its range and quality of services is in line with stakeholders' expectations and that stakeholders' expectations are in line with the capabilities of the SignON framework.

- Through the community iteratively interacting with the SignON application, to test and validate the SignON service and to improve it (and its underlying components) via its machine learning capabilities, ensuring that it reaches indicated quality standards.

- To explicitly address diversity and bias by ensuring that stakeholders involved in ongoing co-creation events represent the diversity of the stakeholder groups.

- To ensure the efficient and effective adoption of the SignON communication services among the stakeholders, leveraging its beneficial impact on DHH users.

4.1.3 Tasks (M1-M9)

T1.1: Case Studies and Evidence Analysis

This task gathers evidence, lessons learned and best/worst practices of sign language translation with a particular emphasis on the adoption of application-based technologies and services while paying particular attention to data protection. The output of T1.1 was translated into D1.1. This deliverable was submitted in March 2021 and describes lessons from projects on sign language machine translation to date as well as highlighting deaf community perspectives towards machine translation software or/and devices with attention to ethical considerations and data management. Particular emphasis is also dedicated to key challenges in order to meet potential user's expectations and ensure effective communication between the user community and the SignON Consortium.

T1.2: (re)define and (re)evaluate target usage domains and use-case scenarios

This task aims to assess the validity of the use-cases and use-domains before using the results of D1.1 to update the use-cases and use-domains and, eventually, to extend the application domain of SignON. A dedicated report will be devoted to this in D1.2 and will be scheduled at the end of the SignON project (M33).

T1.3: User Requirements, Needs and Gaps

This task defines the user requirements, needs and gaps for the new translation technology based on the data from tasks T1.1 and T1.2. For this purpose, communication with DHH citizens will help to refine the outline of end-user requirements, as well as exchanges with industry stakeholders (media, translation service, public authorities) to identify professional user requirements. Details of the results of this quantitative and qualitative users requirements research are reported in D1.3.

The first version of D1.3 was submitted in June 2021 and contains focus group interviews of deaf participants and detailed analysis of user requirements with a list of recommendations. A distinction has been made between recommendations that are within the scope of the SignON project and recommendations that are outside the scope of the SignON project.

For the next steps, we are planning to have feedback on evaluation of the app and avatar and the second and third versions of D1.3 (D1.7 and D1.8) will respectively take place in M18 and M30.

T1.4: Technical user Requirements, Iterative design process (UX)

This task aims to define the technical requirements to support the application development, integration and testing of SignON. These technical requirements are based on the work of T1.3 (user requirements) for the best possible implementation of the SignON application in WP2 (task T2.3). It is planned to take into account the needs of each user group such as end-users and business users. Throughout the development cycles, T1.4 will be considered as a reference intermediary to moderate the execution of each cycle. The work of T1.4 is documented in D1.4, the first version of which was published in June 2021. The second and third versions (D1.9 and D1.10) will be published in M18 and M30 respectively.

T1.5: Building a bias-free community within and outside the SignON project

This task aims to engage all stakeholders through the organisation of co-creation events. During these first 9 months, focus groups were organised with deaf users in Spanish and Flemish sign language via the Zoom platform. More are planned, as the enlargement of the user community is the key to T1.5 to help determine/validate some of the objectives recorded by the different tasks of WP1 (T1.2, T1.3, T1.4). Attention is given to the sign languages studied as well as to the best possible representation of users regardless of gender, ethnicity, religion, etc. In the coming months, T1.5 will focus on linking with WP2.

The production of recommendations and guidelines are expected to get the best out of sign language translation services. Two reports (D1.5 and D1.11) will be drawn from this task in M18 and M33.

4.1.4 Deliverables Submitted

- D1.1: Case studies and evidence analysis (TCD, March 2021)
- D1.3: First users requirements report (EUD, June 2021)
- D1.4: First Technical Requirements and User Research (UX Design) Report (MAC, June 2021)
- D1.13: KPIs (TCD, June 2021)

4.1.5 Deviations and Corrective Actions

At the moment, we didn't feel any need to deviate from the DoA or to carry out any corrective actions in WP1.

4.1.6 Conclusions and Next Steps

- T1.2: New focus groups will be organised in the near future. In these interviews, the participants will have the opportunity to use the prototype of the SignON app and give direct feedback. The focus group interviews will be conducted for NGT, LSE, VGT and ISL users, as well as with some hard of hearing and hearing users. To ensure that the organisation of these focus groups runs smoothly, EUD has shared guidelines with the appropriate partners.

- T1.4: The prototype of the app is now available on both Apple and Android mobile devices and will continue to be updated. This means the app will continue to be improved in the future, the biggest improvement being the introduction of the avatar itself and sign language recognition. A general launch of the app will be D2.6 scheduled for M18, when it's more complete, for now the prototype can only be used by partners and participants in focus group interviews.

- T1.5: Event[2] to be held at the General Assembly of the EUD in May 2022 whilst showing the prototype of the app to deaf representatives from National Associations of the Deaf from every EU and EFTA member country.

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[2] Format to be decided

4.2 Work Package 2

4.2.1 Introduction

WP2 (SignON Service and Mobile App) deals with the technical activities needed to design and develop the SignON Services Framework, which integrates components delivered through WP3 and WP5 with the SignON Mobile App. Moreover, WP2 is concerned with the instantiation and utilisation of the SignON Open Cloud Platform together with the creation of a repository for storing and organising collected data, and with the design and development of the SignON Mobile App. The framework and the app will be free and open-source to allow for easy adoption and evolution during and after the life cycle of the project.

4.2.2 Work Package Objectives (M1-M9)

The general objectives of WP2 are:

- Implementation of the SignON Open Cloud Platform and the SignON Services Framework;

- Integration of the services and components developed in WP3 and WP5;

- Development of the SignON Mobile App to support translation as well as user input for service upgrade according to the use cases of WP1;

- Delivery of the SignON services through a hybrid remote-local service delivery platform i.e. cloud (remote) and mobile (local).

Within the reporting period (M1-M9), the objectives of WP2 are:

- Design of the SignON Services Framework and of the integration of services and components developed in WP3 and WP5;

- Definition of the SignON Development Repository.

Activities regarding the integration of services developed in WP3 and WP5 with the SignON Mobile App and their release through the SignON Open Cloud Platform are in progress and will be carried on throughout the project with incremental releases at M13 (D2.3), M26 (D2.4) and M36 (D2.5).

Activities regarding the development of the SignON Mobile App are in progress and will be carried out throughout the project with incremental releases at M18 (D2.6) and M30 (D2.7).

4.2.3 Tasks (M1-M9)

During the reporting period (M1-M9) these tasks were carried out:

T2.1: Design and implementation of the SignON Open Services Framework (M1-M8: Completed)

This task is focused on the definition of the SignON Development Repository and on the design of the SignON Services Framework architecture.

For the SignON Development Repository, following the positive experience of the industrial partners in previous commercial and research projects, the GitLab platform was adopted for hosting the codebase of the project and a container registry for the Docker images. Furthermore, structure organization and shared patterns (versioning, branching, etc.) were agreed among partners. The results were formalised in the deliverable "D2.1 - SignON Development Repository".

For the design of the SignON Services Framework architecture, the input and output requirements of the SignON App and the SignON Pipeline were used as a starting point to define the SignON Orchestrator, i.e. the component that will take care of dispatching information between the various components of the system. Furthermore, technical details about the component interaction were agreed with the technical WPs (WP3, WP4 and WP5) in order to support the foreseen workflows. The results have been formalised in the deliverable "D2.2 - SignON Services Framework Architecture".

T2.2 Development of the SignON Cloud platform (M7-M36: Ongoing)

The task deals with the definition and implementation of the SignON Open Cloud Platform. The dimensions for the cloud platform have been determined and have been ordered. The hardware is expected to arrive the second week of October 2021. To speed up the service to other participants in the project, a new VPN access system has already been implemented based on open source software. The first virtual machine and access certificates have been provided.

The repository has been built on the basis of already available INT hardware, but will be upgraded soon with new hardware and extra storage. 1.7 Terabytes of data have already been uploaded. When the new storage is implemented, access will be expanded with webdav capabilities on a secured connection.

The results will be formalised later in the project, within the deliverable "D2.3 - First release of the SignON Open Cloud platform, including the Open Cloud Platform design", due by M13.

T2.3 Design and Development of the SignON Communication Mobile Application (M10-M30)

As indicated in the DoA, an initial fast prototype of the SignON App was developed on Android to demonstrate the basic SignON Mobile App Input/output functions and framework services, so that users could start to see, hold and feel a tangible app and provide realistic inputs on what they need (in WP1), and for the developers to get an appreciation of the realities of the mobile app platform and cloud requirements (in WPs 2-5). This initial prototype will be iteratively improved during the remainder of the project based on the user-driven feedback of WP1 (using an iterative DevOps approach) with formal major releases as D2.6 and D2.7 in M18 and M30, respectively.

