D7.3 Management Report for Y3

SL-ReDu
Sign Language Recognition in Education

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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 (D7.3) we overview the progress during the third (final) year (Y3), i.e. M27-M42, of the SL-ReDu project in its various workpackages (WP1-WP7) that has led to the successful completion of the third project milestone (MS3 – M42) and the compilation of twelve (12) deliverables, as planned in the project's Technical Annex.

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1 Introduction

This deliverable (D7.3) constitutes the management report for the third (final) year of the SL-ReDu project, covering the M27-M42 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 the first two years of the project (Y1 and Y2), followed by a summary and detailed presentation of the work conducted over the current reporting period (Y3) in each task);
- Section 3 provides a list of the produced deliverables and the accomplished milestone (MS3);
- Section 4 reports any deviations from the workplan and corresponding mitigation action (no deviations were observed); 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 third (final) year of the project.

2.1 WP1 Progress in Y3 (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 the first two years (Y1 and Y2) of the project, we had worked on both tasks, reporting our efforts in Deliverable D1.1 [1] and Deliverable D1.2 [2]. Briefly, concerning Task T1.1, we had considered two approaches for visual detection, establishing the superiority of the OpenPose deep learning based-approach, developed a 2D-to-3D deep learning-based regression method for obtaining 3D representations of the signer body skeleton and hands, and also considered the ExPose framework to obtain the 3D body pose and shape representation of the signer. Concerning Task T1.2, we had investigated a suite of traditional shape, appearance, and motion-based feature extraction methods in conjunction with a suitable recognition back-ends to allow isolated sign language recognition (SLR) for benchmarking the approaches.

During this reporting period (Y3), we have completed our work on both tasks of WP1, reporting our progress in **Deliverable D1.3** [3]. Specifically, we have extend our previous work on human pose and 3D shape regression, as well as appearance and motion representations extraction that we investigated in Deliverable D1.2 [2], by considering a number of additional networks for visual tracking and feature extraction. Benchmarking these approaches on two isolated GSL tasks, we have reported significant progress over our earlier reported work.

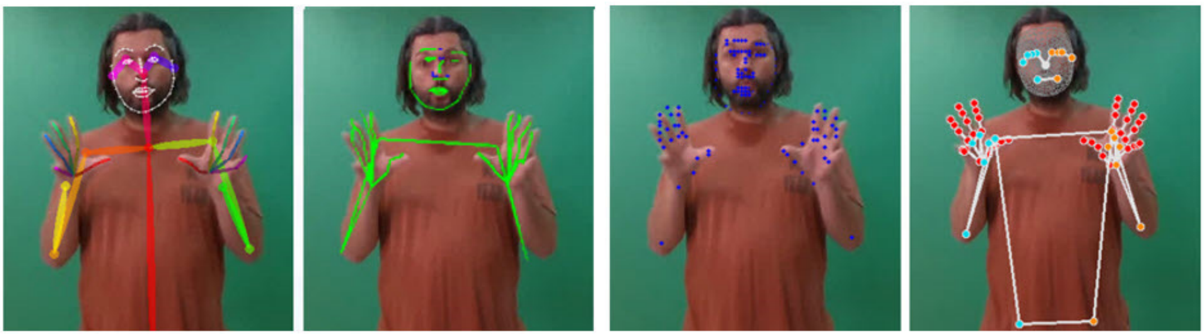


Figure 1: Various human skeletal feature extraction methods considered for Task T1.1 in Y3.

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

Following Y1 and Y2 work, we have continued to employ the OpenPose framework to detect the skeletal joints and a number of facial landmarks of the signer, but have also considered a suite of alternative more recent methods for the task, namely HRNet, HPRNet, and MediaPipe. Further, in addition to ExPose considered in Deliverable D1.2 [2], we have investigated FrankMocap and PIXIE for the body pose and shape representation of the signer in 3D. We have presented details of all these approaches in Deliverable D1.3 (see also Figure 1), where we have used them to drive appropriate feature extraction in Task T1.2 (see also below).

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

Following SL articulator detection, in Y3 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 or 3D skeletal features of the signer (4 different approaches – all shown in Figure 1), 3D expressive body pose and shape features (3 different approaches), as well as appearance and motion features. In particular, for appearance based feature extraction, we have used both 2D CNNs (3 different approaches) as well as 3D CNNs (5 different approaches), whereas for motion based feature extraction, we have considered 3 different approaches for optical flow estimation.

To evaluate the above and allow comparisons with our earlier WP1 deliverables (Y1 and Y2), we have considered the above approaches in conjunction with an SLR back-end (see also Figure 2) for the task of isolated sign recognition on two GSL datasets – in one of which we have considered the task of signer-independent recognition as well. Our progress on the tasks is apparent from Table 1. Note that in addition to single-type (stream) features, we have also considered the combination of the best-performing feature streams of each of the above categories, employing a late (decision) fusion scheme.

