D7.2 Management Report for Y2

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Executive Summary

The SL-ReDu project aims to advance the state-of-the-art in the automatic recognition of Greek Sign Language (GSL) from videos, while focusing on the novel education use-case of standardized teaching of GSL as a second language. In this deliverable (D7.2) we overview the progress during the second year (Y2), i.e. M13-M26, of the SL-ReDu project in its various workpackages (WP1-WP7) that has led to the successful completion of the second project milestone (MS2 – M24) and the production of nine deliverables. D7.2 will be updated as D7.3, which will summarize the SL-ReDu activities during the third (final) year of the project.

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1 Introduction

This deliverable (D7.2) constitutes the management report for the second year of the SL-ReDu project, covering the M13-M26 period. It is structured as follows:

- Section 2 reports an overview of the project work in each of the seven workpackages of the Technical Annex. For each one, the presentation commences with a very brief overview of workpackage activities during Y1, followed by a summary and detailed presentation of the work conducted over the current reporting period (Y2) in each task, concluding with the future work planned immediately ahead (during the third year of the project);
- Section 3 provides a list of the produced deliverables and the accomplished milestone (MS2);
- Section 4 reports any deviations from the workplan and corresponding mitigation action; and
- Section 5 concludes the deliverable.

2 Progress in the Individual SL-ReDu Workpackages

The SL-ReDu project work is structured along seven workpackages. In the following subsections, we report the main activities and achievements in each of them during the second year of the project.

2.1 WP1 Progress in Y2 (Visual Tracking and Feature Extraction)

This workpackage concentrates on the development of computer vision algorithms for visual tracking and feature extraction, and it consists of two tasks: Task T1.1, concerning the detection and tracking of the signer's visual articulators in sign language (SL) video, as well as Task T1.2, which focuses on the extraction of visual features from the tracked articulators in order to provide input to WP2.

During Y1 of the project, we had worked on both tasks, reporting our efforts in Deliverable D1.1 [1] and initiating work towards Deliverable D1.2 [2]. Briefly, concerning Task T1.1, we had compared two approaches for visual detection, establishing the superiority of the OpenPose deep learning based-approach, while also developing a 2D-to-3D deep learning-based regression method for obtaining 3D representations of the signer body skeleton and hands. Concerning Task T1.2, we had investigated a suite of traditional shape, appearance, and motion-based feature extraction methods and had compared them against a vanilla auto-encoder and a convolutional neural network (CNN) based representation, showing the latter to be superior, as evaluated on three isolated-sign GSL databases in conjunction with a simple sign language recognition (SLR) back-end.

During this reporting period (Y2), we have continued work on both tasks of WP1, reporting our work in **Deliverable D1.2** [2] and initiating work towards Deliverable D1.3. More details are provided next.

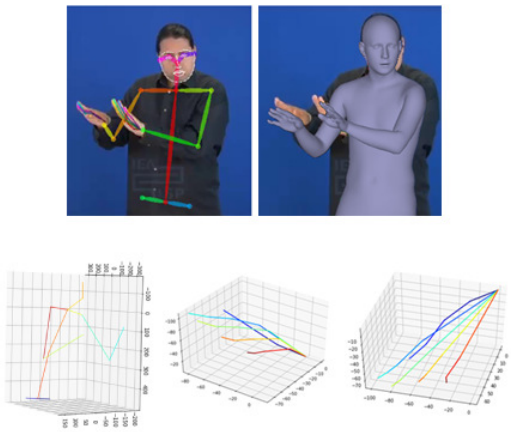

Figure 1: Visual articulator detection using (clockwise from the upper left corner) the OpenPose framework, the ExPose approach, and 2D-to-3D OpenPose coordinate regression of the two hands and of the body skeleton.

Progress on Task T1.1: Detection and Tracking of the Visual Articulators in SL Video

Following Y1 work, we have continued to employ the OpenPose framework to detect the skeletal joints and a number of facial landmarks of the signer, which we have then exploited to obtain the region-of-interest (ROI) of each of the signer hands and mouth. Further, we have used the 2D skeletal-joint coordinates of OpenPose to infer 3D coordinates of the signer's body and hand joints, by regressing the 2D ones to the 3D space via a deep multi-layer neural network. In addition to the above, in Y2 we have investigated the utility of the ExPose framework to obtain 3D shape, pose, and facial expressions of the

signer from single RGB images. We have presented all these approaches in Deliverable D1.2 (see also Figure 1), where we have used them to drive appropriate feature extraction in Task T1.2 (see also below).

Beyond Deliverable D1.1 that was finalized during M16 of the project, additional Y2 work on Task T1.1 involved the investigation of the MediaPipe framework for detection and tracking of the visual articulators in SL videos. This work will be reported in the final WP1 deliverable, D1.3, during Y3 of the project.

Progress on Task T1.2: Extraction of Visual Features of Tracked Articulators

Following SL articulator detection, in Y2 of the project we have investigated a multitude of visual streams providing information at a local or global level, emphasizing articulator shape or appearance, while concentrating on static or motion patterns. Specifically, we have considered 2D skeletal features of the signer, 3D skeletal features, and 3D expressive body pose and shape features. Further, we have investigated deep learning-based appearance representations extracted from the entire image frame, as well as the hands and mouth ROIs, exploring various CNN image feature learners, namely AlexNet, ResNet18, VGG19, and InceptionNet-V3. Finally, we have employed motion representations via different optical flow models, namely SpyNet, FlowNet2, LiteFlowNet, and PWC-Net, thus dramatically extending the deep learning based feature extraction methods over the ones considered in Y1.