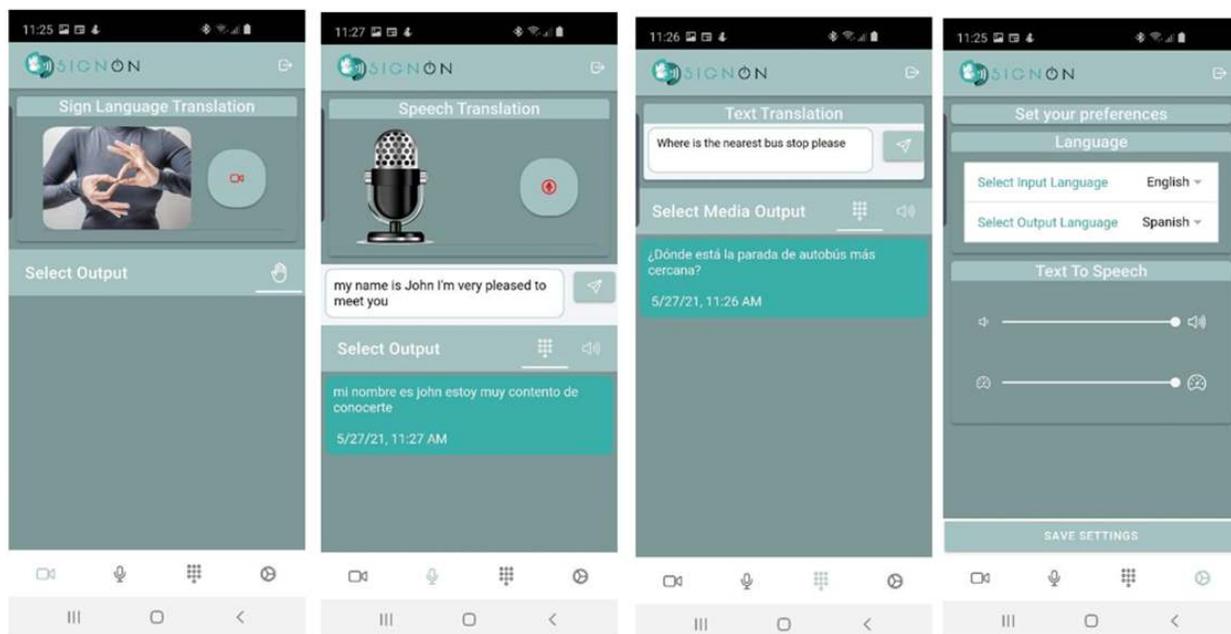*Figure 1: Screens from the initial fast prototype SignON Mobile App*

Following the Android "Play Store" practice, the initial version of the App was published as "closed/hidden" and only available for "Internal Testing" by a defined group of Authorised Testers from the Partners, who installed, reviewed, and provided formative evaluation feedback on the initial SignON Mobile App in WP1 task T1.4.

4.2.4 Deliverables Submitted

During the reporting time (M1-M9) all the two foreseen deliverables were submitted:

- D2.1 - SignON Development Repository (Fincons, March 2021)**:** The deliverable D2.1 is about the definition of a SignON Development Repository, hosted on the GitLab platform and suitably structured to be used by all members of the SignON distributed development team. The SignON Development Repository will enable incremental development, testing and issue management of the SignON Services Framework and of the SignON App. Furthermore, once the basic system is proven in the current project, the SignON Development Repository will support the subsequent publishing and use by the wider open-source community.

- D2.2 - SignON Services Framework Architecture (Fincons, August 2021)**:** The deliverable D2.2 is about the SignON Services Framework architectural design, including a specification of an appropriate storage for the large data (e.g. audio, video, other media, etc.).

4.2.5 Deviations and Corrective Actions

In Task T2.2, the DoA specifies that MAC is responsible for all three of its deliverables. However it was agreed amongst the Partners, that it would make most sense for INT, the task leader, to produce D2.3 describing their platform and its Open Cloud Design in M13, then MAC would prepare the updates of this deliverable, D2.4 and D2.5, in M26 and M36.

Current titles of deliverables now reflect the changes reported in the approved GA amendment, and differ slightly from the ones listed in the EU Projects portal, in order to provide a better adherence with task activities.

For convenience, below is reported the list of deliverables titles from the GA amendment:

- D2.1 - SignON Development Repository
- D2.2 - SignON Services Framework Architecture
- D2.3 - First release of the SignON Open Cloud platform, including the Open Cloud Platform design
- D2.4 - Intermediate release of the SignON Open Cloud Platform
- D2.5 - Final release of the SignON Open Cloud Platform

- D2.6 - First release of the SignON Communication Mobile Application
- D2.7 - Final release of the Communication Mobile Application
- D2.8 - First Machine learning interface
- D2.9 - Final Machine learning interface

4.2.6 Conclusions and Next Steps

The work carried out until now allowed for a fruitful collaboration with all technical partners to successfully design the SignON Services Framework architecture, which defines the interactions among the services and the SignON Mobile App.

In the next steps, the integrations with all services will be developed incrementally together with the development of the services themselves, in a microservice-oriented perspective. Similarly, the SignON Open Cloud Platform will be released incrementally during the project at M13 (D2.3), M26 (D2.4) and M36 (D2.5).

Moreover, the SignON Mobile App will be developed with an Agile DevOps approach and a co-creation process together with users, resulting in a release in two stages at M18 (D2.6) and M30 (D2.7).

Finally, a Machine Learning interface for the SignON Service will be developed starting from M13 (T2.4), which will mainly target proficient signers, e.g. sign language interpreters, to enrich and extend the models and intermediate representations as described in WP3, WP4 and WP5.

4.3 Work Package 3

4.3.1 Introduction

In WP3 (Source Message Recognition, Analysis and Understanding), the research activities needed to recognise and understand source messages are handled. This includes sign language recognition (SLR), to extract information from sign language videos that can be used for translation in WP4. Automatic speech recognition (ASR) is also included in WP3, to transcribe speech audio into text prior to translation. NLU is being developed to conduct text normalisation, spelling correction, named entity recognition, part-of-speech tagging and other techniques. A linguistic analysis task is also part of WP3, specifically aimed at obtaining a linguistic analysis for the sign languages included in the SignON project. Finally, to support this diverse set of tasks, data collection is a crucial task in WP3.

As the WP3 objectives are heavily research oriented, the deliverables for this WP are mostly in the final year of the project. Therefore, this section reports on intermediate progress on the different tasks in WP3.

4.3.2 Work Package Objectives (M1-M9)

The overall objectives of WP3 are:

- The development of a generic component for real-time sign language recognition supporting multiple SLs and supporting continuous learning through user feedback

- Real-time processing of spoken language input using ASR

- Real-time adaptation of written language input using NLU; specifically aimed to correct mistakes made by both hearing and DHH people

- Linguistic analysis and understanding of SLs

- Data collection

In the reported period (M1-M9), the following objectives were relevant:

- Data collection: initial data collection of parallel corpora for sign language recognition and translation

- Sign language recognition: research of sign language recognition techniques as well as the design of a representation for sign languages

- ASR: the use of ASR techniques to automatically annotate video data as well as to create a proof of concept

- NLU: research on natural language understanding techniques

- Linguistic analysis: perform an initial linguistic analysis for Irish Sign Language, after which analysis for other sign languages can follow

4.3.3 Tasks (M1-M9)

All tasks in WP3 are currently ongoing.

Task 3.1. Data collection and organisation

An FTP data repository has been built. In this repository, datasets that can be used for sign language translation are stored. Specifically, data has been collected for several languages. For Flemish Sign Language (VGT), the VGT Corpus and interpreted COVID press conferences from the Belgian federal government have been collected. Several conversations between Irish Sign Language (ISL) users have also been gathered and stored in the data repository. Negotiations with the Flemish public broadcast (VRT), specifically for licencing and GDPR issues, are ongoing. Upon the conclusion of these negotiations, a dataset of public news broadcasts in Flemish with interpreted VGT will be added to the data repository. In order to transcribe the COVID press conferences, a Belgian Dutch speech recognition engine is in preparation. Access to the Dutch Sign Language (NGT) corpus has been requested. Negotiations with VGTC are ongoing for access to the VGT dictionary.

Task 3.2. SLR component development and model training, evaluation and release

Sign language recognition was investigated as part of this task. This resulted in a scientific publication (conference presentation)[3].

Furthermore, ongoing work was presented on sign language representations and segmentation into meaningful units as part of another scientific publication (conference presentation)[4].

Finally, a third scientific contribution was made investigating the benefits of transfer learning of large pre-trained language models for sign language translation from a sign language to a spoken language (conference presentation)[5].

Regular coordination meetings for collaboration with WP4 (Task 4.5) have been held to align the output of the SLR component and the input of the InterL component.

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[3] De Coster, Mathieu and Van Herreweghe, Mieke and Dambre, Joni. "Isolated Sign Recognition from RGB Video using Pose Flow and Self-Attention." *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*. 2021.

[4] De Sisto, Mirella and Shterionov, Dimitar and Murtagh, Irene and Vermeerbergen, Myriam and Leeson, Lorraine. "Defining meaningful units. Challenges in sign segmentation and segment-meaning mapping (short paper)." *Proceedings of the 1st International Workshop on Automatic Translation for Signed and Spoken Languages (AT4SSL).* 2021.

[5] De Coster, Mathieu and D'Oosterlinck, Karel and Pizurica, Marija and Rabaey, Paloma and Verlinden, Severine and Van Herreweghe, Mieke and Dambre, Joni. "Frozen Pretrained Transformers for Neural Sign Language Translation." *Proceedings of the 1st International Workshop on Automatic Translation for Signed and Spoken Languages (AT4SSL).* 2021.

Task 3.3. Linguistic investigation of supported sign languages

The linguistic analysis for Irish Sign Language is finished.