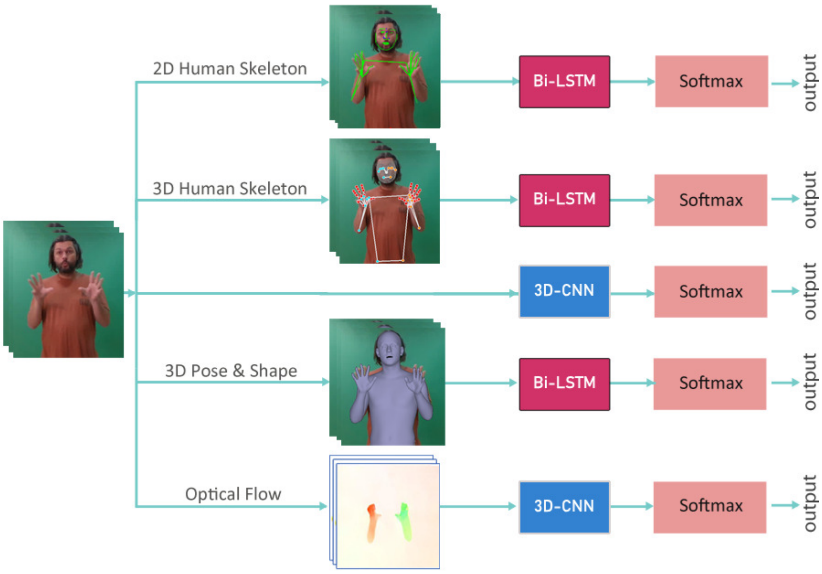


Figure 2: Various visual feature streams considered in Task T1.2 during Y3, in conjunction with an SLR back-end.

Deliverable	**Database**	
	Polytropon	**ITI GSL**
D1.1 [1]	88.24	89.05
D1.2 [2]	95.73	94.89
D1.3 [3]	98.93	98.85

Table 1: Progress over the WP1 life-cycle, as reported in the three WP1 deliverables, with our isolated GSL recognition systems evaluated in terms of their achieved sign classification accuracy (%) on two GSL datasets (Polytropon and ITI GSL).

2.2 WP2 Progress in Y3 (Machine Learning for GSL Recognition)

This workpackage concentrates on the development of machine learning algorithms for the automatic recognition of GSL, aiming to provide the GSL models for the “Phase-A” and “Phase-B” prototype systems of the project. WP2 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 GSL signs.

During Y1 and Y2 of the project, we have worked on both tasks, reporting our efforts in Deliverable D2.1 [4] and Deliverable D2.2 [5]. Specifically, in Deliverable D2.1 [4], we built systems for isolated GSL recognition and recognition of fingerspelled letter sequences in the American sign language (due to the lack of data), exploring a number of model architectures and based on visual features from Deliverable D1.1 [1]. Subsequently, in Deliverable D2.2 [5], we built systems for continuous GSL exploring a number of visual features of Deliverable D1.2 [2]. In addition, we provided the first recognition models for the “Phase-A” SL-ReDu system, capable of recognizing a small vocabulary of isolated GSL signs, as well as continuously fingerspelled letter sequences of GSL. These models have been trained on SL-ReDu data recorded in non-studio quality environments, as part of WP3.

During Y3 of the project, we have focused our work on finalizing the GSL recognition system architecture and providing the SLR models that will be integrated in the “Phase-B” SL-ReDu system, capable to accommodate all three recognition tasks envisaged in the Technical Annex (isolated signing; continuous signing; and continuous fingerspelling of letter sequences). Our proposed architecture is depicted in Figure 3. This work has been reported in **Deliverable D2.3** [6], and it is further overviewed below, presented jointly for both Tasks T2.1 and T2.2.