Subsequently, we have combined the aforementioned visual feature streams by early fusion in various schemes and employed them as the front-end in conjunction with the relatively simple SLR back-end of Deliverable D1.1 for isolated GSL recognition on two databases (see also Figure 2). The best resulting SLR system demonstrated very significant gains over our Y1 work, thus benchmarking the SL-ReDu progress in WP1 activities.

Further to the above that have been reported in Deliverable D1.2, we have performed additional front-end design experiments to support the development of the first SL-ReDu prototype system (see Deliverables D2.2 [3] and D5.3 [4]). The resulting prototype system is capable of recognizing isolated signs (both numerals and non-numerals) and continuous fingerspelling in GSL (see also Section 2.2).

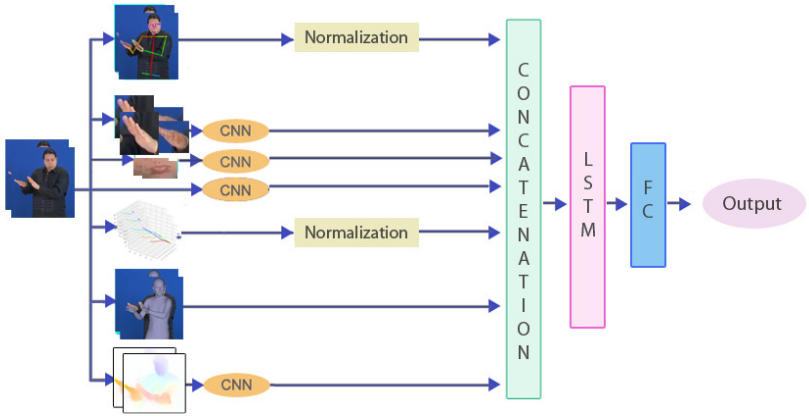

Figure 2: Various visual feature streams considered in Task T1.2 during Y2 in conjunction with an SLR back-end.

WP1 Planned Work in Y3

During Y3 of the project, additional visual feature streams will be considered including 3D-CNNs for appearance modeling, 3D shape and pose representations, and more advanced optical flow techniques, aiming to improve GSL recognition performance. Such work will be reported in Deliverable D1.3.

2.2 WP2 Progress in Y2 (Machine Learning for GSL Recognition)

This workpackage concentrates on the development of machine learning algorithms for the automatic recognition of GSL, and it consists of two tasks: Task T2.1, concerning the recognition of lower-level basic signing units, as well Task T2.2, which focuses on fusing lower-lever results for the recognition of complex signs both for isolated and continuous GSL.

During Y1 of the project, we have worked on both tasks, reporting our efforts in Deliverable D2.1 [3], presenting results on two tasks: isolated GSL recognition and recognition of fingerspelled letter sequences, exploring a number of model architectures and based on visual features from Deliverable D1.1 [1]. In both cases, we have relied on pre-existing GSL resources for model training, since data from SL-ReDu have not yet become available. Note also that, particularly for fingerspelling, due to the lack of GSL data on the task, we relied on such data in the American sign language.

During Y2 of the project, we have expanded our work on GSL recognition, by also considering the task of continuous GSL recognition, as well as fingerspelling in GSL too. In addition, we have built the recognition models that have been later integrated into the first version of the SL-ReDu prototype system ("Phase-A"), thus allowing the first system evaluation by its envisaged end-users, as discussed in Section 5. Note that these models have been trained on data recorded as part of SL-ReDu in non-studio quality environments, as discussed in Section 2.3. This WP2 work has been reported in **Deliverable D2.2** [4], and is further overviewed below.

Progress on Task T2.1: Articulation and GSL Subunit Recognition

As detailed in Deliverable D2.2 [4], for Task T2.1, we have concentrated on GSL fingerspelling recognition, where the subunits constitute alphabet letters. In particular, we have employed a CNN-BiLSTM combination, where the CNN (MobileNet) serves as visual feature learner of each cropped video frame (i.e., it is applied on the signing hand), while the BiLSTM learns their temporal relations. The model architecture and the visual pre-processing is overviewed in Figure 3(a). Note that this approach resulted in the first ever GSL recognition model of fingerspelled letter sequences (to our knowledge, this recognition task has never before been considered in the literature). Note that for model training we have used recently collected SL-ReDu data, as part of WP3 work.

A similar approach has also been employed for the recognition of a small vocabulary of isolated signs in GSL. For this purpose, a ResNet2+1D model has been used, but the cropped video frame contains the upper body of the signer in this case (see also Figure 3(b)). As above, the model has been trained on suitable SL-ReDu data, collected as part of WP3 work.

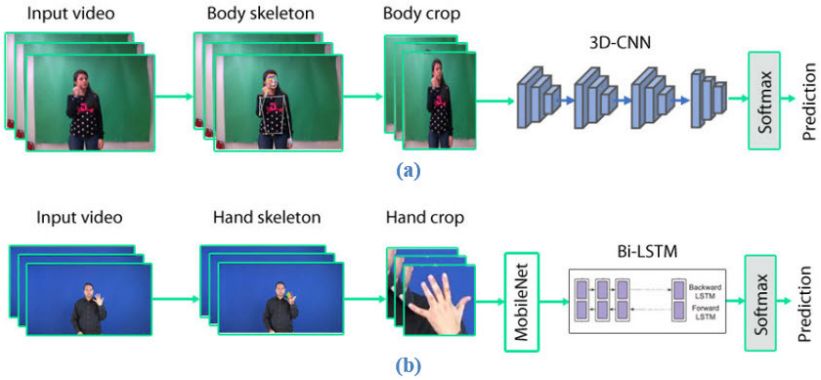

Figure 3: Block diagrams of the GSL recognition modules that have been trained on SL-ReDu data and integrated in the "Phase-A" SL-ReDu prototype, which can recognize: **(a)** isolated signs; and **(b)** continuous fingerspelling.