Collaboration between TU Dublin (Dr. Irene Murtagh) and KU Leuven (Prof. Dr. Myriam Vermeerbergen and Lien Soetemans) has started for the linguistic analysis of Flemish Sign Language.

Task 3.4. ASR component development and model training, evaluation and release

The Kaldi ASR system is being investigated. The ASR server response latency as a function of the size of the language model is being analysed in order to support real time ASR.

Generic speech recognisers for several languages are being worked on. A generic speech recogniser for Dutch has been created and is available as a web service. A generic speech recogniser for Flemish will be made available later this year. Spanish and English speech data are currently being collected; this will be used to create generic speech recognisers for those languages.

Data collection strategies for the speech of DHH speakers are discussed with project partners.

Task 3.5: Implementing language-specific NLU pipelines

Research into language translation has been performed.

Open source packages for NLP tasks have been evaluated, with spaCy and Stanford's CoreNLP: stanza being used to develop prototype pipelines.

NLU pipelines are under active development.

NLU pipelines based on spaCy have been used to provide syntactic information for experiments on gloss generation (text-to-gloss translation). Current work involves the use of the generated representations to implement a system for data augmentation.

4.3.4 Conclusions and Next Steps

Due to the multi-disciplinary structure of WP3, the progress on the individual tasks in this work package is mostly independent. However, wherever a task interacts with other tasks, possibly in other work packages, the work is aligned across work packages and where useful, collaborations have been initiated. For example, there have been meetings to align WP3 with the SignON app (WP2) as well as with the InterL (WP4).

For task 3.1, the next steps are to continue data collection, but also to perform data organisation, cleaning and analysis. The construction of parallel corpora using ASR and SLR methods is underway.

Task 3.2 is also underway, with research into SLR progressing and a data analysis of currently collected data (task 3.1) planned.

Linguistic analysis of the supported sign languages in SignON will continue according to plan (task 3.3). The next sign language that will be analysed is Flemish Sign Language (VGT) in a collaboration between TU Dublin and KU Leuven.

The ASR component of task 3.4 will continue to be developed, taking into account the requirements of the SignON application in terms of audio format and bandwidth requirements. The compensation for acoustic conditions which may occur when the SignON app is used will also be investigated.

Task 3.5 will see the continued development of the NLU pipelines, with more coordination with the linked parts of the input/output pipeline.

4.4 Work Package 4

4.4.1 Introduction

Work package (WP4) focuses on the research and development of models and (software) pipelines to allow the translation between different languages, both signed and spoken. This includes experimentation with existing and development of new models, deciding on input/output requirements and the implementation of mechanisms for training and inference with these models. In the first nine months of this project we focused on the research and initial development of the InterL-E, the first version of training/updating and inference routines.

4.4.2 Work Package Objectives (M1-M9)

The objectives of WP4 as defined in the GA are summarised below:

1. Definition and implementation of multimodal and multilingual intermediate representations which include an abstract interlingual symbolic meaning representation (InterL-S) and a multilingual and multimodal distributional representation based on embeddings (InterL-E), where spoken and signed languages are incorporated in addition to the written form.

2. Hybridisation of symbolic and embedding-based representations combining their strong sides (InterL).

3. Advancing from language specific meaning representations to language independent meaning representations. That is, defining (i) a mapping between language specific NLU analyses (WP3) and the InterL and (ii) a mapping between the InterL and a form that is needed as input for the output module: text representation suitable for text to speech synthesis or for sign language synthesis (WP5).

4. Development of a pipeline for updating the intermediate representation with new data: a framework that can be updated with new data to support new sign, spoken or written languages.

Within the first nine months of this project we worked on the first, third and the fourth of the objectives as stated above. That is, the hybridisation objective (the second one) will be addressed in the second half of this project (M18-M36), once symbolic and embedding-based representations are available.

Overall, in this first part of the project we investigated different pre-built multilingual models that can suit our task for multilingual MT. These were then tuned and updated to address the specific use-cases covered by SignON. To facilitate these activities, training and inference routines were developed.

The implementation of the routines has been uploaded in repositories accessible by and managed by the consortium. To share large models and facilitate the collaboration between the partners we employed external services - B2DROP and B2SHARE. Data has been collected, organised and stored by INT who have developed a common access point for all partners (cf. Task 3.1).

4.4.3 Tasks (M1-M9)

The tasks addressed in the first nine months of the project are:

- **Task 4.1: Development of a symbolic intermediate representation (InterL-S)**, led by KULeuven.

- **Task 4.2: Development of an intermediate representation based on distributional semantics / embeddings (InterL-E)**, led by UPV/EHU.

- **Task 4.4: Source or recognised text transformation from and to InterL**, led by UPF.

- **Task 4.6: Development of an approach for automatic updating of the InterL based on new data**, led by UPV/EHU.

In March, UPV/EHU and UPF, who were working on the deliverables, built an initial pipeline (for training and inference). This pipeline revolved around a large multilingual model that works on text, i.e. not yet supporting representation of signed languages. Issues with efficiency, due to the size and complexity of the models, were resolved by reducing embedding dimensions and vocabularies. This work was followed by the first interlingual representation (InterL-E, the embedding-based interlingua) and routines being ready in April.

Within T4.2 (aiming at D4.3), UPV/EHU experimented with text translation (text-to-text) in a multilingual setting - English, Dutch and Spanish. That is, their model was trained on multiple languages sequentially.

Within Task 4.4 (aiming at D4.6), UPF experimented with text-to-text translation in a bilingual setting - English and Spanish. Their model was trained with English-Spanish data. Furthermore, they experimented with text simplification which was deemed important for the translation of sign languages.

Within Task 4.6, we worked on deliverable D4.11 (details about this deliverable can be found below) and focused on a training and inference pipeline for InterL-E with the supported languages of mBART. Currently we are working on including (spoken) Irish which is originally not supported in mBART. In parallel, the teams from KULeuven, UGent and TiU looked into translation for SL representations.

TiU, TU Dublin, UGent, UCD, KULeuven and TCD teams worked together to investigate a suitable form and transformation mechanism to encode SL into InterL representation. This work is ongoing and is based on the Sign_A formalism developed by Irene Murtagh (TU Dublin).

4.4.4 Deliverables Submitted

Between M1 and M9, deliverables

- D4.3: First distributional intermediate representation based on embeddings - InterL-E (UPV/EHU, April 2021)

- D4.6: First Routines for transformation of text from and to InterL (UPF, April 2021)

- D4.11: First adaptable pipeline for training and updating the InterL (UPV/EHU, June 2021)

were submitted. All deliverables were submitted on time.

4.4.5 Conclusions and Next Steps

In the first nine months we worked on T4.1, T4.2, T4.4 and T4.6 and we submitted the three planned deliverables. At this stage the work conducted within WP4 has focused on models and routines for translation between spoken languages, covering all intended languages (currently working on Irish).

In addition, we collaborated with our partners from WP3 and WP5 on the mechanisms which will connect the InterL models with recognition (WP3) and synthesis (WP5).

The immediate next steps focus on D4.1: First symbolic intermediate representation - InterL-S (due date M18) and D4.7: Second Routines for transformation of text from and to InterL (due date M18) as well as the later deliverable D4.9: First Routines for transformation of SL representations from and to the InterL (due date M22). D4.1. will present our first work on the symbolic intermediate representation based on language-specific WordNets for both spoken and signed languages. In D4.7 we will present our ongoing work on developing training and inference routines to facilitate the operation with the translation component. D4.9. will focus on the routines for encoding a message in SL as an InterL representation and decoding from InterL into an SL representation suitable to be fed into the SL synthesis component (WP5).

4.5 Work Package 5

4.5.1 Introduction

WP5, target message synthesis, deals mainly with the research and development needed for the synthesis of the virtual signer (modelling, animating and rendering a character with the message in the appropriate sign language), of text and spoken messages.

It is formally divided into six tasks, namely:

- T5.1: Co-designing a personalisable virtual animated signer.

- T5.2: Developing an interactive system of learning from user generated signed content.

- T5.3: Development of a Sign_A lexicon and language-specific structure.

- T5.4: Development of a planner for translating from Sign_A representation to BML-based script.

- T5.5: Real-time synthesis and delivery of target SL.

- T5.6: Generating output in the target language and modality - sound or text.

UPF (GTI group) leads T5.1 (modelling of virtual signer), T5.2 (interactive learning system), T5.4 (animation of signers), T5.5 (rendering of signers); TUDublin leads T5.3 (formal representation of SL), and KU Leuven T5.6 (speech and text generation), both with significant interfaces with WP3 and WP4.

4.5.2 Work Package Objectives (M1-M9)

The DoA defines five objectives of the WP, and we recall them here, along with a brief comment with respect to months 1-9:

Objective 1: A language specific representation of sign language (in the target language) suitable for a 3D virtual signer and the corresponding pipeline to convert a message from InterL representation.

This is the key aspect of T5.3, and a central point of the first nine months of the project. Indeed, a deliverable with the first version of Sign_A, the representation, has been prepared and submitted by the end of month 8 (August)

Objective 2: Sign language synthesis via animated signer. SL synthesis will be implemented using a virtual character driven by a mark-up language representation suitable for rendering 3D animated characters.

Work in the markup language (key aspect of T5.4) has gone in parallel with the work of the first version of Sign_A. An initial version of a Sign_A to (an extended) BML has been already produced.