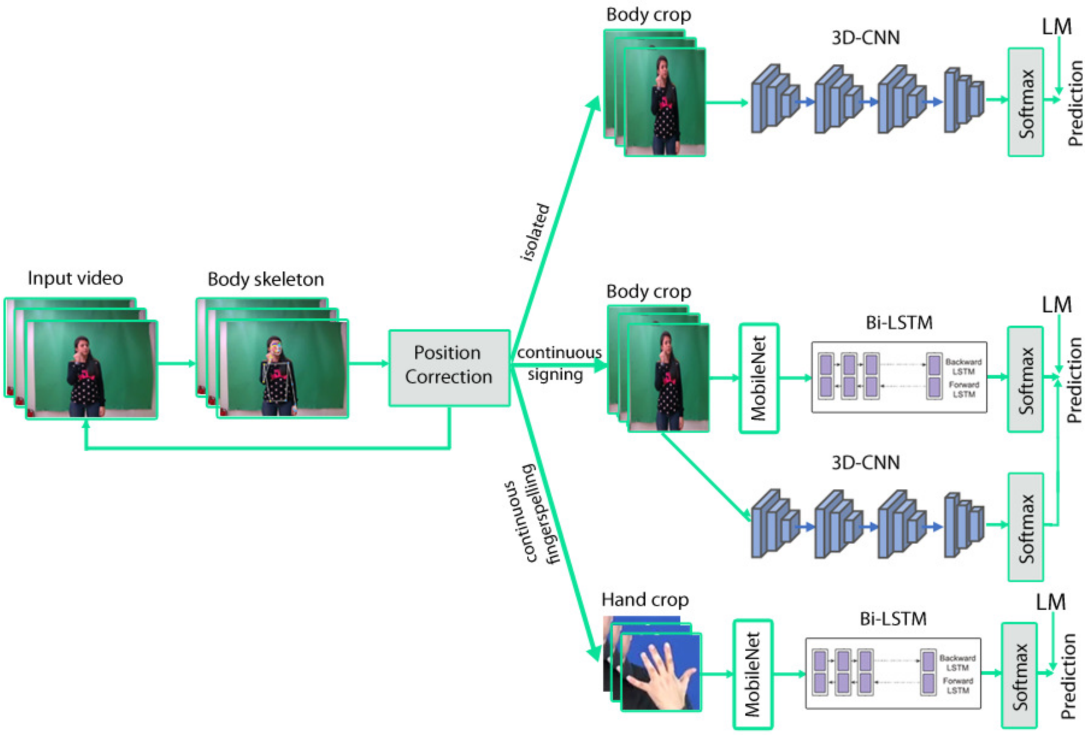


Figure 3: Algorithmic flow-chart of the GSL recognition module as proposed in Deliverable D2.3 [6], for the three recognition tasks of the SL-ReDu project (top-to-bottom: isolated signing; continuous signing of phrases; continuous fingerspelling of letter sequences). The language model (LM) of WP3 is also integrated in the recognition pipeline.

As shown in Figure 3, the adopted visual front-end of the module is based on the MediaPipe algorithm for 3D skeletal information extraction, which drives the body- or hand-cropping process for the appearance-based feature extraction (2D- or 3D-CNN), as well as the position-correction module that provides feedback to the user, in case of incorrect positioning.

Concerning the recognition models, it should be noted that all models are trained on recently collected data as part of the WP3 activities, of both studio and non-studio quality. In addition, all models have integrated appropriate language models developed in WP3 (something that is being done for the first time here). Further:

- The isolated SLR sub-module is based on the architecture of the corresponding “Phase-A” model, proposed in Deliverable D2.2 [5], but can now accommodate a much larger vocabulary of signs (about 9 times more), has a more advanced non-linearity activation function (SiLU instead of ReLU), and is also pretrained on a Chinese SLR dataset.
- The continuous SLR sub-module fuses two parallel paths to perform recognition: The first path adopts the typical MobileNet / BiLSTM architectural pipeline, similar to the continuous fingerspelling module of Deliverable D2.2 [5], but applied to the body-cropped frame and with glosses as recognition units, instead of letters. The second path adopts the isolated SLR module mentioned above, applied on short sliding segments of the input video. The two paths are appropriately fused during decoding. The system is trained to recognize gloss sequences, with a vocabulary of 255 glosses.
- Finally, the continuous fingerspelling recognition sub-module is identical to the one of Deliverable D2.2 [5] (with of course the addition of the appropriate language model).

The performance of the three recognition models is summarized in Table 2 (for non-studio SL-ReDu test data), demonstrating satisfactory performance, which enables us to proceed with their integration to the “Phase-B” prototype system. Additional algorithmic details and experimental results can be found in Deliverable D2.3 [6].

GSL recognition task	**Accuracy metric (%)**	**Experimental framework**	
		Multi-signer	**Signer-independent**
Isolated signing	WAcc	98.54	95.32
Continuous signing	SAcc	92.21	89.77
Continuous fingerspelling	WAcc	84.25	80.94
	LAcc	86.69	80.74

Table 2: Summary of GSL recognition results of Deliverable D2.3 [6] for the three tasks considered on non-studio test data, under two different experimental frameworks concerning signer partitioning, reported in the appropriate accuracy metrics (WAcc: word accuracy; SAcc: sentence accuracy; LAcc: letter accuracy, all in %).

2.3 WP3 Progress in Y3 (Training Data and Language Model)

This workpackage contains three subtasks. Specifically, it concentrates on securing training data for the GSL machine learning algorithms (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 had worked on all three tasks, and during Y2 we had continued work on two of the tasks (Task T3.1 and T3.3), since Task T3.2 had concluded in M12 of the project in accordance with its Technical Annex. Specifically, we had reported our efforts on Task T3.1 in Deliverable D3.1 [7], where we had identified pre-existing GSL resources for our initial work in WP1 / WP2 and had initiated our large-scale data collection to support the SLR modules of the SL-ReDu prototype, collecting non-studio data that allowed SLR model training of the "Phase-A" system, as discussed in Deliverable D2.2 [5]. In addition, we had completed Task T3.2, reporting our work in Deliverable D3.2 [8], designing the language material for the purposes of the specific education use-case of the SL-ReDu project. Finally, we had produced the first version of the SL-ReDu linguistic model, presented in Deliverable D3.3 [9].

During the final year of SL-ReDu (Y3), we have continued work on the two active tasks of WP3, successfully concluding all planned activities by the end of the project. Specifically, in Task T3.1 we have completed our large-scale data collection to support the development of the "Phase-B" prototype system, collecting data for all three SLR tasks under studio and non-studio conditions, and reporting our work in **Deliverable D3.4** [10]. Furthermore, we have publicly released the project data resources, as **Deliverable D3.6** [12], providing the largest studio-quality database in GSL to the research community (containing 21 signers with videos of total duration 36 hrs), in order to foster reproducible research in the area of SLR. In addition, we have finalized our work on Task T3.3, producing the second version of the project linguistic model in **Deliverable D3.5** [11]. An important aspect of this deliverable constitutes the development of statistical and categorical language models, in order to support the SLR models and enhance the "Phase-B" system recognition performance.