Progress on Task T2.2: Fusion for GSL Recognition

In Deliverable D2.2 [4] we have also presented our first attempt to recognize complex continuous sequences of signs in GSL. In particular, we have made numerous advances over Deliverables D1.2 [2] and D2.1 [3], namely: (i) using the MediaPipe framework (in addition to OpenPose) for visual tracking of the signing articulators; (ii) fusing multi-cue signing activity information involving 2D and 3D skeletal data, 3D signer shape and pose, as well as appearance and motion representations via a late fusion mechanism; and (iii) investigating a number of encoding networks for processing the feature representations, followed by connectionist temporal classification (CTC) based decoding for gloss prediction that substitutes the attentional decoders of our earlier work. Our multimodal approach is depicted in Figure 4. Note that the resulting continuous GSL models have been trained on a pre-existing GSL database, since our SL-ReDu data collection effort of continuous signed phrases suitable for the project's education use-case had commenced beyond the completion of this deliverable.

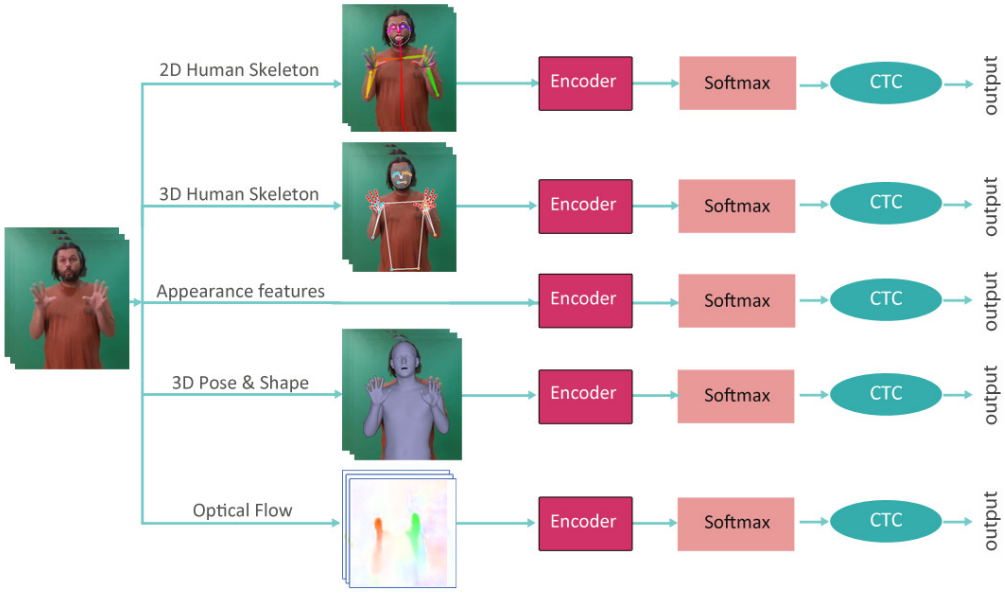

Figure 4: Overview of the continuous GSL recognition framework developed in Deliverable D2.2 [4].

WP2 Planned Work in Y3

During Y3 of the project, additional visual feature streams and recognition approaches will be investigated in order to further improve the results reported in earlier Deliverables D2.1 and D2.2. Primarily, however, our main focus will be on the development of the GSL recognition models for the second version of the SL-ReDu prototype ("Phase-B"). In addition to the fingerspelling task, such model will allow recognition of isolated GSL signs within a much larger vocabulary than "Phase-A", as well as the recognition of continuous GSL phrases. In all cases, model training will be conducted on the SL-ReDu dataset that is currently being collected as part of WP3 activities.

2.3 WP3 Progress in Y2 (Training Data and Language Model)

This workpackage concentrates on securing training data for the GSL machine learning algorithm (Task T3.1), organizing the language material for the project platform (Task T3.2), and developing a linguistic model (Task T3.3). During Y1 of the project, we have worked on all three tasks. Specifically, we reported our efforts in Task T3.1 in Deliverable D3.1 [5], where we have identified pre-existing GSL resources useful in our initial work in WP1 and WP2, and described the setup of our data collection effort in the

recording studio of the AthenaRC premises. We also completed Task T3.2, reporting our work in Deliverable D3.2 [6], designing the language material for the purposes of the specific education use-case of the SL-ReDu project. Finally, we have initiated work in Task T3.3, paving the way for **Deliverable D3.3** [7] that was produced during Y2 of SL-ReDu, as planned in the Technical Anex. In addition to this deliverable, during Y2 (Task T3.1) we have initiated our large-scale data collection for SL-ReDu, allowing model training for the "Phase-A" system (Deliverable D2.2) and progressing with recording data that will be necessary in the "Phase-B" development (Y3). This work will be reported in Deliverable D3.4 due in Y3. Finally, in Task T3.3 we have initiated work towards a statistical language model to assist the recognition models in the "Phase-B" system (Y3).