Objective 3: Signed content co-creation system. An interactive system capturing manual and non-manual gestures (including facial expressions) within the signing (or gestural) space and synthesising them into animated characters, extending an existing facial retargeting system.

Investigation and tests on hardware and software alternatives to capture signs have taken place, in preparation for an initial prototype of the co-creation system. To be more precise, both OpenPose and MediaPipe technologies were compared, and finally the library from Google (MediaPipe) was chosen for its simplicity, accuracy and performance. With that, initial development has been done on a pipeline where a sign video or stream is motion captured and a skeleton that performs the animation is automatically generated and stored in a database.

Objective 4: A pipeline for extracting and processing messages in InterL format into written text in the target language. This pipeline should synthesise text in real-time from the InterL, cover a wide range of languages and be extensible to other languages.

Objective 5: A pipeline for extracting and processing messages in InterL format into spoken equivalents in the target language. This pipeline should synthesise speech in real-time, cover a wide range of languages and be extensible to other languages.

The key to the latter two objectives is interfacing with WP4, which is concerned with the design of the InterL representation. Text generation will be ensured by a multilingual transformer model, which is an integral part of the pipeline developed within WP4. Within WP5, textual output will be normalised, validated and encoded within a format suitable for integration within the SignON application framework. Speech will be provided through an external provider, viz. Acapela group.

4.5.3 Tasks (M1-M9)

The work carried out in the different tasks, briefly summarised above related to the objectives, is described below per task.

T5**.1. Co-designing a personalisable virtual animated signer.**

Figure 2: Personalisable Virtual Animated Signer

The goal of this task is that the users can personalise the character/avatar they will use for SL. Work towards this has taken place along two different aspects, technological and user related.

Technologically,

- the state of the art on tools which could be used to create and personalise models has been updated from Llorach et al.[6]. The key characteristics of characters and tools comparison provided on p. 121 is still essentially valid, except for Adobe Fuse no longer being available; in commercial tools, Metahumans[7] means a huge leap, and SignON should keep an eye on them to be able to eventually adopt them. The pipeline for easily creating characters described in p. 126-127 will be the basis of the co-design strategy.

- existing models of the UPF-GTI have been checked for suitability, in terms of quality and ability to animate manual features, which require more detail in the hands. This aspect is connected to good progress in T5.3 and T5.4, which has been recently achieved with the first definition of Sign_A and Sign_A-BML translator, and work can progress faster now.

In terms of users, the requirements with respect to characters/avatars in the corresponding deliverable have been analysed to be taken on board.

T5.2. Developing an interactive system of learning from user generated signed content.

The evolution of the existing re-targeting system[8] is taking into account very recent work related to (French) Sign Language by Naert et al[9]. A proof-of-concept system is being implemented, after having purchased, integrated and tested some hardware (such as Ultraleap) and software (MediaPipe). Therefore, both the capture and edit modules have been planned and are in development. Also, using a professional Motion Capture system available at the UPF to capture signs has been prepared: it should have taken place in July, but the worsening of the pandemics forced the adjournment.

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[6] G Llorach, J Agenjo, J Blat and S Sayago: Web-Based Embodied Conversational Agents and Older People, in *Perspectives on Human-Computer Interaction Research with Older People*, S Sayago (Ed.), Springer 2019 (https://doi.org/10.1007/978-3-030-06076-3_8)

[7] https://www.unrealengine.com/en-US/digital-humans

[8] Valls-Garolera, E. et al. (2019) Real-time face retargeting and a face rig on the web, *ICGI 2019*.

[9] 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
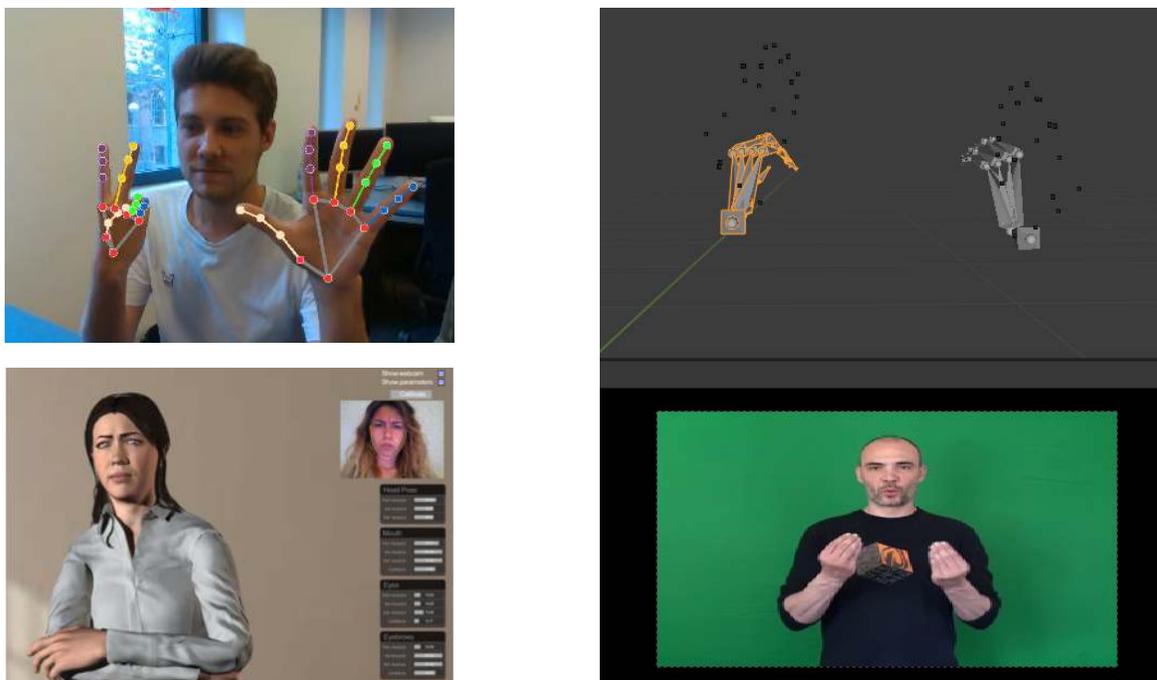
Figure 3:Interactive Learning System

T5.**3. Development of a Sign_A lexicon and language-specific structure**

The core of the work has been related to D5.4, aiming to provide a description of the SignON sign language (SL) lexicon and its architecture. The deliverable also seeks to provide an XML description for the Sign_A computational framework[10] (Murtagh, 2019), which we will leverage both within the lexicon entry descriptions and also, within the development of a markup language that will interface with a realiser on the SL synthesis pipeline (we will use avatar technology to synthesise the SL output within this development).

The SL lexicon of the project will cater for Irish Sign Language (ISL), Flemish Sign Language (VGT), Dutch Sign Language (NGT), Spanish Sign Language (LSE) and British Sign Language (BSL). For the deliverable, the lexicon is populated with data relating to the ISL lexicon, as initial research provides a linguistic analysis of ISL. We endeavour to accommodate both the established and the productive lexicon for ISL in this lexicon architecture. As our linguistic analysis progresses as part of WP3, we will in turn progress the SL lexicons for VGT, NGT, LSE and BSL. Further research will inform future iterations of the SL lexicon architecture for these SLs.

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[10] Murtagh, I. 2019. *A Linguistically Motivated Computational Framework for Irish Sign Language*. PhD Dissertation. Dublin: Trinity College Dublin.

The deliverable outlines the function of the SL lexicon and the attributes associated with it; discusses the architecture of the lexicon and the various repositories associated with the lexicon, that are the building blocks of this architecture; then it provides a SL lexeme repository XML specification with a first part concluding with a brief discussion on the operations that may occur on the lexicon.

The second part of the deliverable provides an in-depth XML specification for the Sign_A framework and a discussion on this. We provide the specification for manual features (MFs), non-manual features (NMFs), location or locus within 3D space <LOCATION> and also temporal parameters <TEMPORAL>. Finally, we provide a section on conclusions and future considerations in terms of the SL lexicon and Sign_A.

T5.**4. Development of a planner for translating from Sign_A representation to BML-based script**
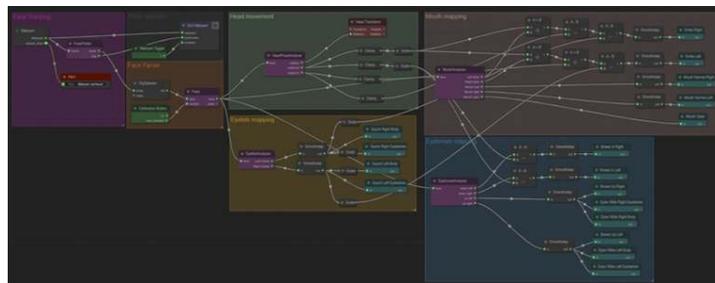
Figure 4:Translation Planner

A behaviour planner available at UPF-GTI is being made more modular and flexible in preparation for the planner to be used in SignON.

Key work in this task has been collaborating with TUDublin to ease the mapping of information from Sign_A to a BML format, which tackles directly the goal of the task. The results helped in the preparation of the M8 deliverable D5.3 (Sign language-specific lexicon and structure (Sign_A)); which presents an initial representation without losing information from Sign_A and that is more suitable as UPF input. Currently, an initial mapping from Sign_A to a new BML extension has been prepared, which should allow UPF-GTI to develop the realtime SL animations. The future work is to keep developing this extension to ease the work of the planner.