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

Taking advantage of the improved pandemic conditions and the resulting lifting of mobility restrictions, we have been able to complete our large-scale data collection in order to allow development of the "Phase-B" GSL recognition system for the three SLR tasks of interest (isolated signing, continuous signing of phrases, and fingerspelling).

In particular, we have collected data on two types of environments: The studio located at the AthenaRC premises in Maroussi, Greece, as well as non-studio indoors settings, in order to increase data variability that better match the expected operating conditions of the SL-ReDu prototype for improved system robustness. Note that parts of the latter non-studio data (small-vocabulary isolated GSL signs and continuously fingerspelled letter sequences) have been collected in Y2 and supported the development of the "Phase-A" prototype system. Such non-studio data have been significantly augmented in Y3 with isolated signing data within a much larger vocabulary, as well as with continuously signed phrases. It should also be noted that the studio-quality data (collected in Y3) represent the largest GSL corpus in the literature that is suitable for SLR, supporting three recognition tasks and exceeding by three times (or more) in number of signers and total video duration a competitive and very important GSL database, which had been released by the Information Technologies Institute (ITI) at the Centre for Research and Technology Hellas (this resource had been identified in Deliverable D3.1 [7] and has supported our initial WP1 / WP2 work decisively). More details on the collected dataset and the recording methodology and setups can be found in Deliverable D3.4 [10]. Data statistics are also summarized in Tables 3 and 4, with example video frames shown in Figure 4.

SLR task	**Studio**			**Non-studio**		
	Signers	**Videos**	**Duration**	**Signers**	**Videos**	**Duration**
Isolated	21	22,632	25:15	34	6,127	8:06
Continuous	21	5,930	8:24	17	906	1:26
Fingerspelling	21	1,554	2:17	12	1,071	1:41

Table 3: Number of signers, videos, and duration (in hr:min format) of the studio and non-studio data.

SLR task	Signers	Unique content	Vocab. size	Videos	Duration
Isolated	21	369 signs	369 signs	22,632	25:15
Continuous	21	799 phrases	294 glosses	5,930	8:24
Fingerspelling	21	950 words	24 letters	1,554	2:17
Total	21	——	——	30,116	35:56

Table 4: Overview statistics of the released studio-quality dataset for the three SLR tasks. Number of signers, unique content size, vocabulary size, number of videos, and duration (in hr:min format) are shown.

As envisaged in the SL-ReDu Document of Work, we have also proceeded with the public release of the SL-ReDu dataset, in order to foster progress in the research community in the field of SLR both in Greece and abroad. In particular, we have released the data that have been collected at the AthenaRC premises (studio recordings), due to the balanced nature of the data across signers and content. We expect that this dataset will be used as standalone in future SLR evaluations of GSL by academic and research / industrial labs from both Greece and abroad, thus providing a golden standard for SLR in GSL. In addition, it could also serve as material that can be pooled together with that of other sign languages, aiming to improve SLR model pretraining or even allow multi-lingual SLR development. Thus, this data release is expected to contribute to both project dissemination and exploitation, providing extra visibility and future funding opportunities to the SL-ReDu project partners. The SL-ReDu corpus is downloadable at the SL-ReDu website (https://sl-redu.e-ce.uth.gr/corpus), with the release further summarized in Deliverable D3.6 [12].

Figure 4: Example frames of the collected GSL data in the AthenaRC studio, showing the 21 different signers.

Progress on Task T3.2: Evaluation Language Material Organization

Task 3.2 has concluded in Y1 (M12) of the project, producing Deliverable D3.2 [8].

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

During Y3, we have completed the second version of the linguistic model of the project, as presented in Deliverable D3.5 [11]. In addition, we have produced statistical and / or categorical language models to assist the SLR modules in the "Phase-B" system. For example, n-grams and / or neural language models have been employed for continuous recognition of gloss phrases and letter sequences, mimicking their use in the field of automatic speech recognition. Further, categorical (class) language models have been employed in SLR of isolated signs and of continuous phrases, taking advantage of the specific GSL education content in each thematic area of the SL-ReDu platform that the user navigates to. Their incorporation to the GSL recognition system significantly boosted SLR performance, as depicted in Figure 5.

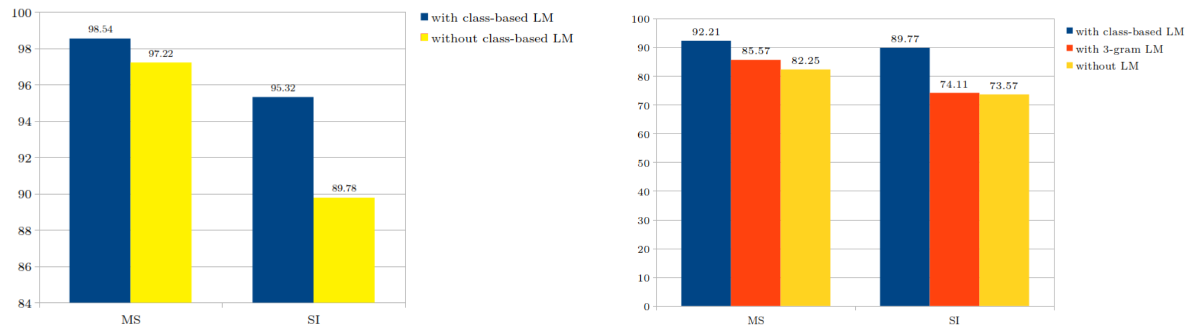


Figure 5: Language model contribution to improved GSL recognition performance of isolated SLR (**left**), shown in word accuracy %, and continuous GSL (**right**), shown in sentence accuracy %, on non-studio test sets under multi-signer (MS) and signer-independent (SI) experimental paradigms.