Progress on Task T3.1: GSL Corpora Harvesting and Collection

During Y2 of the project, taking advantage of the improved pandemic conditions and the resulting lifting of mobility restrictions, we have been able to initiate a large-scale data collection to facilitate model training of the recognition modules of both "Phase-A" and "Phase-B" systems. To help us in this process, we have developed an improved semi-automatic data collection process, allowing speedier collection under the supervision of a single only person in the recording studio, enabling fully automated data post-processing for corpus content organization, and yielding automatic synchronization of the two video cameras used in our studio setup. Further, in addition to the ongoing collection of studio-based data, we have also been collecting GSL videos employing a typical web-cam under non-ideal visual conditions, in order to improve data variability and have a sufficient amount of data that lie closer to the envisaged operating conditions of the SL-ReDu prototype systems. Parts of these non-studio data have already been utilized in the development of the GSL recognizer of Deliverable D2.2 [4], thus allowing us to successfully develop the "Phase-A" SL-ReDu system and conduct its evaluation, as reported in Section 2.5. Further, the main bulk of the collected data (both under studio and non-studio conditions) will be used to develop the GSL recognizer of Y3 Deliverables D2.3 and D5.5 (M39), thus allowing us to conduct the "Phase-B" SL-ReDu system evaluation campaign, as planned in the project Document of Work. Examples of the non-studio data collected for developing the isolated GSL model of Deliverable D2.2 [4] are shown in Figure 5.

Figure 5: Example frames of non-studio recordings of isolated signs by 20 informants. The data were used for model building of the small-vocabulary isolated GSL recognition task of Deliverable D2.2 [4] ("Phase-A" SL-ReDu system).

Progress on Task T3.2: Evaluation Language Material Organization

Task 3.2 has concluded in Y1 (M12) of the project, producing Deliverable D3.2 [6].

Progress on Task T3.3: Linguistic Model for GSL Recognition

During Y2, we have completed the first version of the linguistic model of the project. Our focus lied on its structure methodology and content, in order to support automatic GSL recognition, as well as the design and development of the SL-ReDu platform in respect to its functionalities that serve self-monitoring and testing activities of the end-users, in association with each module content. Such work followed on the footsteps of Deliverable D3.2 [6], and it was reported in Deliverable D3.3 [7]. In addition to the aforementioned work, we have initiated work towards a statistical language model to assist the recognition models in the "Phase-B" system (Y3).

WP3 Planned Work in Y3

During Y3 of the project, only Tasks T3.1 and T3.3 will remain active, according to the plan in the SL-ReDu Technical Annex (Task T3.2 has concluded in Y1). Specifically, concerning Task T3.1, we plan to complete our data collection effort, with the results reported in Deliverables D3.4 and D3.6, the latter concerning the data public release. Further, for Task T3.3, we will develop the second version of the linguistic model, focusing primarily on statistical language modeling approaches to assist GSL recognition, reporting our methodology and results in Deliverable D3.5.

2.4 WP4 Progress in Y2 (Human-Computer Interface)

This workpackage concentrates on the design of an appropriate human-computer interface for the SL-ReDu prototype system (Task T4.1), employing a suitable dialog-management strategy to accommodate both self-monitoring and objective evaluation system modules (Task T4.2). During Y1 of the project, we have initiated work on both tasks, in preparation for **Deliverable D4.1** [8] that was compiled in Y2 (M16), in agreement with the Technical Annex. This work (presented in Deliverable D4.1) has been subsequently integrated into the first version of the SL-ReDu system prototype ("Phase-A"), as is also noted in Section 2.5.

Progress on Task T4.1: Human-Computer Interface Design

During Y2, we have completed the design of the human-computer interface for the first SL-ReDu prototype system, in accordance with the educational material developed as part of Task T3.2 that has been reported in Deliverable D3.2 [4]. Specifically, the developed SL-ReDu platform interface has been designed to accommodate both GSL perception "passive"-type questions (multiple-choice) and "active"-type drills (GSL production) in both self-monitoring and objective evaluation modules of the system, while also allowing easy navigation of all educational material (organized in chapters) for its better comprehension by the learner. Note that for this first version of the interface, only isolated GSL signs and continuously fingerspelled letter sequences are accommodated, in agreement with the project's Technical Annex. Examples of the interface for a perception and a production exercise in the case of fingerspelling are shown in Figure 6.

Progress on Task T4.2: Dialog Management Component

Various aspects of the dialog management component between the user (learner or instructor) and the SL-ReDu system have been implemented, taking into consideration the nature of the specific educational material for each type of question / drill (perception vs. production) and the operation mode of the

platform (self-monitoring vs. objective evaluation). For example, several options for displaying educational material have been considered (text, icons, images, signing avatar videos, or pre-recorded signing videos) in accordance with Deliverable D3.2 [4], and the corresponding files have been prepared and integrated to the platform. Additional dialogue components have also been developed, dealing for example with setting user accounts in the platform with the appropriate credentials (learner or instructor).