T5.**5. Real-time synthesis and delivery of target SL**

Figure 5: Real-time Synthesis and Delivery of Target SL

Some technical work to improve the visual appearance of the rendering of characters has been carried out and tests to smoothly transition between animations.

T5.**6. Generating output in the target language and modality - sound or text**

Activities in these months have been mainly related to interfacing with WP4, where InterL work mainly takes place, and with WP2 to support the definition of the architecture underpinning the integration of the output modalities. Experiments are underway to generate both SL glosses and text using transformer-based models. In the short term we intend to apply the said models to Spanish and LSE glosses using an available dataset for training the models. Moreover, experiments have been carried out to produce simplified English using mBart fine-tuned with a text simplification dataset. Experiments in Spanish are also underway. These experiments will be used as a stepping stone towards a full-fledged multilingual transformer model for translation from sign language glosses to text, and vice versa. The main objective of T5.6 will then be to normalise and validate the text, and encode it into a suitable format for integration within the SignON application framework. According to the DoA, speech will be provided by an external supplier; discussions with potential suppliers and requirements definition have taken place. Speech synthesis will be provided by the Acapela group.[11]

4.5.4 Deliverables Submitted

- D5.3: Sign language-specific lexicon and structure (Sign_A) (TU Dublin, August 2021) has been timely submitted in M8 (end of August as scheduled)

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[11] https://www.acapela-group.com/

4.5.5 Deviations and Corrective Actions

Minor changes in priorities have taken place as is normal in research and innovation, but so far, work has been proceeding as planned. The most significant aspect that needs to be mentioned is that capturing (T5.2) has revealed itself as one of the most complex tasks, and will be extended throughout the project life, with iterative deliveries.

As noted in the proposal and the GA, the task of text-to-speech synthesis will be dedicated to a hired company. After conversations with the named company in the GA, it had been decided to engage with them for the three years of this project. The named company would deliver six text-to-speech models. After the proposal was submitted, the text-to-speech services were reconsidered as another company had offered a similar service, based on the same technology, for a lower price and a larger coverage of text-to-speech models. That is, it could provide access to all of their models (and not only 6) allowing SignON to be more easily adapted to other languages. Furthermore after assessing the quality of speech produced by the two vendors, it was decided that the second company provided a speech quality that was more appropriate to the needs of the SignON project. The cost savings will also provide an opportunity to collaborate with the company to produce models that are not currently available.

4.5.6 Conclusions and Next Steps

WP5 has been proceeding as planned, and has interacted mainly with WP1, in relation to users input, and with WP2 about architecture and integration. Tasks 5.3 and 5.6 have interfaced with WP3 and WP4. The next steps are to continue progressing along the different tasks, as previously described. Major upcoming items are the deliverables due on M12, D5.2 Interactive co-creation web-based platform for learning from user input, related to T5.2 and D5.4. A planner for translating from Sign_A to BML-based script, related to T5.4.

4.6 Work Package 6

4.6.1 Introduction

SignON offers innovative opportunities to exploit and promote its results and WP6 develops business plans and looks in advance at exploitation for the project, including joint and individual opportunities, maximising opportunities for the dissemination of project results and ensuring effective communication procedures are in place. The project draws on significant media networks and established contacts to promote awareness, adoption, and further development of the SignON services and application.

4.6.2 Work Package Objectives (M1-M9)

The overall objectives of WP6 are to maximise the innovation impacts of the project and contribute to the uptake of the project results by the deaf and partially hearing community as well as creating a new market with the creation of jobs. This objective is key to achieving lasting implementation of the outputs of SignON. To achieve these goals, the team will:

1. Manage the knowledge generated in the project and adequately protect project IP where possible.

2. Produce high-quality accessible communication and dissemination materials to the target groups.

3. Actively disseminate the non-confidential results to the target audiences.

4. Design and implement a powerful communication campaign for engagement with key stakeholders.

5. Coordinate the dissemination of research papers, presentations, demos at conferences, journals and other similar venues.

6. Oversee the organization of workshops, such as SLTAT and SLPAT, to bring MT, ASR and Sign Language research communities closer together in a cross-field workshop.

7. Develop, implement and update a business plan to demonstrate the socio-economic feasibility of the results.

8. Contribute to market uptake of project results taking into account commercial interests and IPR rules.

In the reported period (M1-M9), objectives 2, 3, 4, 5, 6 & 7 were relevant.

4.6.3 Tasks (M1-M9)

The following tasks in WP6 are currently ongoing:

Task 6.1: Create, implement and update the dissemination and communication plan

- The Communication and Dissemination Plan (D6.1) was created and uses the 'PDCA' principle (Plan, Do, Check and Adjust), proposing a seven-step method of continuous improvement in the communication approach.

- The new logo for SignON was designed.

- A corporate style guide for SignON was created.

- Different templates (for PowerPoint presentations, correspondence, reports, website and social media) were created.

- Website signon-project.eu was created, with transparent information about the structure and functioning of the project.

- All of the information and communication on the website was made accessible in International Sign.

- Social media accounts were started up: Facebook, Twitter and LinkedIn.

- Hashtag #SignON was introduced.

- The SignON project was announced by a video on Social Media and press releases in different languages (BSL, VGT, ISL, LSE, NGT, IS, English, Dutch and Spanish).

- News, results, research data and publications of the project were communicated on different social media channels and websites.

Task 6.2: Review communication and dissemination activities

- Weekly meeting with WP7 leaders to follow up and evaluate the implementation of the objectives listed in D6.1

- Monthly meeting with all Work Package leaders to gain insight into the communication needs of the other WP.

Task 6.3: Organization of workshops

- Organisation of First International Workshop on Automatic Translation for Sign and Spoken Languages (AT4SSL - online) at MT Summit 2021.

- Editing the presentations of SignON for the 31st Meeting of Computational Linguistics in the Netherlands (online).

Task 6.4: Sustainable Exploitation of the SignOn Services and Mobile Apps

- Work started as scheduled in the DoA – researching markets, competitors, context, possible exploitable SignON IP components etc. focused on the production and delivery of D6.6 (SignON Market Analysis) and D6.7 (First SignON Sustainable Exploitation, Innovation & IPR Plans) in M12.

4.6.4 Deliverables Submitted

There was only one deliverable to be submitted from WP6:

- D6.1: SignON Communication and Dissemination Plan (on time, M3): This deliverable lists a number of strategic and operational objectives that have to be followed up on and implemented.

4.6.5 Deviations and Corrective Actions

After the announcement of SignON on social media, it was noticed that there are still too few likes and/or followers. Last summer, the WP6 coordinator asked his deaf contacts in an informal manner how the SignON project could be successfully received in the Flemish deaf community. Different reactions are common: (1) it's a "far-from-my-bed" show where deaf people don't realise enough that the project can have an impact on their daily lives, (2) deaf people feel the project is something of the "hearing and academic" world which they can't control, and (3) there is still resistance from the deaf communities towards sign language avatars and machine translation between spoken and sign languages. Based on these findings, new communication objectives were formulated in M8 and M9. A new vacancy for an additional media and communication officer was distributed in M9.

4.6.6 Conclusions and Next Steps

We need to invest enormously in raising positive attitudes from our target groups about SignON. In doing so, we must implement the newly formulated communication objectives in addition to objectives already noted in our dissemination and communication plan. With a view to a webinar about SignON, in which we want to conduct interviews with the deaf and interpreter communities, we will focus first on a series of informative videos about SignON and its objectives and functioning. Finally, we will be working on the next WP6 deliverable "D6.2 - Annual reports on communication and dissemination activities", where we will evaluate our activities and adjust our plan for next year accordingly. Also, we need to consider the language choice of our communication to the different deaf communities. Instead of always using International Sign as the only language option, we should free up budgets to invest in communication through different national sign languages (BSL, ISL, VGT, NGT and LSE) to reach more target groups.

4.7 Work Package 7

4.7.1 Introduction

As part of the SignON project, the goal of Work Package 7 (*Coordination and Management*, which runs for the whole duration of the project) is to ensure the smooth running of all the work packages and tasks of the project so that they are tightly integrated and performed on time, using appropriate resources and with effective collaboration among partners to achieve the project milestones.

The work conducted as part of Work Package 7 covers all the aspects involved in managing the project, which includes taking prompt corrective measures in case of deviations from the work plan, with effective remedial measures put in place to prevent or reduce to the minimum extent possible any disruption to the timely and successful execution of the project.

4.7.2 Work Package Objectives (M1-M9)

WP7 (Coordination and Management) involves the overall administrative and technical management of the SignON project to ensure that it achieves its objectives. To this end, the Work Package includes all the necessary activities such as progress monitoring, report preparation, meetings and regular contact with the European Commission on behalf of the SignON Consortium. For this reason, Work Package 7 is scheduled to run throughout the whole project, from its start until the very end.

To achieve the desired level of effectiveness, the management team will operate to the best international practice and will build on DCU's experience of managing complex programmes and projects with wide ranging partners from varying backgrounds (work, focus, cultural, resources, etc.), large budgets and tight deadlines. DCU will lead the consortium in:

- Carrying out a comprehensive series of consortium management activities to optimise the application of resources by creating an appropriate management framework, linking together all project components and ensuring all contractual requirements are met, incl. but not limited to communication and reporting.

- Ensuring project management procedures are implemented.