2.4 WP4 Progress in Y3 (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 and Y2 of the project, we had worked on both tasks, producing the relevant Deliverable D4.1 [13] that was compiled in Y2 (M16), in agreement with the Technical Annex. That work had been subsequently integrated into the first version of the SL-ReDu system prototype ("Phase-A").

In Y3, we have developed the second version of the SL-ReDu human-computer interface (HCI), designed and implemented within the second version ("Phase-B") of the SL-ReDu prototype system in WP5. The implemented human-computer interface comprises an enhanced version of the one reported in Deliverable D4.1 [13] incorporating: (i) necessary improvements resulting from end-user comments and experience during the evaluation of first system version; (ii) extensions that reflect the advancements in SLR technology as a result of research within SL-ReDu and the extended linguistic content that the second version of the prototype system will accommodate; and (iii) new interaction features completing the platform design so that it also addresses the educator end-user needs for creating teaching and testing materials and following / compiling user statistics and performance. The updated human-computer interface incorporates all language material of WP3 in its entirety, while it features appropriate dialog management strategies and exploits SLR technology along with text, icons, video and synthetic signing for a complete educational interaction of the user with the platform. Examples of the developed interface are shown in Figure 6. The work has been reported in **Deliverable D4.2** [14], concluding work on WP4 (for both Tasks T4.1 and T4.2).