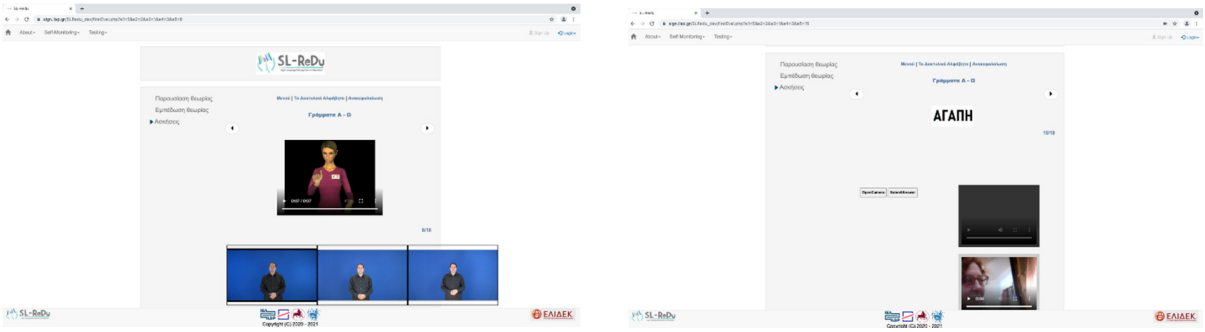

Figure 6: (**Left**): A GSL ***perception*** multiple-choice exercise in the fingerspelling chapter, concerning the matching of a fingerspelled word (shown as a signing avatar stimulus) to the correct one among a set of fingerspelling videos produced by a native signer. (**Right**): A GSL ***production*** exercise on fingerspelling. The student is presented with a word (in the form of a text image) and is asked to fingerspell it within a pre-set time window. The human-computer interface provides appropriate control buttons for recording, revising, and submitting the fingerspelling production to the SL-ReDu recognition engine.

WP4 Planned Work in Y3

WP4 work will continue during Y3 of the project, culminating in the second deliverable of this workpackage (Deliverable D4.2). Such work will take into consideration the results of the "Phase-A" prototype evaluation (see also next section), and it will be incorporated into the second version of the SL-ReDu prototype ("Phase-B"), which will be evaluated at the end of the project in a large-scale evaluation campaign by end-users.

2.5 WP5 Progress in Y2 (System Implementation and Evaluation)

This workpackage aims at the system implementation based on an appropriately defined architecture (Task T5.1), as well as at the system evaluation for the education use-case (Task T5.2). During Y1 of the project, we have worked on both tasks, reporting our efforts in Deliverable D5.1 [9] concerning the second task, while initiating an additional deliverable (D5.2) that will report our work on the first task at the very beginning of Y2 (M13).

During Y2 of the project, we have successfully completed the "Phase-A" part on both tasks, allowing the accomplishment of Milestone MS2 of the project. In particular, we produced two deliverables for Task T5.1, namely **Deliverable D5.2** [10] that defined the architecture of the "Phase-A" system prototype and **Deliverable D5.3** [11] that constitutes the first version of the integrated SL-ReDu system. Subsequently, the system has been evaluated in a small-scale campaign by end-users on the education use-case as part of Task T5.2, achieving very satisfactory results that were reported in **Deliverable D5.4** [12].

Progress on Task T5.1: System Architecture Definition and System Implementation

At the very beginning of Y2 of the project, we completed the definition of the system architecture in order to drive the implementation of the SL-ReDu system, reporting the adopted architecture in Deliverable

D5.2 [10]. The produced document describes the functional requirements of the platform that the architecture should meet, and it proposes a hybrid architecture for the system implementation, which employs a server-hosted web-based application that communicates appropriately with the learner-side device where the GSL recognizer will be run. The latter involves devising an intricate communication protocol, as is graphically depicted in Figure 7.

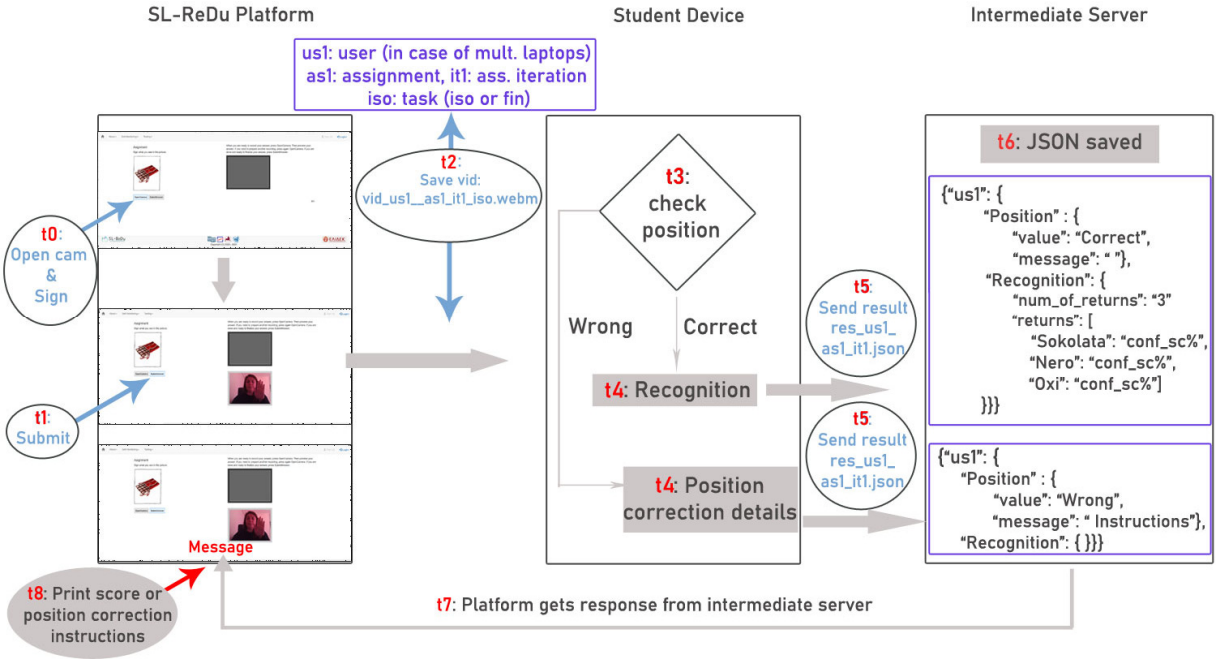

Figure 7: Architecture diagram showing the adopted communication between the web application, learner device, and an introduced intermediate server, which allows active SL production exercises by the learner, their recognition at the learner's device, and appropriate information transfer to the SL-ReDu platform.