- Coordination with and reporting to the European Commission.

4.7.3 Tasks (M1-M9)

Task 7.1 Project Coordination

This task handles all of the coordination and administrative activities within the project and will run for the duration of the project.

For the first 9 months of the project, this work package focussed on the establishment of the coordination and management processes of the project. As specified in the grant agreement, the management structure had been previously defined, with each work package being managed by a Work Package Lead (WPL) and supported by the Project Management Board (PMB). The PMB is made up of 20 participants from the 17 consortium partners, and is the ultimate decision-making authority of the project.

A kick-off meeting took place virtually on the 21st of January and set the expectations for the start of the project. A monthly WP leads meeting was established to allow for any issues or blockers to be raised and discussed. These meetings took place on the 24th of February, 31st of March, 26th of May, 30th of June and 25th of August. Minutes are taken at each meeting and shared on Google drive. PMB meetings were held on the 28th of April and the 6th of July. A Scientific Advisory Board meeting was scheduled for the 6th of July, but unfortunately, the Sign Language Interpreter who was due to attend was sick so it was

decided to postpone the meeting until after the summer break. It is anticipated that this meeting will now take place in November 2021.

Two reporting periods are planned for the entire duration of the project (RP1 is from M1 to M18; RP2 is from M19 to M36). A third, intermediary review that is not linked to a payment period, will take place remotely in October 2021. This follows the submission of this document, D7.1: Interim Progress Report which will be submitted at the end of September 2021.

An internal report has been prepared monthly for the SignON project. This report has been made available to all of the members of the SignON consortium on the shared Google Drive.

A Quality Assurance Plan (D7.2) and Risk Management Plan (D7.3) were created and submitted in March 2021. A risk register was established and a process for ensuring quality deliverables was outlined. More details on these can be found in the relevant deliverables.
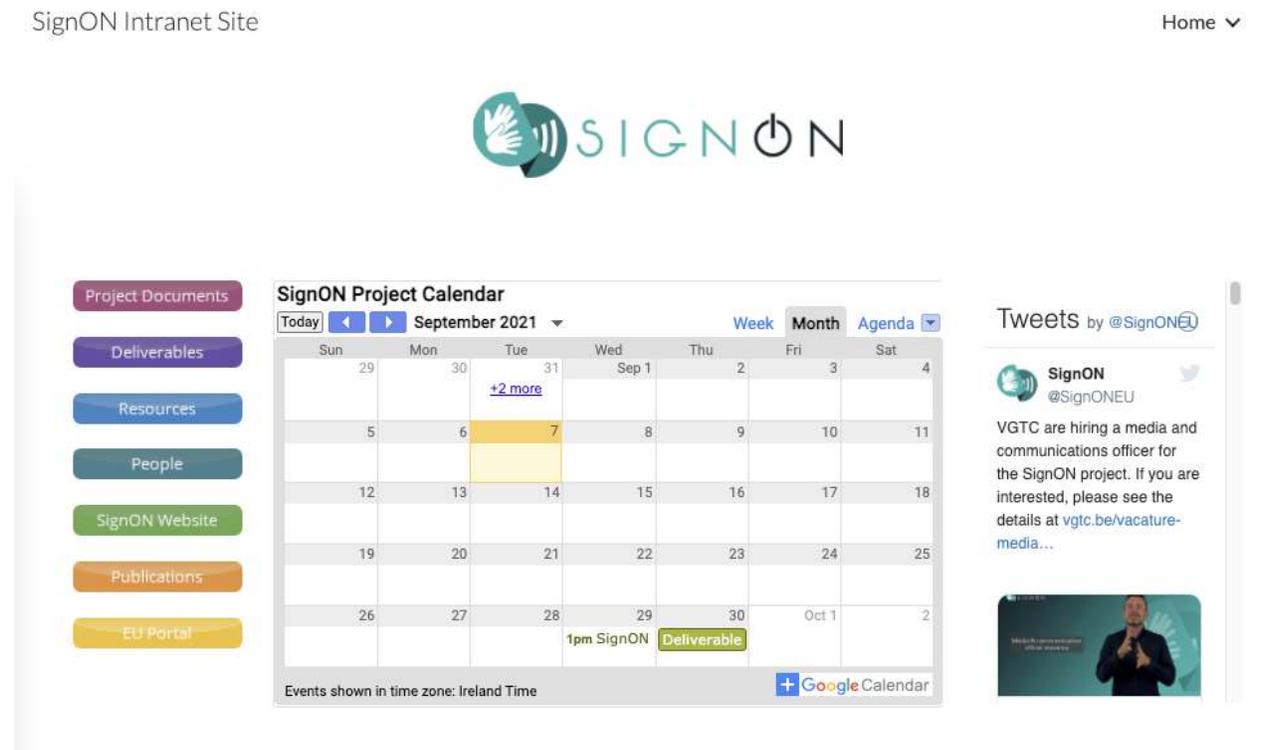
Figure 6: SignON Intranet Landing Page

A project handbook which includes all project policies, procedures and reporting templates, was developed and shared with all of the partners in March 2021. This was a milestone that was achieved in M3.

As an addition to the project handbook an Intranet site was created and access was given to all of the people involved in the project. This Intranet site provides an interface to all of the documents, resources, templates and tools available to the consortium members. An overview of the front page of the Intranet site can be seen in Figure 5, and an idea of the various resources that have been made available to the consortium partners for the SignON project can be seen in Figure 6.

Risk Register
The Risk Register for the project, which tracks all of the risks that have been identified.

Project Handbook
The Project Handbook for SignON, which was created for Milestone 1 (March 2021).

Templates
The templates for reports, deliverables, meeting minutes, etc. to be used in the SignON project.

Reports
The various reports for keeping track of the project progress.

Mailing Lists
The list of mailing lists currently in use for the SignON project.

Meeting Minutes
The minutes and notes from the meetings that take place for the project.

Tools
The tools that are used in the project; Slack, Trello, Gitlab, etc.

Training
Links to any training materials that have been shared with the SignON members.

Figure 7: SignON Intranet Resources Page

SignON Communications

A Slack Workspace has been set up for use by members of the project. This allows for instantaneous communications in a less formal manner than email. Channels have been established for each work package.

A Trello board has also been created, with boards for each work package which allows the WP leads to assign tasks and track progress.

Mailing lists have been created and utilised. There are some for work packages as well as more specific lists, e.g. for the communications team and the ethics committee.

The Intranet site provides the contact details for all of the members of the consortium.

Task 7.2: Financial Management

This task looks at the management of and reporting of the project finances for the duration of the project. Up to now, this task involved setting all of the partners up on the DCU system, in order to be able to transfer the appropriate payment to them on the commencement of the project. To date, all partners have received the initial payment. More detailed financial reporting will be provided at the end of the first official SignON reporting period (M18) at the end of June 2022.

Task 7.3: Quality Assurance and Risk Management

Quality Assurance and Risk Management were defined at the start of the project during the Kick-off meeting and a Quality Assurance Plan and Risk Management Plan were delivered (D7.2 and D7.3) in March 2021. The risks have been encapsulated in a Risk Register which is available to each consortium partner and is actively monitored throughout the project lifecycle. Quality assurance of the deliverables is ensured by facilitating the review of the deliverables by each consortium partner. This ensures that a comprehensive and rigorous review of each deliverable is carried out before submission.

Task 7.4: Project Assessment

This task looks at the assessment of the project's results and its direction. For December 2021, we will conduct the first impact review (D7.5) for the project and provide an assessment of the overall direction of the project and its impact for the user groups.

Task 7.5: Data Management

A Data Management Team was established and, with their help, the Data Management Plan (D7.8) was created and delivered in June 2021. This deliverable set out the principles for Research Data Management in the SignON project. It addressed the project's Open Access publication policy and how the project will meet the FAIR principles for sharing data, models and software after the lifetime of the project, how collecting and sharing data in a GDPR compliant way during and after the lifetime of the project will be dealt with, as well as data security issues and ethical aspects.

These principles will become manifest in the Data Management Plans which will be provided by individual SignON partners in D7.10 (Data Management Report; due Month 36). In order to accommodate for the dynamic nature of the DMP, intermediate versions of D7.10 are scheduled for M12 and M24. These specific DMPs will be reviewed by SignON's Research Ethics Committee (REC). Project partners can use the DMP tools and templates provided by their own organisations as long as the guidelines outlined in this report are followed.

Data Protection training was provided to all partners in May 2021 by the DCU Data Protection Unit. For those who could not attend, recordings were shared in the project Google drive and are linked to from the Intranet site.

In June 2021, a template for Data Transfer Agreement (D8.5) was created and shared to lay out the conditions of transfer of data between consortium members. In collaboration with the DCU Data Protection Unit, it was agreed that all partners would be data controllers and this agreement would be signed by all partners.

4.7.4 Deliverables Submitted

- D7.2: Quality Assurance Plan (DCU, March 2021): This document describes the quality assurance approach for the SignON project. The Quality Assurance Plan (QAP) defines the overall policies, the participant roles and responsibilities, the quality procedures and the means of ensuring that all the activities (R&D activities, deliverable writing, etc.) are in conformance with the contract provisions and specifications.

- D7:3: Risk Management Plan (DCU, March 2021): The Risk Management Plan describes the risk management framework for the SignON project, ensuring that adverse situations will be managed accordingly during the project lifecycle.