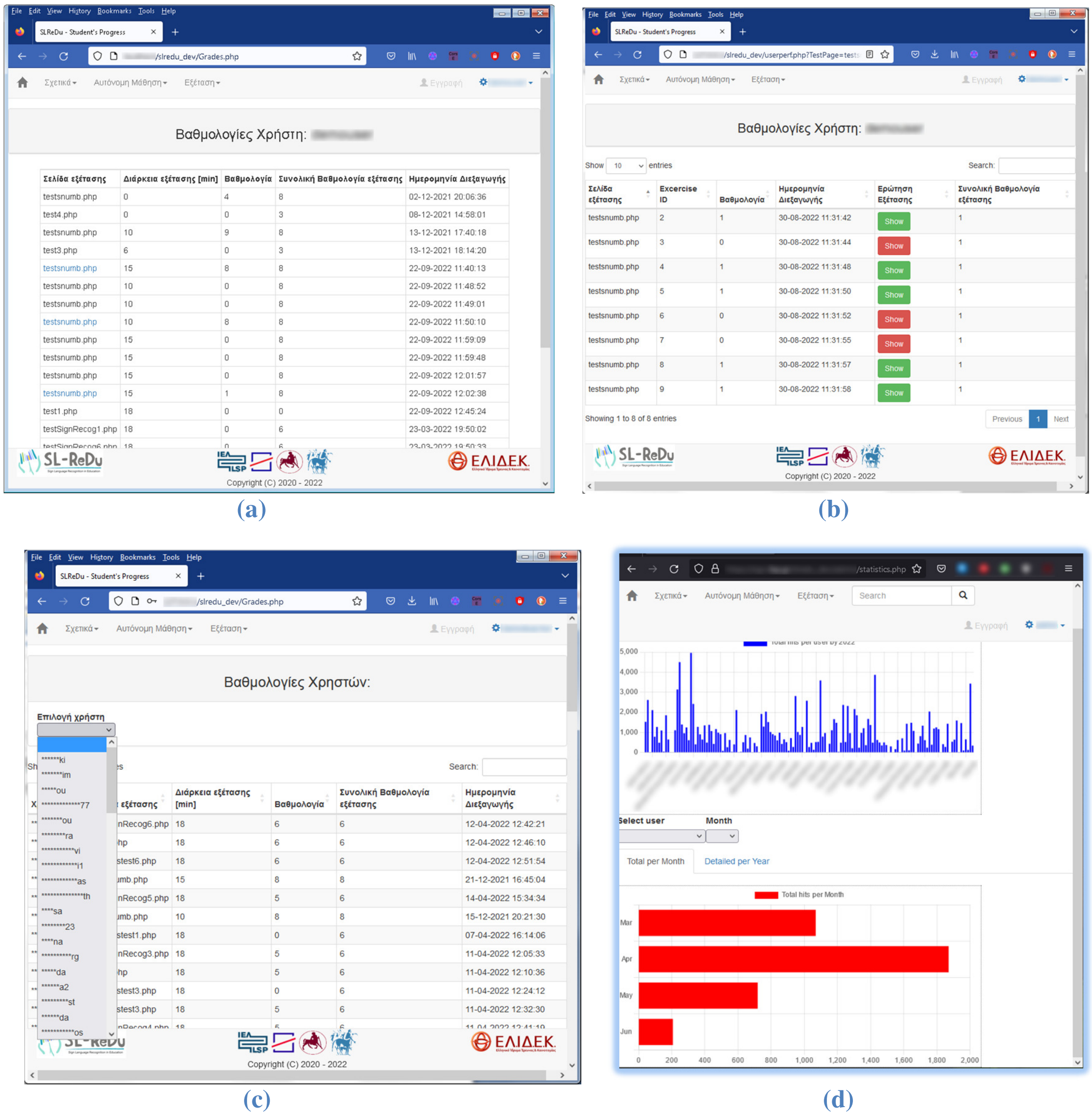


Figure 6: Examples of the second version of the developed human-computer interface, reported in Deliverable D4.2 [14]: **(a)** List of tests performed by a particular user, showing achieved scores, durations, and dates taken; **(b)** Performance table providing the history of the user responses for each exercise of a test; **(c)** Performance of all users, visible to the instructor (actual user login names appear masked); **(d)** Detailed user activity on the platform per month.

2.5 WP5 Progress in Y3 (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 the first two years of the project, we have worked on both tasks, reporting our efforts in Deliverable D5.2 [16] and Deliverable D5.3 [17] for the first task, and in Deliverable D5.1 [15] and Deliverable D5.4 [18] for the second task. Specifically, in Task T5.1, we have defined the SL-ReDu system architecture and implemented the first version of the project's prototype ("Phase-A"). In Task T5.2, we have defined the evaluation procedure for the SL-ReDu prototypes and completed the evaluation of the "Phase-A" system.

During Y3 of the project, we have successfully completed the “Phase-B” part on both tasks (implementation and evaluation), allowing the accomplishment of Milestone MS3 of the project. In particular, we produced **Deliverable D5.5** [19] in Task T5.1, releasing the second (final) SL-ReDu prototype (“Phase-B”), and we also produced **Deliverable D5.6** [20] in Task T5.2, reporting on the large-scale evaluation of it. Note that these two deliverables constitute the primary means of verifying the successful accomplishment of the final project milestone (MS3). Details follow.

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

Following the development of the “Phase-A” prototype [17], in Y3 of the project we have significantly redesigned and augmented it, releasing the “Phase-B” system as Deliverable D5.5 [19]. This new system adopts the updated human-computer interface of Deliverable D4.2 [14]. It also integrates the final version of the GSL recognizer (Deliverable D2.3 [6]), which contains models that allow continuous GSL recognition and also improved recognition of isolated signs within a much larger vocabulary than the first prototype system, as well as of fingerspelled letter sequences of GSL. These models are trained on suitable data of Deliverable D3.4 [10], incorporating the linguistic model of Deliverable D3.5 [11]. Finally, the prototype allows operation of the sign language recognition module remotely at a server, thus extending the architecture of Deliverable D5.2 [16] and enhancing user flexibility (instead of requiring running sign language recognition on the user device).

Progress on Task T5.2: System Evaluation

Following the development of the second system version (“Phase-B”) of the SL-ReDu prototype system (Deliverable D5.5 [19]), we have proceeded with a large-scale evaluation of it by the envisaged end-users, primarily students at UTH-SED and experts, following the evaluation processes defined in Deliverable D5.1 [9] and similarly to the “Phase-A” evaluation run that was reported in Deliverable D5.4 [18]. 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, based on questionnaires that were filled by the volunteers. The entire evaluation run extremely well, and both objective and subjective assessment results were deemed very satisfactory, validating the project’s proposed approach and methodology, as well as the robustness of the designed platform. As depicted in Table 5 that provides a comparison between the “Phase-A” and “Phase-B” evaluations, the latter one is much larger in both its objective and subjective aspects (number of volunteers and exercises conducted), while accommodating significantly larger lexical content (almost a 10-fold increase in the isolated sign vocabulary, plus the incorporation of continuous signing for the first time). A detailed report of the “Phase-B” evaluation was produced as Deliverable D5.6 [20].

Evaluation	**Report**	**objective evaluation**				**subjective evaluation**	**Content (vocabulary sizes)**		
		production		**perception**					
		# sub	**# exc**	**# sub**	**# exc**	**# sub**	**isolated**	**continuous**	**f / spell**
“Phase-A”	**D5.4** (M24)	12	216	11	131	23	18 / 36	n / a	24
“Phase-B”	**D5.6** (M42)	44	880	43	3,022	44	337	255	24

Table 5: A comparison of the “Phase-A” and “Phase-B” evaluations (reported in Deliverables D5.4 and D5.6. respectively), showcasing the much larger scale and coverage of the latter. The number of participating subjects (# sub) and the total number of conducted exercises (# exc) are shown in each case. In addition, the vocabulary size is shown for the various tasks (isolated GSL; continuous GSL; continuous letter fingerspelling), demonstrating the far larger complexity of the evaluated “Phase-B” prototype system over the “Phase-A” one.