Following the platform's architecture definition, the development of the GSL recognition models reported in Deliverable D2.2 [4], and the design of the human-computer interface that was reported in Deliverable D4.1 [8], we implemented the first version of the SL-ReDu system ("Phase-A" system), which was released as Deliverable D5.3 [12]. The system allows both GSL perception and production exercises by its end-users, matching the education use-case outlined in the Technical Anex. In particular, as defined there, the domains of small-vocabulary isolated GSL and continuous fingerspelling of letter sequences are incorporated into the system.

Progress on Task T5.2: System Evaluation

Following the development of the first version ("Phase-A") of the SL-ReDu prototype system (Deliverable D5.3 [11]), we have proceeded with a small-scale evaluation of it by the envisaged end-users, primarily students at UTH-SED and some experts, following the evaluation processes defined in Deliverable D5.1 [9]. The evaluation volunteers performed both perception and production exercises, which allowed us to collect objective measurements of the system's performance on both exercise types. In addition, we obtained a subjective evaluation of the entire system (see also Figure 8), based on questionnaires that were filled by the volunteers. The entire evaluation run very smoothly, and both objective and subjective assessment results were deemed extremely satisfactory, validating the project's proposed approach and methodology, as well as the robustness of the designed platform. A detailed report of the "Phase-A" evaluation was produced as Deliverable D5.4 [12].

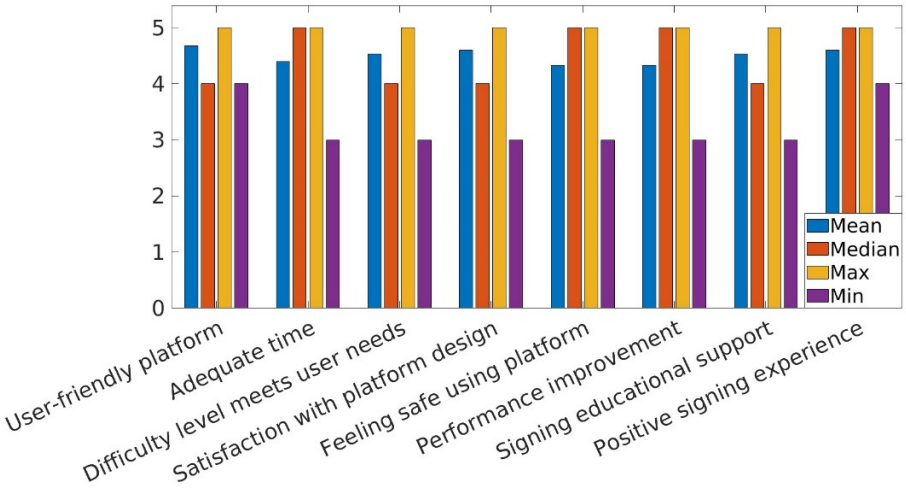

Figure 8: A summary of the "Phase-A" subjective evaluation results, involving answers of the 23 evaluation volunteers to eight questions on the Likert scale.

WP5 Planned Work in Y3

During the last year (Y3) of the project, our work will concentrate on both WP5 tasks. In particular, in Task T5.1, we will be implementing the second version ("Phase-B") of the SL-ReDu prototype system that will allow handling a much larger vocabulary of isolated signs, as well as the signing of continuous GSL phrases. This final system version will be reported as Deliverable D5.5, and it will be followed by a much larger evaluation campaign (Task T5.2) that will be reported in Deliverable D5.6, aiming to accomplish the third (final) project milestone (Milestone MS3).

2.6 WP6 Progress in Y2 (Dissemination and Exploitation)

This workpackage consists of two tasks: Task T6.1 concerning project publicity and dissemination, as well as Task T6.2 that focuses on exploitation activities of the project results.

During Y1 of the project, we had focused exclusively on Task T6.1, mainly producing scientific publications and presenting the corresponding works at international conferences, while also designing the project logo, flyer, poster, and website. A summary of the project publicity and dissemination activities during Y1 had been reported in Deliverable D6.1 [13].

During this reporting period (Y2) we have addressed both tasks of WP6, but again concentrated mostly on project publicity and dissemination activities (Task T6.1), conducting preliminary only work on exploitation (Task T6.2). A summary of the former activities are reported in concurrently produced **Deliverable D6.2** [14]. More details are provided next.

Progress in Task T6.1: Project Publicity and Dissemination

In more detail, during Y2 of the project, the following dissemination activities have taken place:

- Four scientific publications of SL-ReDu work have been published in the proceedings of well-established international conference with stringent review procedures
- Three presentations of project work have been given at international conferences (corresponding to three of the above papers – the fourth one will be presented in May 2022).