- D7.8: Data Management Plan (DCU, June 2021): This deliverable D7.8 outlines the framework and the principles which individual DMPs in the project should meet in line with the contract obligations stipulated in Article 29.3 of the Grant Agreement of the project. D7.8 is complemented by the specific DMPs for each partner. These will be delivered in D7.10 which is due in M36. In order to accommodate for the dynamic nature of DMPs intermediate versions of D7.10 are scheduled for M12 and M24.

- D7.9: Data Transfer Agreement (DCU, June 2021): This deliverable sets out the template for the data transfer agreement between all partners on the transference of data.

4.7.5 Milestones Achieved

- MS1: Project Handbook (DCU, Month 3): The Project Handbook describes in detail the plan to implement and execute the project; providing an overview of the management framework that the Consortium has established to guide all the project activities and tasks, with a view to ensuring smooth and effective collaboration amongst the partners, so that the overall project is successfully executed. The Handbook was prepared and shared with the consortium members in March 2021.

4.7.6 Conclusions and Next Steps

WP7 is progressing as planned. All deliverables have been submitted on time and the tasks are progressing. The next steps involve preparing for and attending the intermediary review with the Project Officer in October 2021 as well as continuing on with the project management and administration of the SignON project. The end of the first reporting period is at the end of June 2022, so we will need to focus on preparing the documentation and other materials for the formal review.

4.8 Work Package 8

4.8.1 Introduction

When the details of the project were being added into the EU portal, this Work Package was automatically generated. It focuses on the Ethics Requirements for the project and runs for the duration of the project. The ethics requirements that the project must comply with are included as a deliverable in this WP. There was one deliverable due in this work package (D8.1) and this was submitted in June 2021.

4.8.2 Work Package Objectives (M1-M9)

The objective of this work package is to ensure compliance with the ethics requirements of the project.

4.8.3 Tasks (M1-M9)

The preparation of the deliverable D8.1 aimed to emphasise how all of the data that will be processed as part of the SignON project is relevant and limited to its purposes in accordance with the 'data minimisation' principle.[12] The details for this were submitted as deliverable D7.8: Data Management Plan. D7.8 contains the framework and requirements for the Data Management Plans (DMPs) of each project partner and will be complemented by the specific DMPs for each partner. These will be delivered in D7.10 which is due in M36. In order to accommodate the dynamic nature of the DMPs, intermediate versions of D7.10 are scheduled for M12 and M24. Each partner's DMP, which will be reviewed and approved by SignON's Research Ethics Committee, is the framework which ensures the protection of personal data (POPD) within the project. All of our work will be conducted in accordance with the EU Code of Conduct for Research Integrity.

4.8.4 Deliverables Submitted

- D8.1: POPD (Protection of Personal Data) - Requirement No. 2 (TCD, June 2021)**:** This deliverable D8.1 was requested by the European Commission. This deliverable points to D7.8: Data Management Plan which details how, in accordance with the 'data minimisation' principle, the data that will be processed as part of the project is relevant and limited to the purposes of the research project. It also references D9.1: Ethical Guidelines and Protocols, which describes the ethical guidelines and processes that we apply across the execution of our project.

4.9 Work Package 9

4.9.1 Introduction

WP9 has as a goal, the articulation of the ethical values underpinning SignON and the processes and practices associated with implementing our work.

WP9 oversees and coordinates all ethical aspects of the project and provides ethical guidelines and protocols for identification and recruitment of participants. It ensures all consortium members abide by the EU Code of Research Integrity, further imbued by consideration of ethical points that are important for deaf communities.

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[12] Data minimisation as defined by GDPR, art. 1, section 1, c) https://gdpr-info.eu/art-5-gdpr/

4.9.2 Work Package Objectives (M1-M9)

This work package ensures the work carried out in SignON is in accordance with the EU Code of Conduct for Research Integrity and provides ethical guidance to consortium members in conducting the research plan and in the identification and recruitment of participants for the use cases.

4.9.3 Tasks (M1-M9)

Task 9.1: Development of ethical guidelines and protocols (ongoing)

We have established the SignON REC Committee. This committee meets monthly/bi-monthly, as necessary. A SignOn REC Folder is now online (Google Drive), which documents work in this sphere. https://drive.google.com/drive/folders/1whQ_D1VI9uH56KiRLeSUc3b91iFtYxwt. A SignON REC email address has also been established: signon-rec@adaptcentre.ie

Task 9.2: Provide ethical support to members of stakeholder communities (ongoing)

The SignON REC has provided support and feedback in relation to the DCU REC amendment process to support WP1 and to a TCD REC application, which also supports WP1. D9.1 has been completed and submitted on time.

Task 9.3: Ethics Monitoring (ongoing)

An annual report will be compiled for the end of year 1, and annually, across the life of the project.

Task 9.4: Ethics training, organization of Ethical committee meetings and Ethical approvals (ongoing)

As above.

4.9.4 Deliverables Submitted

- D9.1 - Ethical Guidelines and Protocols (TCD, June 2021)

4.9.5 Conclusions and Next Steps

The SignON REC will continue to meet monthly/bi-monthly as necessary across the life of the project. We can also meet to respond to any acute concerns, should they arise. We will work to complete annual reviews of ethics-related work and, as appropriate, organise ethics training sessions for consortium members.

5. Summary of Deliverables and Milestones

It was specified in the Grant Agreement that eighteen deliverables would be delivered in the first nine months of the project. To date, seventeen have been delivered, with this deliverable, the eighteenth, being submitted at the end of September 2021.

Deliverable	Title	Lead Beneficiary	Due Date	Status
D1.1	Case studies and evidence analysis	TCD	3	Delivered on time
D2.1	SignON Development Repository	FINCONS	3	Delivered on time
D6.1	SignON Communication and Dissemination Plan	VGTC	3	Delivered on time
D7.2	Quality Assurance plan	DCU	3	Delivered on time
D7.3	Risk Management Plan	DCU	3	Delivered on time
D4.3	First distributional intermediate representation based on embeddings - InterL-E	UPV/EHU	4	Delivered on time
D4.6	First Routines for transformation of text from and to InterL	UPF	4	Delivered on time
D1.13	KPIs	TCD	6	Delivered on time
D1.3	First user Requirements Report.	EUD	6	Delivered on time
D1.4	First technical requirements and user research (UX design) report.	MAC	6	Delivered on time
D4.11	First adaptable pipeline for training and updating the InterL.	UPV/EHU	6	Delivered on time
D7.8	Data Management Plan	DCU	6	Delivered on time
D7.9	Data Transfer Agreement	DCU	6	Delivered on time
D8.1	POPD - Requirement No. 2	TCD	6	Delivered on time
D9.1	Ethical Guidelines and Protocols	TCD	6	Delivered on time
D2.2	SignON Services Framework Architecture	FINCONS	8	Delivered on time
D5.4	First Sign language-specific lexicon and structure	TU Dublin	8	Delivered on time

D7.1	Interim progress report	DCU	9	Pending
D5.3	Interactive co-creation web-based platform for learning from user input	UPF	12	Pending
D5.7	A planner for translating from Sign_A to BML-based script	UPF	12	Pending
D6.2	First Annual reports on communication and dissemination activities	DCU	12	Pending
D6.6	SignON Market Analysis	MAC	12	Pending
D6.7	First SignON Sustainable Exploitation, Innovation and IPR Plans	MAC	12	Pending
D7.5	First Impact Review	DCU	12	Pending
D9.2	First Annual Ethical Report on Practices Towards the Stakeholder Communities	TCD	12	Pending
D9.5	First Annual Ethical Report on Internal Affairs	TCD	12	Pending
D2.3	First release of the SignON Open Cloud platform, including the Open Cloud Platform design	INT	13	Pending
D3.5	First Natural Language Processing Pipelines	UPF	16	Pending
D1.5	First Interim Community building Report.	EUD	18	Pending
D1.7	Second User Requirement Report	EUD	18	Pending
D1.9	Second Technical requirements and user research (UX design) report.	MAC	18	Pending
D2.6	First release of the SignON Communication Mobile Application	MAC	18	Pending
D2.8	First Machine learning interface	FINCONS	18	Pending
D4.1	First symbolic intermediate representation - InterL-S	KU Leuven	18	Pending
D4.7	Second Routines for transformation of text from and to InterL	UPF	18	Pending
D5.1	First version of virtual character	UPF	18	Pending
D5.8	A realiser of BML-based script to 3D animated character	UPF	18	Pending

D5.9	InterL to Text to speech pipeline	KU Leuven	18	Pending
D4.9	First Routines for transformation of SL representations from and to the InterL	NUID UCD	22	Pending
D3.1	Internal repository with language data resources (sign and oral)	INT	24	Pending
D4.12	Second adaptable pipeline for training and updating the InterL.	UPV/EHU	24	Pending
D5.5	Second Sign language-specific lexicon and structure	TU Dublin	24	Pending
D6.3	Second Annual reports on communication and dissemination activities	DCU	24	Pending
D7.6	Second Impact Review	DCU	24	Pending
D9.3	Second Annual Ethical Report on Practices Towards the Stakeholder Communities	TCD	24	Pending
D9.6	Second Annual Ethical Report on Internal Affairs	TCD	24	Pending
D2.4	Intermediate release of the SignON Open Cloud Platform	MAC	26	Pending
D1.10	Final Technical requirements and user research (UX design) report.	MAC	30	Pending
D1.6	Quality Assessment Report	UPF	30	Pending
D1.8	Final User requirements report	EUD	30	Pending
D2.7	Final release of the Communication Mobile Application	MAC	30	Pending
D2.9	Final Machine Learning interface	FINCONS	30	Pending
D3.2	Sign language recognition component and models	UGent	30	Pending
D3.4	Automatic speech recognition component and models	RU	30	Pending
D4.4	Second distributional intermediate representation based on embeddings - InterL-E	UPV/EHU	30	Pending
D6.5	Workshops, showcases, demonstrations report	VGTC	30	Pending