2.6 WP6 Progress in Y3 (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.

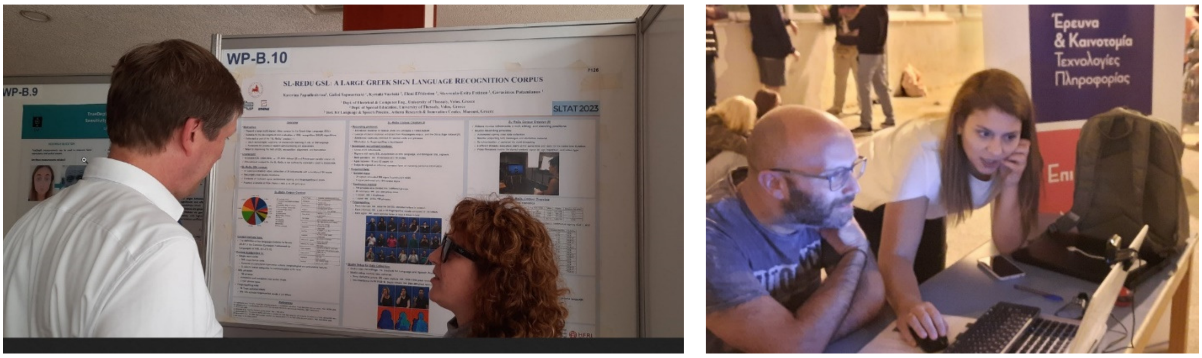
During the first two years of the project, we had focused exclusively on Task T6.1, mainly producing scientific publications and presenting the corresponding papers at international conferences, while also designing the project logo, flyer, poster, and website, as well as showcasing the project at appropriate dissemination events targeting various stakeholder audiences. A summary of the project publicity and dissemination activities during Y1 and Y2 had been reported in Deliverables D6.1 [21] and D6.2 [22], respectively.

During this reporting period (Y3) we have addressed both tasks of WP6, thus also placing emphasis on Task T6.2. We have summarized this work in three reports, namely **Deliverable D6.4** [24] concerning the dissemination activities, and with regards to exploitation we have produced **Deliverable D6.3** [23] and its updated version as **Deliverable D6.5** [25]. More details are provided next.

Progress in Task T6.1: Project Publicity and Dissemination

In more detail, during Y3 of the project, the following dissemination activities have taken place:

- Seven scientific publications of SL-ReDu work have been published in the proceedings of well-established international conferences with stringent review procedures.
- One scientific publication of SL-ReDu work has been published in an open access journal.
- Seven presentations of project work have been given at international conferences (corresponding to the conference papers of the first bullet – note that one will be presented in August 2023) – see also Figure 7(a).
- Student education activities have taken place on the project topics, with one Ph.D. Thesis and two Master Theses currently ongoing, three Diploma Theses successfully defended, and one more Diploma Thesis in progress (all ongoing Theses are close to their completion).
- In addition, in June 2022, the SL-ReDu project was presented at an education event that was organized by UTH-SED at their premises in Volos, Greece, in conjunction with the European Centre for Modern Languages (ECML) and the Directorate of European and International Affairs of the Greek Ministry of Education and Religious Affairs. For this purpose, a video was recorded that was played during the event. Further, in September 2022, the project and its prototype were presented at the DEAFestival'22 held in Athens at the premises of the National Institute of the Deaf (see also Figure 7(b)).
- Furthermore, SL-ReDu personnel (E. Efthimiou and S.-E. Fotinea) have been actively involved (as members of the organizing committee) in two editions of the established SLTAT workshop series (Sign Language Translation and Avatar Technology). In both events (held in June 2022 and June 2023), in addition to SL-ReDu paper presentations, SL-ReDu brochures were available for the participants, and many discussions took place between project personnel and interested stakeholders, paving the way for project exploitation opportunities.
- Finally, the project poster and flyer have been redesigned, capturing more up-to-date information of the SL-ReDu project.



(a) **(b)**

Figure 7: **(a)** Presentation of the SL-ReDu paper at the ICASSPW-SLTAT'23 workshop in Rhodes, Greece, in June 2023; **(b)** Presentation of the SL-ReDu project and system at the DEAFestival'22 in Athens, Greece, in September 2022.

The eight project publications during Y3 are the following:

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Note that the total number of publications during the project life-span has reached sixteen (16).

Progress in Task T6.2: Project Exploitation Plan

During Y3 of the project, we have compiled the SL-ReDu exploitation plan, following initial Y2 work on it. Details on the SL-ReDu exploitation strategy and actions are provided in Deliverable D6.3 [23] and Deliverable D6.5 [35]. In the latter report, particular emphasis has also been placed on the exploitation actions that are being undertaken beyond the project's life-cycle, including contacts with research labs and the industry.

2.7 WP7 Progress in Y3 (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 (H.F.R.I.); (c) the coordination of the project team; and (d) the review of all project deliverables.

Concerning communication with the funding agency, there have been three main events:

- In early October 2022, H.F.R.I. provided their feedback on the Interim Project Report that had been submitted by the PI and the UTH Special Account for Research Grants in late November 2021 (see also Deliverable D7.2 [27]). This feedback had been positive, with H.F.R.I. accepting and verifying the Report. In particular, the project evaluator (expert) has stated that the "Project has fully achieved its objectives, deliverables and milestones for the specific reporting period". Following this feedback, the projects' second funding installment was released.
- In the middle of November 2022, the project's PI requested a slight extension of the project's duration by an extra two months, in order to mitigate some lingering issues due to the pandemic crisis earlier in the project's life-cycle. H.F.R.I. accepted the request a few days later, thus the project's duration has been extended to 42 months (six more, compared to its original Technical Annex).
- Finally, in early April 2023, the project's PI requested a slight readjustment in the project's budget, specifically a reduction in equipment, travel, and dissemination funds, with an equal increase in personnel costs. H.F.R.I. accepted the request in May 2023.