- Student education activities have taken place on the project topics, with one Ph.D. Thesis currently ongoing, two Diploma Theses successfully defended, and two more Diploma Theses in progress (expected defense dates in July and September 2022).
- In addition, the project has been presented to the students of UTH-SED in Volos as part of the "Phase-A" project evaluation campaign, as well as at the Staff Assembly of AthenaRC-ILSP in Maroussi. Both these dissemination activities took place in December 2021.
- Social media accounts have been set up (see also Figure 9).

Figure 9: Project dissemination via social media (Facebook).

The four project publications during Y2 are the following:

- M. Parelli, K. Papadimitriou, G. Potamianos, G. Pavlakos, and P. Maragos, "Spatio-temporal graph convolutional networks for continuous sign language recognition," [accepted for publication, to appear in:] *Proceedings of the IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2022.
- E. Efthimiou, S.-E. Fotinea, C. Flouda, T. Goulas, G. Ametoglou, G. Sapountzaki, K. Papadimitriou, and G. Potamianos, "The SL-ReDu environment for self-monitoring and objective learner assessment in Greek Sign Language," in *Proceedings of the International Conference on Human-Computer Interaction (HCII): Universal Access in Human-Computer Interaction. Access to Media, Learning and Assistive Environments*, pp. 72–81, 2021 (DOI: 10.1007/978-3-030-78095-1_7).
- K. Papadimitriou, M. Parelli, G. Sapountzaki, G. Pavlakos, P. Maragos, and G. Potamianos, "Multimodal fusion and sequence learning for cued speech recognition from videos", in *Proceedings of the International Conference on Human-Computer Interaction (HCII): Universal Access in Human-Computer Interaction. Access to Media, Learning and Assistive Environments*, pp. 277–290, 2021 (DOI: 10.1007/978-3-030-78095-1_21).
- G. Sapountzaki, E. Efthimiou, S. E. Fotinea, K. Papadimitriou, and G. Potamianos, "Educational material organization in a platform for Greek Sign Language self monitoring and assessment," in *Proceedings of the International Conference on Education and New Learning Technologies (EDULEARN)*, pp. 3322–3331, 2021 (DOI: 10.21125/edulearn.2021.0707).

Progress in Task T6.2: Project Exploitation Plan

During Y2 of the project, work has been initiated on the project exploitation plan. In these efforts, the competition landscape of sign language educational platforms has been investigated and potential markets

identified. The work will culminate to drafting the first version of the project exploitation plan (Deliverable D6.3) in two months.

WP6 Planned Work in Y3

During Y3 of the project, publicity and dissemination activities will continue with additional publications, as well as participation in a series of events that attract heavy interest by the general public, project stakeholders, and policy makers. These actions will be reported in Deliverable D6.4. Further, the first version of the project exploitation plan will be reported shortly in Deliverable D6.3 (M28), as envisaged in the SL-ReDu Technical Annex, and it will be followed by the final exploitation plan (as Deliverable D6.5) at the end of the project.

2.7 WP7 Progress in Y2 (Project Management)

This workpackage focuses on management activities of the project. These involve: (a) the communication between the project PI and the Special Account for Research Grants at the host institution (UTH), as well as the use of the software platform of the latter for entering project requests; (b) the communication between the project PI and the funding agency; (c) the coordination of the project team; and (d) the review of all project deliverables.

Concerning communication with the funding agency, in early July 2021 (M18) a four-month project extension has been requested by the PI. This was justified in order to mitigate delays caused by the pandemic, primarily concerning GSL data acquisition. Such was deemed unsafe in the indoors space of the AthenaRC data recording studio (basement with no windows), where multiple personnel are required to co-locate with the GSL informant volunteers, who cannot wear protective masks due to the need of capturing their mouthing action. The requested extension has been granted by H.F.R.I.

In addition, the PI, in conjunction with the UTH Special Account for Research Grants, have submitted the Interim Project Report in late November 2021 (M23) to the funding agency. As of the writing of this deliverable, there has been no feedback yet from H.F.R.I. on the report.

Further, it should be noted that the project members have been holding frequent Skype calls, typically once every week or two weeks, depending on the project workload and time period. In addition, an informal project meeting has been held during the period of the "Phase-A" evaluation campaign (December 13–15, 2021 (M23/24)) at the UTH-SED and UTH-ECE premises in Volos. Of course, further to the above, individual project partner teams have been meeting regularly at their premises in Volos and Athens.

The workpackage activities also include the compilation of this deliverable (**Deliverable D7.2**), following the structure of the Y1 corresponding management report (Deliverable D7.1 [15]).

3 Produced Deliverables and Achieved Milestones in Y2

During Y1, the first project milestone has been successfully accomplished on schedule (M12):

- **MS1:** Basic Versions of Components and Resources for System Implementation.

In addition, seven (7) deliverables have been produced in a timely fashion according to the project Technical Anex, as listed in Table 1.

Num	*Deliverable Title*	*WP*	*Level*	*Type*	*Due*	*Ready*	*Lead*
D1.1	First version of visual tracking and feature extraction components	**1**	**PU**	**R**	**M06**	**M06**	UTH-ECE
D2.1	First version of GSL recognizer	**2**	**PU**	**R**	**M12**	**M12**	UTH-ECE
D3.1	First version of data resources	**3**	**RE**	**R**	**M12**	**M12**	AthenaRC
D3.2	Evaluation language material organization	**3**	**RE**	**R**	**M12**	**M12**	UTH-SED
D5.1	Definition of evaluation procedure	**5**	**PU**	**R**	**M12**	**M12**	UTH-SED
D6.1	Publicity and dissemination report for Y1, incl. project website	**6**	**PU**	**R/O**	**M12**	**M12**	UTH-ECE
D7.1	Management report for Y1	**7**	**PU**	**R**	**M12**	**M12**	UTH-ECE

Table 1: Project deliverables completed during Y1 of the SL-ReDu project, specifying corresponding workpackage, dissemination level (PU: public, RE: restricted), type (R: report, O: other (e.g., project website)), planned and actual delivery date, and lead partner responsible.