D9.8	Report on Ethical approval	TCD	30	Pending
D4.10	Final Routines for transformation of SL representations from and to the InterL	NUID UCD	32	Pending
D4.2	Second symbolic intermediate representation - InterL-S	KU Leuven	32	Pending
D4.8	Final Routines for transformation of text from and to InterL	UPF	32	Pending
D1.11	Final Interim Community Building Report	MAC	33	Pending
D1.2	Report on the use-cases and usage domains and stakeholders' acceptance.	KU Leuven	33	Pending
D1.12	User generated data	UPF	36	Pending
D2.5	Final release of the SignON Open Cloud Platform	MAC	36	Pending
D3.3	Linguistic description for ISL, BSL, VGT, NGT and LSE	TU Dublin	36	Pending
D3.6	Second Natural Language processing pipeline	UPF	36	Pending
D4.5	A hybrid intermediate representation	TiU	36	Pending
D5.2	Final version of virtual character	UPF	36	Pending
D5.6	Final Sign language-specific lexicon and structure	TU Dublin	36	Pending
D6.4	Final Annual reports on communication and dissemination activities	DCU	36	Pending
D6.8	Final SignON Sustainable Exploitation, Innovation and IPR Plans	MAC	36	Pending
D7.10	Data Management Report	DCU	36	Pending
D7.4	Final Report	DCU	36	Pending
D7.7	Final Impact Review	DCU	36	Pending
D9.4	Final Annual Ethical Report on Practices Towards the Stakeholder Communities	TCD	36	Pending
D9.7	Final Annual Ethical Report on Internal Affairs	TCD	36	Pending

Table 2: Summary of SignON Deliverables

Milestone Number	Milestone Title	WP	Lead Beneficiary	Due Date	Means of Verification	Status
MS1	Project handbook	WP7	DCU	3	Project handbook with details on the overall project management procedures delivered	Reached on time
MS2	Sign Language Data	WP3	UGent	12	Sign language data available for initial languages (VGT, NGT, ISL, BSL)	Pending
MS3	Verbal Language Data	WP3	UGent	12	Verbal language data available for initial languages (Dutch, English)	Pending
MS4	Sign Language Recognition Component	WP3	UGent	13	Sign language recognition component is ready for training and inference	Pending
MS5	Sign Language Recognition Model for VGT/NGT and ISL/BSL	WP3	TU Dublin	18	Sign language recognition models have been trained for VGT, NGT, ISL and BSL	Pending
MS6	Automatic Speech Recognition Component	WP3	RU	13	Automatic speech recognition component is ready for training and inference	Pending
MS7	Automatic Speech Recognition Model for Dutch and English	WP3	RU	18	Automatic speech recognition models have been trained for Dutch and English	Pending
MS8	First version of pipeline to convert the recognised or input text into the InterL and from the InterL to representation suitable to be output to the user	WP4	UPV/EHU	20	First version of pipeline available and ready.	Pending
MS9	A set of routines to convert the recognised WP4 sign language into InterL.	WP4	UPF	14	First set of routines identified	Pending
MS10	A set of routines to convert encoded message from InterL to a SRSL representation	WP4	NUID UCD	14	First set of routines identified	Pending

Table 3: Summary of SignON Milestones

6. Impact

One in a thousand persons in the EU (approximately half a million DHH persons) communicate in one of 31 national or regional SL as their first language. The aim of the SignON service is to bridge the gap between deaf communities, people with hearing impairments (including people with implants), hearing people (including family members and friends of deaf people), industry partners and policy makers, and to promote inclusion of the deaf community by providing an open source and scalable solution for real-time translation between SL, text and speech. With the expected wide uptake of the technology, SignON will make a significant contribution to its users and the community.

SignON will also impact academic research, industry innovation and business progression through its SOTA advancements in real-time SL linguistics, SLR, NLU, ASR (including atypical speech), MT and 3D avatar technology, and their fundamentals. Our 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 expectation is that SignON will promote excellent dissemination within target audiences. This will ensure proper visibility, accessibility and promotion of SignON and its results during the project lifecycle and after its completion. We will particularly target five groups: (i) deaf community (signers), (ii) DHH people (non-signers), (iii) hearing people, (iv) SL interpreters, and (v) scientific community. To reach all these groups in a timely and appropriate manner, the consortium will rely on the extensive network already established by SignON participants representing the community and industry partners as well as significant international reach of the External Advisory Board.

These audiences will be engaged and informed via the co-creation events through (i) scientific and popular publications; (ii) conference, workshop (AT4SSL) and seminar presentations, (iii) wide-ranging media coverage (e.g.: newsletters, brochures, press releases, etc); (iv) prototype presentations and demonstrations. A dissemination hub for SignON is its website which together with social media channels maximises the impact potential.

As an illustration, WP1 (EUD) organised several interviews, either with multiple participants (a focus group), or with just one person. In total we held seven interviews in respectively VGT or LSE. To ensure a diverse group of participants, we invited people from different ages and genders, which resulted in a heterogeneous group of ten participants. The impact is such that the potential (deaf) users felt listened to during these interviews, which resulted in a strong willingness to follow-up further stages of SignON development (e.g. to test each component of the SignON services if they have the opportunity). The impact is the positive view on the SignON project, thanks to being aware that deaf people are involved from the start this time and that we will actually listen to them.

Since the major update of the website and its publication, and the social media channels of SignON have been launched, our target groups are aware of our project. Although they may still experience it as not necessarily relevant to them personally, the positioning of SignON is clearly present among the target groups, or in other words: they know that the SignOn project exists and what its purpose is. The deaf people and Sign Language interpreters have started talking about it and asking questions to the coordinator of WP6 in an informal way. These questions are good input for the planned FAQ-page on our website. Maartje De Meulder, a Deaf researcher with a high reputation within the academic field for deaf studies and sign languages, wrote an article about the ethical issues on sign language avatars and automated translation from spoken/written languages to sign languages and vice versa. She was invited to give a lecture on this at our first workshop AT4SSL and an interview with her is planned, to strengthen the involvement of the deaf academy in our project. A small resistance from the BSL community has begun with hashtag #notoavatars, that will be monitored by the coordinator of WP6. In this way we bring the target groups closer to us and this can improve our communication approach and address the communication and dissemination plan if necessary.

7. Academic Publications

- Mathieu De Coster, Mieke Van Herreweghe and Joni Dambre, Isolated Sign Recognition from RGB Video using Pose Flow and Self-Attention, In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) Workshops, 2021, pp. 3441-3450

- H. Saggion, D. Shterionov, G. Labaka, T. Van de Cruys, V. Vandeghinste and J. Blat, SignON: Bridging the gap between Sign and Spoken Languages, XXXVII Spanish Society for Natural Language Processing conference (SEPLN2021).

- Dimitar Shterionov, Vincent Vandeghinste, Horacio Saggion, Josep Blat, Mathieu De Coster, Joni Dambre, Henk van den Heuvel, Irene Murtagh, Lorraine Leeson, and Ineke Schuurman, The SignON project: a Sign Language Translation Framework, Abstract for poster presentation at the 31st Meeting of Computational Linguistics in the Netherlands #CLIN31

- Dimitar Shterionov, John O'Flaherty, Marcello Paolo Scipioni, MatteoVilla, Edward Keane and Marco Giovanelli, Early-stage development of the SignON app and open framework - challenges and opportunities, In proceedings of the 18th Machine Translation Summit (MTSummit2021), user track.

- De Sisto, Mirella and Shterionov, Dimitar and Murtagh, Irene and Vermeerbergen, Myriam and Leeson, Lorraine. "Defining meaningful units. Challenges in sign segmentation and segment-meaning mapping (short paper)." Proceedings of the 1st International Workshop on Automatic Translation for Signed and Spoken Languages (AT4SSL). 2021.

- De Coster, Mathieu and D'Oosterlinck, Karel and Pizurica, Marija and Rabaey, Paloma and Verlinden, Severine and Van Herreweghe, Mieke and Dambre, Joni. "Frozen Pretrained Transformers for Neural Sign Language Translation." Proceedings of the 1st International Workshop on Automatic Translation for Signed and Spoken Languages (AT4SSL). 2021.

- Egea Gómez, Santiago and McGill, Euan and Saggion, Horacio. "Syntax-aware Transformers for Neural Machine Translation: The Case of Text to Sign Gloss Translation". Proceedings of the 14th Workshop on Building and Using Comparable Corpora (BUCC). 2021.

8. Conclusions

This report presents in detail the progress made during the first 9 months of the SignON Project. It describes the work carried out across all tasks in the nine Work Packages as well as the deliverables that have been submitted and the milestones that have been met. It also reports on deviations as well as corrective actions. It outlines the next steps in our roadmap which, along with tracing the deliverables and meeting milestones, are guided by the established and excellent intra-team collaborations and effective management.