In addition, there has been ongoing preparation of the Final Project Report, due in late September 2023.

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-B" evaluation campaign (May 14–17, 2023 (M41)) at the UTH-SED 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 D7.3**), following the structure of the Y1 and Y2 corresponding management reports (Deliverable D7.1 [26] and Deliverable D7.2 [27]).

3 Produced Deliverables and Achieved Milestones in Y3

During the first two years of the project, the first two project milestones have been successfully accomplished on schedule:

- **MS1:** Basic Versions of Components and Resources for System Implementation (M12).
- **MS2:** Phase-A System Implementation and Evaluation (M24).

In addition, sixteen (16) deliverables have been produced in a timely fashion according to the project Technical Anex, as listed in Table 6.

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
D1.2	Intermediate version of visual tracking and feature extraction components	**1**	**RE**	**R**	**M16**	**M16**	UTH-ECE
D2.1	First version of GSL recognizer	**2**	**PU**	**R**	**M12**	**M12**	UTH-ECE
D2.2	Intermediate version of GSL recognizer	**2**	**RE**	**R**	**M22**	**M22**	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
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
D5.1	Definition of evaluation procedure	**5**	**PU**	**R**	**M12**	**M12**	UTH-SED
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
D6.1	Publicity and dissemination report for Y1, incl. project website	**6**	**PU**	**R/O**	**M12**	**M12**	UTH-ECE
D6.2	Publicity and dissemination report for Y2	**6**	**PU**	**R**	**M26**	**M26**	UTH-ECE
D7.1	Management report for Y1	**7**	**PU**	**R**	**M12**	**M12**	UTH-ECE
D7.2	Management report for Y2	**7**	**PU**	**R**	**M26**	**M26**	UTH-ECE

Table 6: Project deliverables completed during the first two years of the SL-ReDu project, specifying corresponding workpackage, dissemination level (PU: public, RE: restricted), type (R: report, P: prototype, O: other (e.g., project website)), planned and actual delivery date, and lead partner responsible.

During this reporting period (Y3), the third (final) of the three project milestones (**Milestone MS3**) has been achieved on schedule (M42). The particular milestone is titled:

- **MS3:** Phase-B System Implementation and Evaluation.

MS3 primarily involves workpackages WP1, WP2, WP3, WP4, and WP5, and it is verified mainly by means of Deliverable D5.5 [19] and Deliverable D5.6 [20], both produced on time (M39 and M42, respectively).

In addition, during Y3, twelve (12) deliverables have been prepared according to the project Technical Annex and are listed in Table 7 (next page). Brief overviews of the work reported in these documents have been provided in the previous section (within the corresponding workpackage).

Therefore, all three (3) project milestones and all twenty-eight (28) deliverables have been successfully completed during the project 42-month life-cycle.

Num	*Deliverable Title*	*WP*	*Level*	*Type*	*Due*	*Ready*	*Lead*
D1.3	Final version of visual tracking and feature extraction components	**1**	**RE**	**R**	**M35**	**M35**	UTH-ECE
D2.3	Final version of GSL recognizer	**2**	**RE**	**R**	**M37**	**M37**	UTH-ECE
D3.4	Second version of data resources	**3**	**RE**	**R**	**M28**	**M28**	AthenaRC
D3.5	Second version of linguistic model	**3**	**RE**	**R**	**M36**	**M36**	AthenaRC
D3.6	Project language resources public release	**3**	**PU**	**R/O**	**M42**	**M42**	AthenaRC
D4.2	Second version of human-computer interface	**4**	**PU**	**R**	**M37**	**M37**	AthenaRC
D5.5	Second version on system implementation	**5**	**RE**	**P**	**M39**	**M39**	UTH-ECE
D5.6	Evaluation of second system version	**5**	**RE**	**R**	**M42**	**M42**	UTH-SED
D6.3	First version of exploitation plan	**6**	**PU**	**R**	**M28**	**M28**	AthenaRC
D6.4	Publicity and dissemination report for Y3	**6**	**PU**	**R**	**M42**	**M42**	UTH-ECE
D6.5	Updated version of exploitation plan and exploitation actions	**6**	**PU**	**R**	**M42**	**M42**	AthenaRC
D7.3	Management report for Y3	**7**	**PU**	**R**	**M42**	**M42**	UTH-ECE

Table 7: Project deliverables completed as 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

The SL-ReDu work has progressed according to the project Technical Annex that includes a 6-month extended revised timeframe, as also evidenced by the prepared deliverables (listed in Tables 6 and 7) and the timely accomplishment of all three project Milestones MS1, MS2, and MS3. Thus, there have been no deviations to report.

5 Conclusions

This deliverable has presented an overview of the SL-ReDu project activities and progress during its third (final) year, covering the M27-M42 period. All three (3) project milestones and all its twenty-eight (28) deliverables have been successfully completed during the project 42-month life-cycle on time, as planned, thus successfully concluding the project’s research work.

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