During this reporting period (Y2), the second of the three project milestones (**Milestone MS2**) has been achieved on schedule (M24). The particular milestone is titled:

- **MS2:** Phase-A System Implementation and Evaluation.

MS2 primarily involves workpackages WP1, WP2, WP3, WP4, and WP5, and it is verified mainly by means of Deliverable D5.3 [11] and Deliverable D5.4 [12], both produced on time (M23 and M24, respectively).

In addition, during Y2, nine (9) deliverables have been prepared according to the project Technical Annex and are listed in Table 2. Brief overviews of the work reported in these documents have been provided in the previous section (within the corresponding workpackage or task descriptions of Y2 work).

Num	*Deliverable Title*	*WP*	*Level*	*Type*	*Due*	*Ready*	*Lead*
D1.2	Intermediate version of visual tracking and feature extraction components	**1**	**RE**	**R**	**M16**	**M16**	UTH-ECE
D2.2	Intermediate version of GSL recognizer	**2**	**RE**	**R**	**M22**	**M22**	UTH-ECE
D3.3	First version of linguistic model	**3**	**RE**	**R**	**M16**	**M16**	AthenaRC
D4.1	First version of human-computer interface	**4**	**PU**	**R**	**M16**	**M16**	AthenaRC
D5.2	Technical specifications and system architecture definition	**5**	**PU**	**R**	**M13**	**M13**	UTH-ECE
D5.3	First version of system implementation	**5**	**RE**	**P**	**M23**	**M23**	UTH-ECE
D5.4	Evaluation of first system version	**5**	**RE**	**R**	**M24**	**M24**	UTH-SED
D6.2	Publicity and dissemination report for Y2	**6**	**PU**	**R**	**M26**	**M26**	UTH-ECE
D7.2	Management report for Y2	**7**	**PU**	**R**	**M26**	**M26**	UTH-ECE

Table 2: Project deliverables completed as planned during Y2 of the SL-ReDu project, specifying corresponding workpackage, dissemination level (PU: public, RE: restricted), type (R: report, P: prototype), planned and actual delivery date, and lead partner responsible.

During the third (final) year of the project, twelve (12) additional deliverables will be produced as indicated in Table 3. Further, the third project milestone is due to be reached, namely:

- **MS3:** Phase-B System Implementation and Evaluation (due in M40).

Num	*Deliverable Title*	*WP*	*Level*	*Type*	*Due*	*Lead*
D1.3	Final version of visual tracking and feature extraction components	**1**	**RE**	**R**	**M32**	UTH-ECE
D2.3	Final version of GSL recognizer	**2**	**RE**	**R**	**M34**	UTH-ECE
D3.4	Second version of data resources	**3**	**RE**	**R**	**M28**	AthenaRC
D3.5	Second version of linguistic model	**3**	**RE**	**R**	**M32**	AthenaRC
D3.6	Project language resources public release	**3**	**PU**	**R/O**	**M40**	AthenaRC
D4.2	Second version of human-computer interface	**4**	**PU**	**R**	**M34**	AthenaRC
D5.5	Second version on system implementation	**5**	**RE**	**P**	**M36**	UTH-ECE
D5.6	Evaluation of second system version	**5**	**RE**	**R**	**M40**	UTH-SED
D6.3	First version of exploitation plan	**6**	**PU**	**R**	**M28**	AthenaRC
D6.4	Publicity and dissemination report for Y3	**6**	**PU**	**R**	**M40**	UTH-ECE
D6.5	Updated version of exploitation plan and exploitation actions	**6**	**PU**	**R**	**M40**	AthenaRC
D7.3	Management report for Y3	**7**	**PU**	**R**	**M40**	UTH-ECE

Table 3: Future project deliverables planned during Y3 of the SL-ReDu project, specifying corresponding workpackage, dissemination level (PU: public, RE: restricted), type (R: report, P: prototype, O: other), planned delivery date, and lead partner responsible.

4 Deviations from Workplan during Y2 and Mitigation

Overall, the SL-ReDu work has been progressing according to the project Technical Annex that includes its 4-month extended revised timeframe, as also evidenced by the prepared deliverables (listed in Tables 1 and 2) and the timely accomplishment of Milestones MS1 and MS2.

Nevertheless, the project data collection in the AthenaRC studio has commenced full-speed only recently (around M24, thus with a major delay) due to the pandemic restrictions and health concerns. To reduce the health risk to the participants, we have automated the data collection process to a significant extend, thus reducing the necessary supporting personnel to one person, who interacts with the unmasked GSL informant volunteers in the studio. Thus, there is a risk of a small delay in Deliverables D1.3, D2.3, D3.5, D5.5, and D5.6, which depend on the collected data resources. This may necessitate a second request for a project extension, expected to be for an additional two months, resulting to a corresponding time-shift of the due dates of the remaining project deliverables and milestone MS3. Such action may be taken during the Fall of 2022.

5 Conclusions

This deliverable has presented an overview of the SL-ReDu project activities and progress during its second year, covering the M13-M26 period. An additional final management deliverable will be produced concerning the third year of the project.

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